B.E.: Electronics & Communication Engineering

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EC71	Microwave and Antennas	EC	04		03	60	40	100	4
2	17EC72	Digital Image Processing	EC	04		03	60	40	100	4
3	17EC73	Power Electronics	EC	04		03	60	40	100	4
4	17EC74X	Professional Elective-3	EC	03		03	60	40	100	3
5	17EC75X	Professional Elective-4	EC	03		03	60	40	100	3
6	17ECL76	Advanced Communication Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
7	17ECL77	VLSI Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17ECP78	Project Work Phase–I + Project work Seminar	EC		03		-	100	100	2
	TOTAL			**Theory:18 hours Practical and Project: 09 hours**		**21**	**420**	**380**	**800**	**24**

Professional Elective-3		Professional Elective-4	
17EC741	Multimedia Communication	17EC751	DSP Algorithms and Architecture
17EC742	Biomedical Signal Processing	17EC752	IOT and Wireless Sensor Networks
17EC743	Real Time Systems	17EC753	Pattern Recognition
17EC744	Cryptography	17EC754	Advanced Computer Architecture
17EC745	CAD for VLSI	17EC755	Satellite Communication

1. **Project Phase – I and Project Seminar:** Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and Seminar presentation skill.

B.E.: Electronics & Communication Engineering

VIII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EC81	Wireless Cellular and LTE 4G Broadband	EC	4	-	3	60	40	100	4
2	17EC82	Fiber Optics & Networks	EC	4	-	3	60	40	100	4
3	17EC83X	Professional Elective-5	EC	3	-	3	60	40	100	3
4	17EC84	Internship/Professional Practice	EC	Industry Oriented		3	50	50	100	2
5	17ECP85	Project Work	EC	-	6	3	100	100	200	6
6	17ECS86	Seminar	EC	-	4	-	-	100	100	1
		TOTAL		**Theory: 11 hours Project and Seminar: 10 hours**		**15**	**330**	**370**	**700**	**20**

Professional Elective -5	
17EC831	Micro Electro Mechanical Systems
17EC832	Speech Processing
17EC833	Radar Engineering
17EC834	Machine learning
17EC835	Network and Cyber Security

1. Internship/ Professional Practice: 4 Weeks internship to be completed between the (VI and VII semester vacation) and/or (VII and VIII semester vacation) period.

B.E E&C SEVENTH SEMESTER SYLLABUS

<table>
<tr><td colspan="4" align="center">MICROWAVES AND ANTENNAS
B.E., VII Semester, Electronics &Communication Engineering
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
<tr><td>Course Code</td><td>17EC71</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>04</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50 (10 Hours / Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 04</td></tr>
</table>

Course objectives: This course will enable students to:
- Describe the microwave properties and its transmission media
- Describe microwave devices for several applications
- Understand the basics of antenna theory
- Select antennas for specific applications

Module-1

Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.2)

Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching) **L1, L2**

Module-2

Microwave Network theory: Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3)

Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16) **L1, L2**

Module-3

Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11)

Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13,2.15) **L1, L2, L3**

Module-4

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.(Text 3: 5.1 – 5.11, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of Lambda/2 Antenna. (Text 3: 6.1 -6.6)

L1, L2, L3, L4

Module-5

Loop and Horn Antenna: Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas.(Text 3: 7.1-7.8, 7.19, 7.20)

Antenna Types: Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7) **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:
- Describe the use and advantages of microwave transmission
- Analyze various parameters related to microwave transmission lines and waveguides
- Identify microwave devices for several applications
- Analyze various antenna parameters necessary for building an RF system
- Recommend various antenna configurations according to the applications

Text Books:
1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Liao, Pearson Education.
3. **Antennas and Wave Propagation,** John D. Krauss, Ronald J Marhefka and Ahmad S Khan,4th Special Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.

Reference Books:
1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007.

DIGITAL IMAGE PROCESSING			
B.E., VII Semester, Electronics & Communication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC72	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			

Course Objectives: The objectives of this course are to:

- Understand the fundamentals of digital image processing

- Understand the image transform used in digital image processing
- Understand the image enhancement techniques used in digital image processing
- Understand the image restoration techniques and methods used in digital image processing
- Understand the Morphological Operations and Segmentation used in digital image processing

Module-1

Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.
[Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2] **L1, L2**

Module-2

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters
Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.
[Text: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10]
L1, L2, L3

Module-3

Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.
[Text: Chapter 5: Sections 5.2, to 5.9] **L1, L2, L3**

Module-4

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.
Wavelets: Background, Multiresolution Expansions.
Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.
[Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5] **L1, L2, L3**

Module-5

Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds.
Representation and Description: Representation, Boundary descriptors.
[Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1 and 11.2]
L1, L2, L3

Course Outcomes: At the end of the course students should be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
- Conduct independent study and analysis of Image Enhancement techniques.

Text Book:
   Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

Reference Books:
1. **Digital Image Processing**- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014.
2. **Fundamentals of Digital Image Processing**-A. K. Jain, Pearson 2004.

POWER ELECTRONICS				
B.E., VII Semester, Electronics & Communication Engineering **[As per Choice Based Credit System (CBCS) Scheme]**				
Course Code	17EC73	**CIE Marks**		40
Number of Lecture Hours/Week	04	**SEE Marks**		60
Total Number of Lecture Hours	50 (10 Hours / Module)	**Exam Hours**		03
CREDITS – 04				

Course Objectives: This course will enable students to:

- Understand the construction and working of various power devices.
- Study and analysis of thyristor circuits with different triggering conditions.
- Learn the applications of power devices in controlled rectifiers, converters and inverters.
- Study of power electronics circuits under various load conditions.

Module-1

Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits, Peripheral Effects.
Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics, di/dt and dv/dt limitations. (Text 1) **L1, L2**

Module-2

Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transisitor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation – Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit, UJT Firing Circuit. (Text 2) **L1, L2, L3**

Module-3

Controlled Rectifiers - Introduction, Principle of Phase-Controlled Converter Operation, Single-Phase Full Converter with RL Load, Single-Phase Dual Converters, Single-Phase Semi Converter with RL load.
AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase controllers with resistive and inductive loads. (Text 1) **L1, L2, L3**

Module-4

DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators: Buck regulator, Boost regulator, Buck-Boost Regulators, Chopper circuit design. (Text 1) **L1, L2**

Module-5

Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter, Inverter circuit design.
Static Switches: Introduction, Single phase AC switches, DC Switches, Solid state relays, Microelectronic relays. (Text 1) **L1, L2**

Course Outcomes: At the end of the course students should be able to:

- Describe the characteristics of different power devices and identify the various applications associated with it.
- Illustrate the working of power circuit as DC-DC converter.
- Illustrate the operation of inverter circuit and static switches.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

Evaluation of Internal Assessment Marks:

It is suggested that at least 4 experiments of Power Electronics to be conducted by the students. This activity can be considered for the evaluation of 10 marks out of 40 Continuous Internal Evaluation marks, reserved for the other activities.

Text Books:
1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897

Reference Books:
1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.
3. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi, 2005.
4. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, ePub eBook.

MULTIMEDIA COMMUNICATION			
B.E., VII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based credit System (CBCS) Scheme			
Course Code	17EC741	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hours / Module)	Exam Hours	03
CREDITS – 03			

Course objectives: This course will enable students to:
- Gain fundamental knowledge in understanding the basics of different multimedia networks and applications.
- Understand digitization principle techniques required to analyze different media types.
- Analyze compression techniques required to compress text and image and gain knowledge of DMS.
- Analyze compression techniques required to compress audio and video.
- Gain fundamental knowledge about multimedia communication across different networks.

Module-1
Multimedia Communications: Introduction, Multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology. (Chap 1 of Text 1) **L1, L2**

Module-2
Information Representation: Introduction, Digitization principles, Text, Images, Audio and Video (Chap 2 of Text 1) **L1, L2**

Module-3
Text and image compression: Introduction, Compression principles, text compression, image Compression. (Chap 3 of Text 1)

Distributed multimedia systems: Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia operating systems (Chap. 4 - Sections 4.1 to 4.5 of Text 2). **L1, L2, L3**

Module-4
Audio and video compression: Introduction, Audio compression, video compression, video compression principles, video compression. (Chap. 4 of Text 1). **L1, L2, L3**

Module-5
Multimedia Communication Across Networks: Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks (Chap. 6 - Sections 6.1, 6.2, 6.3 of Text 2). **L1, L2**

Course Outcomes: After studying this course, students will be able to:
- Understand basics of different multimedia networks and applications.
- Understand different compression techniques to compress audio and video.
- Describe multimedia Communication across Networks.
- Analyse different media types to represent them in digital form.
- Compress different types of text and images using different compression techniques and analyse DMS.

Text Books:
1. Fred Halsall, "Multimedia Communications", Pearson education, 2001 ISBN - 9788131709948.

2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004. ISBN -9788120321458

Reference Book:
Raifsteinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002. ISBN -9788177584417

BIOMEDICAL SIGNAL PROCESSING			
B.E., VII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	**17EC742**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours / Module)**	**Exam Hours**	**03**
CREDITS – 03			

Course Objectives: The objectives of this course are to:

- Describe the origin, properties and suitable models of important biological signals such as ECG and EEG.
- Introduce students to basic signal processing techniques in analysing biological signals.
- Develop the students mathematical and computational skills relevant to the field of biomedical signal processing.
- Develop a thorough understanding on basics of ECG signal compression algorithms.
- Increase the student's awareness of the complexity of various biological phenomena and cultivate an understanding of the promises, challenges of the biomedical engineering.

Module-1
Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis.   **Electrocardiography:** Basic electrocardiography, ECG lead systems, ECG signal characteristics.   **Signal Conversion** :Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits (Text-1) **L1, L2**

Module-2
Signal Averaging: Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging.   **Adaptive Noise Cancelling:** Principal noise canceller model, 60-Hz adaptive cancelling using a sine wave model, other applications of adaptive filtering (Text-1) **L1, L2, L3**

Module-3
Data Compression Techniques: Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG (Text-1) **L1, L2, L3**

Module-4

Cardiological signal processing:
Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Realtime ECG processing algorithm, ECG interpretation, ST segment analyzer, Portable arrhythmia monitor. (Text -2) **L1, L2, L3**

Module-5	

Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation.

Analysis of EEG channels: Detection of EEG rhythms, Template matching for EEG, spike and wave detection (Text-2). **L1, L2, L3**

Course outcomes: At the end of the course, students will be able to:

- Possess the basic mathematical, scientific and computational skills necessary to analyse ECG and EEG signals.
- Apply classical and modern filtering and compression techniques for ECG and EEG signals
- Develop a thorough understanding on basics of ECG and EEG feature extraction.

Text Books:
1. **Biomedical Digital Signal Processing-** Willis J. Tompkins, PHI 2001.
2. **Biomedical Signal Processing Principles and Techniques-** D C Reddy, McGraw-Hill publications 2005

Reference Book:
   Biomedical Signal Analysis-Rangaraj M. Rangayyan, John Wiley & Sons 2002

REAL TIME SYSTEMS			
B.E., VII Semester, Electronics & Communication Engineering /Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC743	**CIE Marks**	**40**
Number of Lecture Hours/Week	03	**SEE Marks**	**60**
Total Number of Lecture Hours	40 (08 Hours per Module)	**Exam Hours**	**03**
Credits – 03			

Course Objectives: This Course will enable students to:
- Discuss the historical background of Real-time systems and its classifications.
- Describe the concepts of computer control and hardware components for Real-Time Application.
- Discuss the languages to develop software for Real-Time Applications.
- Explain the concepts of operating system and RTS development methodologies.

Module-1
Introduction to Real-Time Systems: Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs.   **Concepts of Computer Control:** Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text Book: 1.1 to 1.6 and 2.1 to 2.6) **L1, L2**
Module-2
Computer Hardware Requirements for Real-Time Applications: Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.(Text Book: 3.1 to 3.8) **L1, L2**
Module-3
Languages for Real-Time Applications: Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages. (Text Book: 5.1 to 5.14) **L1, L2, L3**
Module-4
Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.(Text Book: 6.1 to 6.11) **L1, L2**
Module-5
Design of RTS – General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.   **RTS Development Methodologies:** Introduction, Yourdon Methodology, Ward and Mellor Method, Hately and Pirbhai Method. (Text Book: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5) **L1, L2, L3**

Course Outcomes: At the end of the course, students should be able to:
- Understand the fundamentals of Real time systems and its classifications.
- Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications.
- Develop the software languages to meet Real time applications.
- Apply suitable methodologies to design and develop Real-Time Systems.

Text Book:

Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.

Reference Books:
1. C.M. Krishna, Kang G. Shin, "Real –Time Systems", McGraw –Hill International Editions, 1997.
2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005.
3. Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005.

CRYPTOGRAPHY			
B.E., VII Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC744	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (08 Hours / Module)	**Exam Hours**	03
CREDITS – 03			

Course Objectives: This Course will enable students to:
- Enable students to understand the basics of symmetric key and public key cryptography.
- Equip students with some basic mathematical concepts and pseudorandom number generators required for cryptography.
- Enable students to authenticate and protect the encrypted data.
- Enrich knowledge about Email, IP and Web security.

Module-1
Basic Concepts of Number Theory and Finite Fields: Divisibility and the divisibility algorithm, Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields, Finite fields of the form GF(p), Polynomial arithmetic, Finite fields of the form $GF(2^n)$(Text 1: Chapter 3) **L1, L2**

Module-2
Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography (Text 1: Chapter 1) **SYMMETRIC CIPHERS:** Traditional Block Cipher structure, Data Encryption Standard (DES) (Text 1: Chapter 2: Section1, 2) **L1, L2**

Module-3
SYMMETRIC CIPHERS: The AES Cipher. (Text 1: Chapter 4: Section 2, 3, 4) **Pseudo-Random-Sequence Generators and Stream Ciphers:** Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs (Text 2: Chapter 16: Section 1, 2, 3, 4) **L1, L2, L3**

Module-4
More number theory: Prime Numbers, Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, discrete logarithm. (Text 1: Chapter 7) **Principles of Public-Key Cryptosystems**: The RSA algorithm, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography (Text 1: Chapter 8, Chapter 9: Section 1, 3, 4) **L1, L2, L3**

Module-5

One-Way Hash Functions: Background, Snefru, N-Hash, MD4, MD5, Secure Hash Algorithm [SHA],One way hash functions using symmetric block algorithms, Using public key algorithms, Choosing a one-way hash functions, Message Authentication Codes. Digital Signature Algorithm, Discrete Logarithm Signature Scheme (Text 2: Chapter 18: Section 18.1 to 18.5, 18.7, 18.11 to 18.14 and Chapter 20: Section 20.1, 20.4) **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:
- Use basic cryptographic algorithms to encrypt the data.
- Generate some pseudorandom numbers required for cryptographic applications.
- Provide authentication and protection for encrypted data.

Text Books:
1. William Stallings , "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3
2. Bruce Schneier, "Applied Cryptography Protocols, Algorithms, and Source code in C", Wiley Publications, 2nd Edition, ISBN: 9971-51-348-X

Reference Books:
1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

CAD for VLSI			
B.E., VII Semester, Electronics & Communication Engineering **[As per Choice Based Credit System (CBCS) Scheme]**			
Course Code	17EC745	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			

Course Objectives: This course will enable students to:
- Understand various stages of Physical design of VLSI circuits
- Know about mapping a design problem to a realizable algorithm
- Become aware of graph theoretic, heuristic and genetic algorithms
- Compare performance of different algorithms

Module 1

Data Structures and Basic Algorithms:

Basic terminology, Complexity issues and NP-Hardness. Examples - Exponential, heuristic, approximation and special cases. Basic Algorithms. Graph Algorithms for Search, spanning tree, shortest path, min-cut and max-cut, Steiner tree. Computational Geometry Algorithms: Line sweep and extended line sweep methods. **L1, L2**

Module 2

Basic Data Structures. Atomic operations for layout editors, Linked list of blocks, Bin-based method, Neighbor pointers, corner-stitching, Multi-layer operations, Limitations of existing data structures. Layout specification languages.

Graph algorithms for physical design: Classes of graphs in physical design, Relationship between graph classes, Graph problems in physical design, Algorithms for Interval graphs, permutation graphs and circle graphs. **L1, L2**

Module 3

Partitioning: Problem formulation, Design style specific partitioning problems, Classification of Partitioning Algorithms.

Group migration algorithms: Kernighan-Lin algorithm, Fiduccia-Mattheyses Algorithm, Simulated Annealing, Simulated Evolution.

Floor Planning: Problem formulation, Constraint based floor planning, Rectangular dualization, Simulated evolution algorithms. **L1, L2, L3**

Module 4

Pin Assignment: Problem formulation. Classification of pin assignment problems, General pin assignment problem.

Placement: Problem formulation, Classification of placement algorithms. Simulation based placement: Simulated annealing, simulated evolution, force directed placement. Partitioning based algorithms: Breur's Algorithm, Terminal propagation algorithm, Other algorithms for placement. **L1, L2, L3**

Module 5

Global Routing: Problem formulation, Classification of Global routing algorithms, Maze routing algorithms: Lee's algorithm, Soukup's algorithm and Hadlock's Algorithm, Line probe algorithms.

Detailed Routing: Problem formulation, Routing considerations, models, channel routing and switch box routing problems. General river routing problem, Single row routing problem.

Two-layer channel routing algorithms: Basic Left Edge Algorithm, Dogleg router, Symbolic router-YACR2. **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:
- Appreciate the problems related to physical design of VLSI
- Use genralized graph theoretic approach to VLSI problems
- Design Simulated Annealing and Evolutionary algorithms
- Know various approaches to write generalized algorithms

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of Three sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Algorithms for VLSI Physical Design Automation, 3rd Ed, Naveed Sherwani, 1999 Kluwer Academic Publishers, Reprint 2009 Springer (India) Private Ltd. ISBN 978-81-8128-317-7.

DSP ALGORITHMS and ARCHITECTURE				
B.E., VII Semester, Electronics & Communication Engineering /Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]				
Course Code	17EC751	CIE Marks	40	
Number of Lecture Hours/Week	03	SEE Marks	60	
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03	
CREDITS – 03				

Course Objectives: This course will enable students to:

- Figure out the knowledge and concepts of digital signal processing techniques.
- Understand the computational building blocks of DSP processors and its speed issues.
- Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xx processor.
- Learn how to interface the external devices to TMS320C54xx processor in various modes.
- Understand basic DSP algorithms with their implementation.

Module-1

Introduction to Digital Signal Processing:
Introduction, A Digital Signal – Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

Computational Accuracy in DSP Implementations:
Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation. **L1, L2**

Module-2

Architectures for Programmable Digital Signal – Processing Devices:
Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing. **L1, L2, L3**

Module-3

Programmable Digital Signal Processors:
Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54XX, Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On – Chip Peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor. **L1, L2, L3**

Module-4

Implementation of Basic DSP Algorithms:
Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

Implementation of FFT Algorithms:
Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS32OC54xx. **L1, L2, L3**

Module-5

Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices:
Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).

Interfacing and Applications of DSP Processors:
Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.
L1, L2, L3

Course Outcomes: At the end of this course, students would be able to

- Comprehend the knowledge and concepts of digital signal processing techniques.
- Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor.
- Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor.
- Develop basic DSP algorithms using DSP processors.
- Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device.
- Demonstrate the programming of CODEC interfacing.

Text Book:
"Digital Signal Processing", Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

Reference Books:
1. "Digital Signal Processing: A practical approach", Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002.
2. "Digital Signal Processors", B Venkataramani and M Bhaskar, TMH, 2nd, 2010
3. "Architectures for Digital Signal Processing", Peter Pirsch John Weily, 2008

IoT & WIRELESS SENSOR NETWORKS			
B.E., VII Semester, Electronics & Communication Engineering /Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC752	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			

Course Objectives: This course will enable students to:

- Understand various sources of IoT & M2M communication protocols.
- Describe Cloud computing and design principles of IoT.
- Become aware of MQTT clients, MQTT server and its programming.
- Understand the architecture and design principles of WSNs.
- Enrich the knowledge about MAC and routing protocols in WSNs.

Module-1

Overview of Internet of Things: IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT,M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway, web communication protocols used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT,XMPP) for IoT/M2M devices. **L1, L2**

Module-2

Architecture and Design Principles for IoT: Internet connectivity, Internet-based communication,IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports.

Data Collection, Storage and Computing using a Cloud Platform: Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing services using Nimbits. **L1, L2**

Module-3

Prototyping and Designing Software for IoT Applications: Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development.

Programming MQTT clients and MQTT server. Introduction to IoT privacy and security. Vulnerabilities, security requirements and threat analysis, IoT Security Tomography and layered attacker model. **L1, L2, L3**

Module-4

Overview of Wireless Sensor Networks:
Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

Architectures: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs Gateway Concepts.
L1, L2, L3

Module-5

Communication Protocols:
Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols(CSMA,PAMAS), Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses, Routing Protocols-Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering.
L1, L2, L3

Course Outcomes: At the end of the course, students will be able to:
- Describe the OSI Model for the IoT/M2M Systems.
- Understand the architecture and design principles for IoT.
- Learn the programming for IoT Applications.
- Identify the communication protocols which best suits the WSNs.

Text Books:

1. Raj Kamal, "Internet of Things-Architecture and design principles", McGraw Hill Education.
2. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Reference Books:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, And Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

PATTERN RECOGNITION			
B.E., VII Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC753	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours / Module)	**Exam Hours**	03
CREDITS – 03			

Course Objectives: The objectives of this course are to:
- Introduce mathematical tools needed for Pattern Recognition
- Impart knowledge about the fundamentals of Pattern Recognition.
- Provide knowledge of recognition, decision making and statistical learning problems
- Introduce parametric and non-parametric techniques, supervised learning and clustering concepts of pattern recognition

Module-1
Introduction: Importance of pattern recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-supervised learning, Introduction to Bayes Decision Theory, Discriminant Functions and Decision Surfaces, Gaussian PDF and Bayesian Classification for Normal Distributions. **L1, L2**
Module-2
Data Transformation and Dimensionality Reduction: Introduction, Basis Vectors, The Karhunen Loeve (KL) Transformation, Singular Value Decomposition, Independent Component Analysis (Introduction only). Nonlinear Dimensionality Reduction, Kernel PCA. **L1, L2**
Module-3
Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability estimation, Bayesian Interference, Maximum Entropy Estimation, Mixture Models, Naive-Bayes Classifier, The Nearest Neighbor Rule. **L1, L2, L3**
Module-4
Linear Classifiers: Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error Estimate. **L1, L2, L3**
Module-5
Nonlinear Classifiers: The XOR Problem, The two Layer Perceptron, Three Layer Perceptron, Back propagation Algorithm, Basic Concepts of Clustering, Introduction to Clustering , Proximity Measures. **L1, L2, L3**

Course outcomes: At the end of the course, students will be able to:
- Identify areas where Pattern Recognition and Machine Learning can offer a solution.
- Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
- Describe genetic algorithms, validation methods and sampling techniques
- Describe and model data to solve problems in regression and classification
- Implement learning algorithms for supervised tasks

Text Book:

Pattern Recognition: Sergios Theodoridis, Konstantinos Koutroumbas, Elsevier India Pvt. Ltd (Paper Back), 4th edition.

Reference Books:

1. **The Elements of Statistical Learning:** Trevor Hastie, Springer-Verlag New York, LLC (Paper Back), 2009.
2. **Pattern Classification:** Richard O. Duda, Peter E. Hart, David G. Stork. John Wiley & Sons, 2012.
3. **Pattern Recognition and Image Analysis Earl Gose:** Richard Johnsonbaugh, Steve Jost, ePub eBook.

<table>
<tr><td colspan="4" align="center">ADVANCED COMPUTER ARCHITECTURE
B.E., VII Semester, Electronics & Communication Engineering
/Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
<tr><td>Course Code</td><td>17EC754</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40 (8 Hours / Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
</table>

Course Objectives: This course will enable students to:
- Understand the various parallel computer models and conditions of parallelism
- Explain the control flow, dataflow and demand driven machines
- Study CISC, RISC, superscalar, VLIW and multiprocessor architectures
- Understand the concept of pipelining and memory hierarchy design
- Explain cache coherence protocols.

Module-1

Parallel Computer Models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivectors and SIMD computers.

Program and Network Properties: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency. **L1, L2**

Module-2

Program flow mechanisms: Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. **L1, L2, L3**

Module-3

Speedup Performance Laws: Amdhal's law, Gustafson's law, Memory bounded speed up model, Scalability Analysis and Approaches.

Advanced Processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures. **L1, L2, L3**

Module-4

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design.

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies. **L1, L2, L3**

Module-5

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols. **L1, L2, L3**

Course Outcomes: At the end of the course, the students will be able to:
- Explain parallel computer models and conditions of parallelism
- Differentiate control flow, dataflow, demand driven mechanisms
- Explain the principle of scalable performance
- Discuss advanced processors architectures like CISC, RISC, superscalar and VLIW
- Understand the basics of instruction pipelining and memory technologies
- Explain the issues in multiprocessor architectures

Question paper pattern:

The question paper will have ten questions.

- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:
        Kai Hwang, "Advanced computer architecture"; TMH.

Reference Books:
   1. Kai Hwang and Zu, "Scalable Parallel Computers Architecture"; MGH.
   2. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing.
   3. D.A.Patterson, J.L.Hennessy, "Computer Architecture :A quantitative approach"; Morgan Kauffmann Feb, 2002.

SATELLITE COMMUNICATION			
B.E., VII Semester, Electronics & Communication Engineering **[As per Choice Based Credit System (CBCS) Scheme]**			
Course Code	17EC755	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			

Course Objectives: This course will enable students to

- Understand the basic principle of satellite orbits and trajectories.
- Study of electronic systems associated with a satellite and the earth station.
- Understand the various technologies associated with the satellite communication.
- Focus on a communication satellite and the national satellite system.
- Study of satellite applications focusing various domains services such as remote sensing, weather forecasting and navigation.

Module-1

Satellite Orbits and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle. **L1, L2**

Module-2

Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload.

Earth Station: Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking. **L1, L2**

Module-3

Multiple Access Techniques: Introduction, FDMA (No derivation), SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA.

Satellite Link Design Fundamentals: Transmission Equation, Satellite Link Parameters, Propagation considerations. **L1, L2, L3**

Module-4

Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems. **L1, L2**

Module-5

Remote Sensing Satellites: Classification of remote sensing systems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications.

Weather Forecasting Satellites: Fundamentals, Images, Orbits, Payloads, Applications.

Navigation Satellites: Development of Satellite Navigation Systems, GPS system, Applications. **L1, L2, L3**

Course Outcomes: At the end of the course, the students will be able to:

- Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
- Describe the electronic hardware systems associated with the satellite subsystem and earth station.
- Describe the various applications of satellite with the focus on national satellite system.
- Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.

Text Book:

Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015, ISBN: 978-81-265-2071-8.

Reference Books :

1. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017, ISBN: 978-81-265-0833-4

ADVANCED COMMUNICATION LAB			
B.E., VII Semester, Electronics & Communication Engineering **[As per Choice Based Credit System (CBCS) Scheme]**			
Course Code	**17ECL76**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03**	**SEE Marks**	**60**
RBT Levels	**L1, L2, L3**	**Exam Hours**	**03**
CREDITS – 02			

Course objectives: This course will enable students to:
- Design and demonstrate the digital modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Model an optical communication system and study its characteristics.
- Simulate the digital communication concepts and compute and display various parameters along with plots/figures.

Laboratory Experiments
PART-A: Following Experiments No. 1 to 4 has to be performed using discrete components.

1. Time Division Multiplexing and Demultiplexing of two bandlimited signals.

2. ASK generation and detection

3. FSK generation and detection

4. PSK generation and detection

5. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.

6. Measurement of directivity and gain of microstrip dipole and Yagi antennas.

7. Determination of

    a. Coupling and isolation characteristics of microstrip directional coupler.

    b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.

    c. Power division and isolation of microstrip power divider.

8. Measurement of propagation loss, bending loss and numerical aperture of an optical fiber.

PART-B: Simulation Experiments using SCILAB/MATLAB/Simulink or LabView

1. Simulate NRZ, RZ, half-sinusoid and raised cosine pulses and generate eye diagram for binary polar signaling.

2. Simulate the Pulse code modulation and demodulation system and display the waveforms.

3. Simulate the QPSK transmitter and receiver. Plot the signals and its constellation diagram.

4. Test the performance of a binary differential phase shift keying system by simulating the non-coherent detection of binary DPSK.

Course outcomes: On the completion of this laboratory course, the students will be able to:
- Determine the characteristics and response of microwave devices and optical waveguide.
- Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
- Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters.
- Design and test the digital modulation circuits/systems and display the waveforms.

Conduct of Practical Examination:
- All laboratory experiments are to be considered for practical   examination.
- For examination one question from **PART-A** and one question from **PART-B or** only one question from **PART-B** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

VLSI LAB
B.E., VII Semester, Electronics & Communication Engineering
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17ECL77	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to:
- Explore the CAD tool and understand the flow of the Full Custom IC design cycle.
- Learn DRC, LVS and Parasitic Extraction of the various designs.
- Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts.
- Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts.

Experiments can be conducted using any of the following or equivalent design tools: Cadence/Synopsis/Mentor Graphics/Microwind

Laboratory Experiments
PART - A
ASIC-DIGITAL DESIGN

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.
   - i.   An inverter
   - ii.   A Buffer
   - iii. Transmission Gate
   - iv.   Basic/universal gates
   - v.   Flip flop -RS, D, JK, MS, T
   - vi.   Serial & Parallel adder
   - vii. 4-bit counter [Synchronous and Asynchronous counter]
   - viii. Successive approximation register [SAR]

PART - B
ANALOG DESIGN

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
a. Draw the schematic and verify the following
    i) DC Analysis
    ii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design
e. Verify & Optimize for Time, Power and Area to the given constraint*

2. Design the (i) Common source and Common Drain amplifier and (ii) A Single Stage differential amplifier, with given specifications**, completing the design flow mentioned below:
a. Draw the schematic and verify the following
    i) DC Analysis
    ii) AC Analysis
    iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.

3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
a. Draw the schematic and verify the following
    i) DC Analysis
    ii). AC Analysis
    iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.

4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
a. Draw the schematic and verify the following
    i) DC Analysis
    ii) AC Analysis
    iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW. [Specifications to GDS-II]
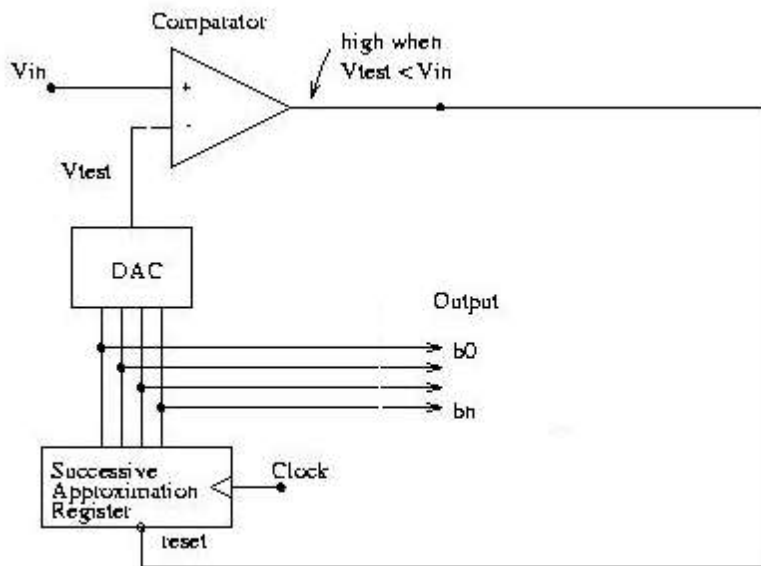
* An appropriate constraint should be given.

** Appropriate specification should be given.

*** Applicable Library should be added & information should be given to the Designer.

Course outcomes: On the completion of this laboratory course, the students will be able to:
- Write test bench to simulate various digital circuits.
- Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
- Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
- Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Conduct of Practical Examination:
- All laboratory experiments are to be included for practical examination.
- For examination, one question from **PART-A** and one question from **PART-B** to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C EIGTH SEMESTER SYLLABUS

WIRELESS CELLULAR and LTE 4G BROADBAND
**B.E., VIII Semester, Electronics &Communication Engineering/
Telecommunication Engineering**
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC81	CIE Marks	40
Number of Lecture	04	SEE Marks	60
Total Number	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to:

- Understand the basics of LTE standardization phases and specifications.
- Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles.
- Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.
- Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth.

Module – 1

Key Enablers for LTE features: OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture. (Sec 1.4- 1.5 of Text).

Wireless Fundamentals: Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC – Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading (Sec 2.2 – 2.7of Text). **L1, L2**

Module – 2

Multicarrier Modulation: OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE (Sec 3.2 – 3.6 of Text).

OFDMA and SC-FDMA: OFDM with FDMA,TDMA,CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE (Sec 4.1 – 4.3, 4.5 of Text).

Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial Multiplexing (Sec 5.1 – 5.6 of Text). **L1, L2**

Module – 3

Overview and Channel Structure of LTE: Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink SC-FDMA Radio Resource(Sec 6.1 – 6.4 of Text).

Downlink Transport Channel Processing: Overview, Downlink shared

channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink(Sec 7.1 – 7.7 of Text). **L1, L2**

Module – 4

Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink (Sec 8.1 – 8.6 of Text).

Physical Layer Procedures: Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink(Sec 9.1- 9.6, 9.8, 9.9, 9.10 Text). **L1, L2**

Module – 5

Radio Resource Management and Mobility Management:
PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination (Sec 10.1 – 10.5 of Text). **L1, L2**

Course Outcomes: At the end of the course, students will be able to:

- Understand the system architecture and the functional standard specified in LTE 4G.
- Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.
- Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios.
- Test and Evaluate the Performance of resource management and packet data processing and transport algorithms.

Text Book:

Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg. and Emerging Technologies.

Reference Books:

1. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.

2. 'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.

3. 'LTE – The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.

<table>
<tr><td colspan="4" align="center">FIBER OPTICS and NETWORKS
B.E., VIII Semester, Electronics &Communication Engineering
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
<tr><td>Course Code</td><td>17EC82</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>4</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50(10 Hours / Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 04</td></tr>
</table>

Course Objectives: This course will enable students to:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Learn the network standards in optical fiber and understand the network architectures along with its functionalities.

Module -1

Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. (Text 2) **L1, L2**

Module -2

Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.

Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers. (Text 2) **L1, L2**

Module -3

Optical sources: Energy Bands, Direct and Indirect Bandgaps, Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and Radiation Patterns: Single mode lasers.

Photodetectors: Physical principles of Photodiodes, Photodetector noise, Detector response time.

Optical Receiver: Optical Receiver Operation: Error sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 1) **L1, L2**

Module -4

WDM Concepts and Components: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources,

Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 1) **L1, L2**

Module -5

Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment: Long-haul networks, Metropoliton area networks, Access networks, Local area networks. (Text 2) **L1, L2**

Course Outcomes: At the end of the course, students will be able to:

1. Classification and working of optical fiber with different modes of signal propagation.
2. Describe the transmission characteristics and losses in optical fiber communication.
3. Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
4. Describe the constructional features and the characteristics of optical sources and detectors.
5. Illustrate the networking aspects of optical fiber and describe various standards associated with it.

Text Books:
1. Gerd Keiser , Optical Fiber Communication, 5th Edition, McGraw Hill Education(India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

Reference Book:
Joseph C Palais, Fiber Optic Communication , Pearson Education, 2005, ISBN:0130085103

<table>
<tr><td colspan="4" align="center">MICRO ELECTRO MECHANICAL SYSTEMS
B.E., VIII Semester, Electronics & Communication Engineering/
Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
</table>

Course Code	17EC831	CIE Marks	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	03

<div align="center">CREDITS – 03</div>

Course Objectives: This course will enable students to:
- Understand overview of microsystems, their fabrication and application areas.
- Working principles of several MEMS devices.
- Develop mathematical and analytical models of MEMS devices.
- Know methods to fabricate MEMS devices.
- Various application areas where MEMS devices can be used.

<div align="center">Module 1</div>

Overview of MEMS and Microsystems: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets. **L1, L2**

<div align="center">Module 2</div>

Working Principles of Microsystems: Introduction, Microsensors, Microactuation, MEMS with Microactuators, Microaccelerometers, Microfluidics.

Engineering Science for Microsystems Design and Fabrication: Introduction, Molecular Theory of Matter and Inter-molecular Forces, Plasma Physics, Electrochemistry. **L1, L2**

<div align="center">Module 3</div>

Engineering Mechanics for Microsystems Design: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermomechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis. **L1, L2, L3**

<div align="center">Module 4</div>

Scaling Laws in Miniaturization: Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Fluid Mechanics, Scaling in Heat Transfer. **L1, L2, L3**

<div align="center">Module 5</div>

Overview of Micromanufacturing: Introduction, Bulk Micromanufacturing, Surface Micromachining, The LIGA Process, Summary on Micromanufacturing. **L1, L2**
Course Outcomes: After studying this course, students will be able to: • Appreciate the technologies related to Micro Electro Mechanical Systems. • Understand design and fabrication processes involved with MEMS devices. • Analyse the MEMS devices and develop suitable mathematical models • Know various application areas for MEMS device
Text Book: Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley.
Reference Books: 1. Hans H. Gatzen, Volker Saile, JurgLeuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015. 2. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cenage Learning.

SPEECH PROCESSING			
B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC832	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours / Module)	**Exam Hours**	03
CREDITS – 03			

Course Objectives: This course enables students to:

● Introduce the models for speech production
● Develop time and frequency domain techniques for estimating speech parameters
● Introduce a predictive technique for speech compression
● Provide fundamental knowledge required to understand and analyse speech recognition, synthesis and speaker identification systems.

Module-1

Fundamentals of Human Speech Production: The Process of Speech Production, Short-Time Fourier Representation of Speech, The Acoustic Theory of Speech Production, Lossless Tube Models of the Vocal Tract, Digital Models for Sampled Speech Signals. **L1, L2**

Module-2

Time-Domain Methods for Speech Processing: Introduction to Short-Time Analysis of Speech, Short-Time Energy and Short-Time Magnitude, Short-Time Zero-Crossing Rate, The Short-Time Autocorrelation Function, The Modified Short-Time Autocorrelation Function, The Short-Time Average Magnitude Difference Function. **L1, L2**

Module-3

Frequency Domain Representations: Discrete-Time Fourier Analysis, Short-Time Fourier Analysis, Spectrographic Displays, Overlap Addition(OLA),Method of Synthesis, Filter Bank Summation(FBS) Method of Synthesis, Time-Decimated Filter Banks, Two-Channel Filter Banks, Implementation of the FBS Method Using the FFT, OLA Revisited, Modifications of the STFT. **L1, L2**

Module-4

The Cepstrum and Homomorphic Speech Processing: Homomorphic Systems for Convolution, Homomorphic Analysis of the Speech Model, Computing the Short-Time Cepstrum and Complex Cepstrum of Speech, Homomorphic Filtering of Natural Speech, Cepstrum Analysis of All-Pole Models, Cepstrum Distance Measures. **L1, L2, L3**

Module-5

Linear Predictive Analysis of Speech Signals: Basic Principles of Linear Predictive Analysis, Computation of the Gain for the Model, Frequency Domain Interpretations of Linear Predictive Analysis, Solution of the LPC Equations, The Prediction Error Signal, Some Properties of the LPC Polynomial A(z), Relation of Linear Predictive Analysis to

Lossless Tube Models, Alternative Representations of the LP Parameters. **L1, L2, L3**

Course outcomes: Upon completion of the course, students will be able to:
- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate speech model for a given application.
- Analyse speech recognition, synthesis and speaker identification systems

Text Book:

Theory and Applications of Digital Speech Processing-Rabiner and Schafer, Pearson Education 2011

Reference Books:

1. **Fundamentals of Speech Recognition-** Lawrence Rabiner and Biing-Hwang Juang, Pearson Education, 2003.

2. **Speech and Language Processing–An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition-** Daniel Jurafsky and James H Martin, Pearson Prentice Hall 2009.

<table>
<tr><td colspan="4" align="center">RADAR ENGINEERING
B.E., VIII Semester, Electronics & Communication Engineering/
Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
</table>

Course Code	17EC833	**CIE Marks**	**40**
Number of Lecture Hours/Week	03	**SEE Marks**	**60**
Total Number of Lecture Hours	40 (8 Hours / Module)	**Exam Hours**	**03**

<div align="center">CREDITS – 03</div>

Course objectives: This course will enable students to:
- Understand the Radar fundamentals and analyze the radar signals.
- Understand various technologies involved in the design of radar transmitters and receivers.
- Learn various radars like MTI, Doppler and tracking radars and their comparison

<div align="center">Module-1</div>

Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power.
Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. (Chapter 1 of Text) **L1, L2, L3**

<div align="center">Module-2</div>

The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Probability of Detection,
Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. (Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11) **L1, L2, L3**

<div align="center">Module-3</div>

MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler,
Digital MTI Processing – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. (Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text) **L1, L2, L3**

<div align="center">Module-4</div>

Tracking Radar:
Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse.
Sequential Lobing, Conical Scan Tracking, Block Diagram of Conical Scan Tracking Radar, Tracking in Range, Comparison of Trackers. (Chapter 4: 4.1, 4.2, 4.3 of Text) **L1, L2, L3**

<div align="center">Module-5</div>

The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas**. (Chapter 9: 9.1, 9.2 9.4,

9.5 of Text)
Radar Receiver: The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. (Chapter 11 of Text)
L1, L2, L3

Course outcomes: At the end of the course, students will be able to:
- Understand the radar fundamentals and radar signals.
- Explain the working principle of pulse Doppler radars, their applications and limitations
- Describe the working of various radar transmitters and receivers.
- Analyze the range parameters of pulse radar system which affect the system performance

Text Book:
   Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.

Reference Books:
1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998.
3. Principles of Modem Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. HoIm. Yesdee, 2013

	MACHINE LEARNING		
B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC834	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			

Course Objectives: This course will enable students to:

- Introduce some concepts and techniques that are core to Machine Learning.

- Understand learning and decision trees.

- Acquire knowledge of neural networks, Bayesian techniques and instant based learning.

- Understand analytical learning and reinforced learning.

Module-1
Learning: Designing Learning systems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Elimination Algorithm, Inductive bias. **L1, L2**
Module-2
Decision Tree and ANN: Decision Tree Representation, Hypothesis Space Search, Inductive bias in decision tree, issues in Decision tree. Neural Network Representation, Perceptrons, Multilayer Networks and Back Propagation Algorithms. **L1, L2**
Module-3
Bayesian and Computational Learning: Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier. **L1, L2**
Module-4
Instant Based Learning and Learning set of rules: K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning. Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rules. **L1, L2**
Module-5
Analytical Learning and Reinforced Learning: Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, FOCL Algorithm, Reinforcement Learning. **L1, L2**

Course outcomes: At the end of the course, students should be able to:
- Understand the core concepts of Machine learning.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms.
- Explain paradigms of supervised and un-supervised learning.
- Recognize a real world problem and apply the learned techniques of Machine Learning to solve the problem.

Text Book:

    Machine Learning-Tom M. Mitchell, McGraw-Hill Education, (Indian Edition), 2013.

Reference Books:

1. **Introduction to Machine Learning-** Ethem Alpaydin, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. **The Elements of Statistical Learning-**T. Hastie, R. Tibshirani, J. H. Friedman, Springer; 1st edition, 2001.

NETWORK AND CYBER SECURITY			
B.E., VIII Semester, Electronics & Communication Engineering [As per Choice Based credit System (CBCS) Scheme]			
Course Code	17EC835	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			

Course Objectives: This course will enable students to:

- Know about security concerns in Email and Internet Protocol.
- Understand cyber security concepts.
- List the problems that can arise in cyber security.
- Discuss the various cyber security frame work.

Module-1
Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH) (Text 1: Chapter 15). **L1, L2**
Module-2
E-mail Security: Pretty Good Privacy, S/MIME, Domain keys identified mail (Text 1: Chapter 17). **L1, L2**
Module-3
IP Security: IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Combining security Associations Internet Key Exchange. Cryptographic Suites(Text 1: Chapter 18.) **L1, L2**
Module-4
Cyber network security concepts: Security Architecture, antipattern: signature based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, behavioural and entropy based malware detection.   **The problems:** cyber antipatterns concept, forces in cyber antipatterns, cyber anti pattern templates, cyber security antipattern catalog (Text-2: Chapter1 & 2). **L1, L2, L3**
Module-5
Cyber network security concepts contd. : **Enterprise security using Zachman framework** Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem solving patterns, enterprise workshop, matrix mining, mini patterns for problem solving meetings. **Case study:** cyber security hands on – managing administrations and root accounts, installing hardware, reimaging OS, installing system protection/ antimalware, configuring firewalls (Text-2: Chapter 3 & 4). **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Explain network security protocols
- Understand the basic concepts of cyber security
- Discuss the cyber security problems
- Explain Enterprise Security Framework
- Apply concept of cyber security framework in computer system administration

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3.

2. Thomas J. Mowbray, "Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions", Wiley.

Reference Books:

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: B.E: Electronics & Communication Engineering

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	HSMC	18ES51	Technological Innovation Management and Entrepreneurship		3	0	--	03	40	60	100	3
2	PCC	18EC52	Digital Signal Processing		3	2	--	03	40	60	100	4
3	PCC	18EC53	Principles of Communication Systems		3	2	--	03	40	60	100	4
4	PCC	18EC54	Information Theory & Coding		3	--	--	03	40	60	100	3
5	PCC	18EC55	Electromagnetic Waves		3	--	--	03	40	60	100	3
6	PCC	18EC56	Verilog HDL		3	--	--	03	40	60	100	3
7	PCC	18ECL57	Digital Signal Processing Laboratory		--	2	2	03	40	60	100	2
8	PCC	18ECL58	HDL Laboratory		--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
			TOTAL		**19**	**8**	**4**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: B.E: Electronics & Communication Engineering

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week				Examination					Credits
					Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Duration in hours	CIE Marks	SEE Marks	Total Marks			
1	PCC	18EC61	Digital Communication		3	2	--	03	40	60	100			4
2	PCC	18EC62	Embedded Systems		3	2	--	03	40	60	100			4
3	PCC	18EC63	Microwave and Antennas		3	2	--	03	40	60	100			4
4	PEC	18XX64X	Professional Elective -1		3	--	--	03	40	60	100			3
5	OEC	18XX65X	Open Elective -A		3	--	--	03	40	60	100			3
6	PCC	18ECL66	Embedded Systems Laboratory		--	2	2	03	40	60	100			2
7	PCC	18ECL67	Communication Laboratory		--	2	2	03	40	60	100			2
8	MP	18ECMP68	Mini-project		--	--	2	03	40	60	100			2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.										
			TOTAL		**15**	**10**	**6**	**24**	**320**	**480**	**800**			**24**

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1

Course code under 18XX64X	Course Title
18EC641	Operating System
18EC642	Artificial Neural Networks
18EC643	Data Structures using C++
18EC644	Digital System Design Using Verilog
18EC645	Nanoelectronics
18EC646	Python Application Programming

OPEN ELECTIVE group-B	
18EC651	Signal Processing
18EC652	Sensors &Signal Conditioning
18EC653	**Virtual Instrumentation**
18EC654	**Microcontrollers**
18EC655	**Basic VLSI Design**

Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Mini-project work:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-project:

(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

B. E. 2018 Scheme Fifth Semester Syllabus (EC / TC)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER – V

TECHNOLOGICAL INNOVATION MANAGEMENT AND ENTREPRENEURSHIP

Course Code	: **18ES51**	CIE Marks : 40
Lecture Hours/Week	: 03	SEE Marks : 60
Total Number of Lecture Hours : 40 (08 Hours / Module) Exam Hours : 03		
CREDITS 03		

Course Learning Objectives: This course will enable students to:
- Understand basic skills of Management
- Understand the need for Entrepreneurs and their skills
- Identify the Management functions and Social responsibilities
- Understand the Ideation Process, creation of Business Model, Feasibility Study and sources of funding

Module-1
Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession **(Selected topics of Chapter 1, Text 1).**
Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making (**Selected topics from Chapters 4 & 5, Text 1).** L1,L2

Module-2
Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees–Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; **Staffing**-Need and Importance**,** Recruitment and Selection Process **(Selected topics from Chapters 7, 8 & 11,Text 1).**
Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership;

Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process

(**Selected topics from Chapters 15 to 18 and 9, Text 1).** L1,L2

Module-3

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance **(Selected topics from Chapter 3, Text 1).**

Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship **(Selected topics from Chapter 2, Text 2).** L1,L2

Module-4

Family Business: Role and Importance of Family Business, Contributions of Family Business in India, Stages of Development of a Family Business, Characteristics of a Family-owned Business in India, Various types of family businesses **(Selected topics from Chapter 4,(Page 71-75) Text 2).**

Idea Generation and Feasibility Analysis- Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities.**(Selected topics from Chapter 6(Page No. 111-117) & Chapter 7(Page No. 140-142), Text 2)** L1,L2

Module-5

Business model – Meaning, designing, analyzing and improvising; Business Plan – Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails? **(Selected topics from Chapter 8 (Page No 159-164, Text 2)**

Financing and How to start a Business? Financial opportunity identification; Banking sources; Nonbanking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for funding business; Pre launch, Launch and Post launch requirements; Procedure for getting License and Registration; Challenges and Difficulties in Starting an Enterprise**(Selected topics from Chapter 7(Page No 147-149), Chapter 5(Page No 93-99) & Chapter 8(Page No. 166-172) Text 2)**

Project Design and Network Analysis: Introduction, Importance of Network

Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.
(Selected topics from Chapters 20, Text 3). **L1,L2,L3**

Course Outcomes: After studying this course, students will be able to:
1. Understand the fundamental concepts of Management and Entrepreneurship and opportunities in order to setup a business
2. Identify the various organizations' architecture
3. Describe the functions of Managers, Entrepreneurs and their social responsibilities
4. Understand the components in developing a business plan
5. Recognize the various sources of funding and institutions supporting entrepreneurs

Text Books:
1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.
4. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, "Entrepreneurship", 8th Edition, Tata Mc-Graw Hill Publishing Co.Ltd.- New Delhi, 2012

Reference Book:
1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

DIGITAL SIGNAL PROCESSING

Course Code : **18EC52**	CIE Marks : 40
Lecture Hours/Week : 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)	Exam Hours : 03

CREDITS : 04

Course Learning Objectives: This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.
- Understand the architecture and working of DSP processor

Module-1

Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties.
[Text 1],   **L1,L2,L3**

Module-2

Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long data Sequences.
Fast-Fourier-Transform (FFT) algorithms: Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms.
[Text 1],   **L1,L2, L3**

Module-3

Design of FIR Filters: Characteristics of practical frequency –selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR filters using windows - Rectangular, Hamming, Hanning, Bartlett windows. Design of FIR filters using frequency sampling method. Structure for FIR Systems: Direct form, Cascade form and Lattice structures**.
[Text1],   **L1, L2, L3**

Module-4

IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Lowpass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II.

[Text 2],   **L1,L2,L3**

Module-5

Digital Signal Processors: DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors, Floating point processors, FIR and IIR filter implementations in Fixed point systems**.**

[Text 2],   **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:
1. Determine response of LTI systems using time domain and DFT techniques.
2. Compute DFT of real and complex discrete time signals.
3. Compute DFT using FFT algorithms and linear filtering approach.
4. Design and realize FIR and IIR digital filters.
5. Understand the DSP processor architecture.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60

Text Book:
1. Proakis & Manolakis, "Digital Signal Processing – Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2. Li Tan, Jean Jiang, "Digital Signal processing – Fundamentals and Applications", Academic Press, 2013, ISBN: 978-0-12-415893.

Reference Books:
1. Sanjit K Mitra, "Digital Signal Processing, A Computer Based Approach", 4th Edition, McGraw Hill Education, 2013,
2. Oppenheim & Schaffer, "Discrete Time Signal Processing" , PHI, 2003.
3. D.Ganesh Rao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

PRINCIPLES OF COMMUNICATION SYSTEMS

Course Code	: **18EC53**	CIE Marks : 40
Lecture Hours/Week : 03 + 2 (Tutorial)		SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)		Exam Hours : 03
CREDITS : 04		

Course Learning Objectives: This course will enable students to
- Understand and analyse concepts of Analog Modulation schemes viz; AM, FM, Low pass sampling and Quantization as a random process.
- Understand and analyse concepts digitization of signals viz; sampling, quantizing and encoding.
- Evolve the concept of SNR in the presence of channel induced noise and study Demodulation of analog modulated signals.
- Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver.

Module-1
AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency Domain description, Switching modulator, Envelop detector. **(3.1 – 3.2 in Text)**

DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. **(3.3 – 3.4 in Text)**

SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing,Theme Example: VSB Transmission of Analog and Digital Television. **(3.5 – 3.8 in Text)**

L1, L2, L3

Module-2
ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver **(4.1 – 4.6 of Text)**

L1, L2, L3

Module-3

[Review of Mean, Correlation and Covariance functions of Random Processes. (No questions to be set on these topics)]
NOISE - Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth **(5.10 in Text)**
NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM **(6.1 – 6.6 in Text)**

L1,L2,L3

Module-4

SAMPLING AND QUANTIZATION: Introduction, Why Digitize Analog Sources?, The Low pass Sampling process Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves.**(7.1 – 7.7 in Text)**

L1,L2,L3

Module-5

SAMPLING AND QUANTIZATION (Contd): The Quantization Random Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation **(7.8 – 7.10 in Text)**,
Application examples - (a) Video + MPEG **(7.11 in Text)** and (b) Vocoders **(refer Section 6.8 of Reference Book 1)**.

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Analyze and compute performance of AM and FM modulation in the presence of noise at the receiver.
2. Analyze and compute performance of digital formatting processes with quantization noise.
3. Multiplex digitally formatted signals at Transmitter.
4. Demultiplex the signals and reconstruct digitally formatted signals at the receiver.
5. Design /Demonstrate the use of digital formatting in Multiplexers, Vocoders and Video transmission.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.

- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
1. "Communication Systems", Simon Haykin & Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

Reference Books:
1. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press, 4th edition.
2. An Introduction to Analog and Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.
3. Principles of Communication Systems, H.Taub & D.L.Schilling, TMH, 2011.
4. Communication Systems, Harold P.E, Samy A. Mahmoud, Lee Elliott Stern, Pearson Edition, 2004.

INFORMATION THEORY and CODING

Course Code	: **18EC54**	CIE Marks	: 40
Lecture Hours/Week	: 3	SEE Marks	: 60
Total Number of Lecture Hours : 40 (8 Hrs / Module)		Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to
- Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
- Study various source encoding algorithms.
- Model discrete & continuous communication channels.
- Study various error control coding algorithms.

Module-1
Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Markoff Sources
(Section 4.1, 4.2 of Text 1)   **L1, L2,L3**

Module-2
Source Coding: Encoding of the Source Output, Shannon's Encoding Algorithm**(Sections 4.3, 4.3.1 of Text 1),** Shannon Fano Encoding Algorithm **(Section 2.15 of Reference Book 4)**
Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI, Huffman codes **(Section 2.2 of Text 2)**
                                                        L1, L2, L3

Module-3
Information Channels: Communication Channels, Discrete Communication channels Channel Matrix, Joint probabilty Matrix, Binary Symmetric Channel, System Entropies. **(Section 4.4, 4.5, 4.51,4.5.2 of Text 1)**

Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel, **(Section 2.5, 2.6 of Text 2)**

Binary Erasure Channel, Muroga's Theorem **(Section 2.27, 2.28 of Reference Book 4)**
                                                        L1, L2, L3

Error Control Coding:
Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array.

Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction **(Sections 9.1, 9.2,9.3,9.3.1,9.3.2,9.3.3 of Text 1)** ,

L1, L2, L3

Module-5
Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) **(Section 8.5 – Articles 1, 2 and 3, 8.6- Article 1 of Text 2),**

L1, L2, L3

Course Outcomes: After studying this course, students will be able to:
1. Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
2. Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
3. Model the continuous and discrete communication channels using input, output and joint probabilities
4. Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
5. Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
1.   Digital and Analog Communication Systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2.   Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

Reference Books:
1.   ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2.   Principles of Digital Communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering
3.   Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
4.   Information Theory and Coding, HariBhat, Ganesh Rao, Cengage, 2017.
5.   Error Correction Coding, Todd K Moon, Wiley Std. Edition, 2006

ELECTROMAGNETIC WAVES

Course Code	: **18EC55**	CIE Marks	: 40
Lecture Hours/Week	: 3	SEE Marks	: 60
Total Number of Lecture Hours : 40 (8 Hrs / Module)		Exam Hours	: 03

CREDITS – 03

Course Learning Objectives: This course will enable students to:
- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart's, Ampere's Law and Stokes' theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behavior in different media.
- Acquire knowledge of Poynting theorem and its application of power flow.

Module-1
Revision of Vector Calculus – **(Text 1: Chapter 1)**
Coulomb's Law, Electric Field Intensity and Flux density: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**

L1, L2, L3

Module -2
Gauss's law and Divergence: Gauss law, Application of Gauss law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ∇ and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).**
Energy, Potential and Conductors: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and 4.6).** Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**

L1, L2, L3

Module-3

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation **(Text: Chapter 7.1 to 7.3)**

Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems. (**Text: Chapter 8.1 to 8.6)**

L1, L2, L3

Module -4

Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3)**.

Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems **(Text: Chapter 9.6 to 9.7)**.

Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**

L1, L2, L3

Module -5

Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)**

Uniform Plane Wave: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (γ, α, β, η) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**

L1, L2, L3

Course Outcomes: After studying this course, students will be able to:
1. Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
2. Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.

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3. Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
4. Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
5. Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
1. W.H. Hayt and J.A. Buck, ―Engineering Electromagnetics, 8th Edition, Tata McGraw-Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books:
1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4th Edn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balmain, PHI, 2nd Edn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. Fundamentals of Electromagnetics for Engineering - N. Narayana Rao, Pearson.

Verilog HDL

Course Code	: **18EC56**	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours : 40 (08 Hrs/Module)		Exam Hours	: 03
CREDITS– 03			

Course Learning Objectives: This course will enable students to:
- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand Verilog Tasks, Functions and Directives.
- Understand timing and delay Simulation.
- Understand the concept of logic synthesis and its impact in verification

Module 1
Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs.
Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.   **L1,L2,L3**

Module 2
Basic Concepts: Lexical conventions, data types, system tasks, compiler directives.
Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing   **L1,L2,L3**

Module 3
Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.
Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types.   **L1,L2,L3**

Module 4
Behavioral Modeling: Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.
Tasks and Functions: Differences between tasks and functions, declaration, invocation, automatic tasks and functions.   **L1,L2,L3**

Module 5

Useful Modeling Techniques: Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks.
Logic Synthesis with Verilog: Logic Synthesis, Impact of logic synthesis, Verilog HDL Synthesis, Synthesis design flow, Verification of Gate-Level Netlist**. (Chapter 14 till 14.5 of Text).   L1,L2,L3**

Course Outcomes: At the end of this course, students will be able to
1.   Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
2.   Design and verify the functionality of digital circuit/system using test benches.
3.   Identify the suitable Abstraction level for a particular digital design.
4.   Write the programs more effectively using Verilog tasks, functions and directives.
5.   Perform timing and delay Simulation and Interpret the various constructs in logic synthesis.

Question paper pattern:
* Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
* Each full question can have a maximum of 4 sub questions.
* There will be 2 full questions from each module covering all the topics of the module.
* Students will have to answer 5 full questions, selecting one full question from each module.
* The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
1.   Samir Palnitkar, "**Verilog HDL: A Guide to Digital Design and Synthesis**", Pearson Education, Second Edition.

Reference Books:
1.   Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.
2.   Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.
3.   Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

DIGITAL SIGNAL PROCESSING LABORATORY

Course Code : **18ECL57**	CIE Marks : 40	SEE Marks : 60
Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory		
RBT Level : L1, L2, L3	Exam Hours : 03	
CREDITS – 02		

Course Learning Objectives: This course will enable students to
- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

Laboratory Experiments

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Verification of sampling theorem (use interpolation function).

2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.

3. Auto and cross correlation of two sequences and verification of their properties

4. Solving a given difference equation.

5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).

6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
   (ii) DFT computation of square pulse and Sinc function etc.

7. Design and implementation of Low pass and High pass FIR filter to meet the desired specifications (using different window techniques) and test the filter with an audio file. Plot the spectrum of audio signal before and after filtering.

8. Design and implementation of a digital IIR filter (Low pass and High pass) to meet given specifications and test with an audio file. Plot the spectrum of audio signal before and after filtering.

Following Experiments to be done using DSP kit
9. Obtain the Linear convolution of two sequences.
10. Compute Circular convolution of two sequences.
11. Compute the N-point DFT of a given sequence.
12. Determine the Impulse response of first order and second order system.
13. Generation of sine wave and standard test signals

Course Outcomes:
On the completion of this laboratory course, the students will be able to:
1. Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
2. Model the discrete time signals and systems and verify its properties and results.
3. Implement discrete computations using DSP processor and verify the results.
4. Realize the digital filters using a simulation tool and analyze the response of the filter for an audio signal.
5. Write programs using Matlab / Scilab/Octave to illustrate DSP concepts.

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

Reference Books:
1. Vinay K Ingle, John G Proakis, Digital Signal Processing using MATLAB, Fourth Edition, Cengage India Private Limited, 2017.

HDL LABORATORY

Course Code : **18ECL58**	CIE Marks : 40	SEE Marks : 60

Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory

RBT Level : L1, L2, L3   Exam Hours : 03

CREDITS – 02

Course Learning Objectives: This course will enable students to:
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD board and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

PART A

1. Write Verilog program for the following combinational design along with test bench to verify the design:
   a. 2 to 4 decoder realization using NAND gates only (structural model)
   b. 8 to 3 encoder with priority and without priority (behavioural model)
   c. 8 to 1 multiplexer using case statement and if statements
   d. 4-bit binary to gray converter using 1-bit gray to binary converter 1-bit adder and subtractor

2. Model in Verilog for a full adder and add functionality to perform logical operations of XOR, XNOR, AND and OR gates. Write test bench with appropriate input patterns to verify the modeled behaviour.

3. Verilog 32-bit ALU shown in figure below and verify the functionality of ALU by selecting appropriate test patterns. The functionality of the ALU is presented in Table 1.
   a. Write test bench to verify the functionality of the ALU considering all possible input patterns
   b. The enable signal will set the output to required functions if enabled, if disabled all the outputs are set to tri-state
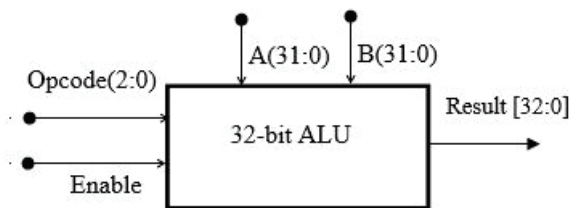   c. The acknowledge signal is set high after every operation is complete

Figure 1 ALU top level block diagram

Table 1 ALU Functions

Opcode (2:0)	ALU Operation	Remarks	
000	A + B	Addition of two numbers	Both A and B are in two's complement format
001	A – B	Subtraction of two numbers	
010	A + 1	Increment Accumulator by 1	A is in two's complement format
011	A - 1	Decrement accumulator by 1	
100	A	True	Inputs can be in any format
101	A Complement	Complement	
110	A OR B	Logical OR	
111	A AND B	Logical AND	

4. Write Verilog code for SR, D and JK and verify the flip flop.
5. Write Verilog code for 4-bit BCD synchronous counter.
6. Write Verilog code for counter with given input clock and check whether it works as clock divider performing division of clock by 2, 4, 8 and 16. Verify the functionality of the code.

PART-B

Interfacing and Debugging (EDWinXP, PSpice, MultiSim, Proteus, CircuitLab or any other equivalent tool can be used)

1. Write a Verilog code to design a clock divider circuit that generates 1/2, 1/3rd and 1/4th clock from a given input clock. Port the design to FPGA and validate the functionality through oscilloscope.
2. Interface a DC motor to FPGA and write Verilog code to change its speed and direction.
3. Interface a Stepper motor to FPGA and write Verilog code to control the Stepper motor rotation which in turn may control a Robotic Arm. External switches to be used for different controls like rotate the Stepper motor (i) +N steps if Switch no.1 of a Dip switch is closed (ii) +N/2 steps if Switch no. 2 of a Dip switch is closed (iii) –N steps if Switch no. 3 of a Dip switch is closed etc.

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4. Interface a DAC to FPGA and write Verilog code to generate Sine wave of frequency F KHz (eg. 200 KHz) frequency. Modify the code to down sample the frequency to F/2 KHz. Display the Original and Down sampled signals by connecting them to an oscilloscope.

5. Write Verilog code using FSM to simulate elevator operation.

6. Write Verilog code to convert an analog input of a sensor to digital form and to display the same on a suitable display like set of simple LEDs, 7-segment display digits or LCD display.

Course Outcomes: At the end of this course, students will be able to:
1. Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
2. Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
3. Use FPGA/CPLD kits for down loading Verilog codes and check output.
4. Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
5. Interface the hardware to the programmable chips and obtain the required output

Conduct of Practical Examination:
*   All laboratory experiments are to be included for practical examination.
*   Students are allowed to pick one experiment from the lot.
*   Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
*   Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

ENVIRONMENTAL STUDIES

Course Code	: 18CIV59	CIE Marks	: 40
Lecture Hours / Week (L:T:P)	: (1:0:0)	SEE Marks	: 60
Credits	: 01	Exam Hours	: 02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.

Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.

Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns(Concept, policies and case-studies):Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course outcomes: At the end of the course, students will be able to:
1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
4. Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
5. Relate to the latest Developments in Environmental Pollution Mitigation Tools.

Question paper pattern:
- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Textbook/s
1. Environmental Studies, Benny Joseph, Tata McGraw – Hill., 2nd Edition, 2012
2. Environmental Studies, S M Prakash, Pristine Publishing House, Mangalore, 3rd Edition, 2018
3. Environmental Studies – From Crisis to Cure, R Rajagopalan, Oxford Publisher, 2005

Reference Books
1. Principles of Environmental Science and Engineering, Raman Sivakumar, Cengage learning, Singapur. 2nd Edition, 2005
2. Environmental Science – working with the Earth, G.Tyler Miller Jr., Thomson Brooks /Cole, 11th Edition, 2006
3. Text Book of Environmental and Ecology, Pratiba Sing, Anoop Singh & Piyush Malaviya, Acme Learning Pvt. Ltd. New Delhi, 1st Edition

B. E. 2018 Scheme Sixth Semester Syllabus (EC)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER – VI
DIGITAL COMMUNICATION

Course Code	: 18EC61	CIE Marks : 40
Lecture Hours/Week	: 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)		Exam Hours : 03
CREDITS : 04		

Course Learning Objectives: This course will enable students to:
* Understand the mathematical representation of signal, symbol, and noise.
* Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
* Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
* Compute performance parameters and mitigate channel induced impediments in corrupted channel conditions.

Module-1
Bandpass Signal to Equivalent Low pass: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems **(Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).**

Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities **(Text 1: Ch 6.10).**
Overview of HDB3, B3ZS, B6ZS **(Ref. 1: 7.2)**

L1,L2,L3

Module-2
Signaling over AWGN Channels- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver **(Text 1: 7.1, 7.2, 7.3, 7.4).**

L1,L2,L3

Module – 3
Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM **(Relevant topics in Text 1 of 7.6, 7.7).**

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Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability **(Relevant topics in Text 1 of 7.8).**
Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) **(Text 1: 7.11, 7.12. 7.13).**

L1,L2,L3

Module-4
Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI–The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol–by–Symbol detection of data with controlled ISI **(Text 2: 9.1, 9.2, 9.3.1, 9.3.2).**
Channel Equalization: Linear Equalizers (ZFE, MMSE), **(Text 2: 9.4.2).**

L1,L2,L3

Module-5
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 **(Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).**

L1,L2,L3

Course Outcomes: At the end of the course, the students will be able to:
1. Associate and apply the concepts of Bandpass sampling to well speci-fied signals and channels.
2. Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels.
3. Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.

4. Demonstrate that bandpass signals subjected to corruption and distortion in a bandlimited channel can be processed at the receiver to meet specified performance criteria.
5. Understand the principles of spread spectrum communications.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:
1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

Reference Books:
1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. Bernard Sklar and Ray, "Digital Communications - Fundamentals and Applications", Pearson Education, Third Edition, 2014, ISBN: 978-81-317-2092-9.

EMBEDDED SYSTEMS

Course Code	: 18EC62	CIE Marks : 40
Lecture Hours/Week	: 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)		Exam Hours : 03
CREDITS : 04		

Course Learning Objectives: This course will enable students to:
- Explain the architectural features and instructions of 32 bit microcontroller -ARM Cortex M3.
- Develop Programs using the various instructions of ARM Cortex M3 and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Module 1
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence **(Text 1: Ch-1, 2, 3)**

L1,L2

Module 2
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming **(Text 1: Ch-4, Ch-10.1 to 10.6)**

L1,L2,L3

Module 3
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation),
Differences between RISC and CISC, Harvard and Princeton, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only)

(Text 2: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only).

L1, L2

Module 4

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). **Text 2: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)**

L1,L2,L3

Module 5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques **(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch-12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)**

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
2. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
3. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
4. Develop the hardware software co-design and firmware design approaches.
5. Explain the need of real time operating system for embedded system applications.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:
1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

Reference Books:
1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0-471-72180-2.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd Ed. Man Press LLC ©2015 ISBN: 0982692633 9780982692639.
3. K.V. K. K Prasad, Embedded Real Time Systems, Dreamtech publications, 2003.
4. Rajkamal, Embedded Systems, 2nd Edition, McGraw hill Publications, 2010.

MICROWAVE and ANTENNAS

Course Code	: **18EC63**	CIE Marks : 40
Lecture Hours/Week	: 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)		Exam Hours : 03
CREDITS : 04		

Course Learning Objectives: This course will enable students to:
- Describe the microwave properties and its transmission media
- Describe microwave devices for several applications
- Understand the basics of antenna theory
- Select antennas for specific applications

Module 1
Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). **(Text 1: 9.1, 9.2.1)**

Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching.
(Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching)
                                                                                      L1,L2

Module 2
Microwave Network theory: Introduction**,** Symmetrical Z and Y-Parameters for reciprocal Networks, S matrix representation of Multi-Port Networks. **(Text1: 6.1, 6.2, 6.3)**

Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees.
(Text 1: 6.4.2,6.4.14, 6.4.15, 6.4.16)   **L1,L2**

Module 3
Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines**. (Text 2: 11.1, 11.2, 11.3, 11.4)**

Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Radio Communication Link, Antenna Field Zones. **(Text 3: 2.1 - 2.7, 2.9 – 2.11, 2.13)**   **L1,L2,L3**

Module 4

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Arrays of two isotropic point sources, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.
(Text 3: 5.1 – 5.6, 5.9, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole, Radiation Resistance of a Short Electric Dipole, Thin Linear Antenna (Field Analyses)
(Text 3: 6.1 - 6.5)

L1,L2,L3,L4

Module 5

Loop and Horn Antenna: Introduction, Small loop, The Loop Antenna General Case, The Loop Antenna as a special case, Radiation resistance of loops, Directivity of Circular Loop Antennas with uniform current, Horn antennas Rectangular Horn Antennas.
(Text 3: 7.1, 7.2, 7.4, 7.6, 7.7, 7.8, 7.19, 7.20)

Antenna Types: The Helix geometry, Helix modes, Practical Design considerations for the mono-filar axial mode Helical Antenna, Yagi-Uda array, Parabolic reflector
(Text 3: 8.3, 8.4, 8.5, 8.8, 9.5)

L1,L2,L3

Course outcomes: At the end of the course students will be able to:
1. Describe the use and advantages of microwave transmission
2. Analyze various parameters related to microwave transmission lines and waveguides
3. Identify microwave devices for several applications
4. Analyze various antenna parameters necessary for building a RF system
5. Recommend various antenna configurations according to the applications.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

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Text Books:
1. **Microwave Engineering** – Annapurna Das, Sisir K Das, TMH, Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Samuel Y Liao, Pearson Education
3. **Antennas and Wave Propagation**- John D. Krauss, Ronald J Marhefka, Ahmad S Khan, 4th Edition, McGraw Hill Education, 2013

Reference Books:
1. **Microwave Engineering** - David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2nd Edn, 2015
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007

OPERATING SYSTEM

Course Code	: 18EC641	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to:
- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management.
- Describe the structure and organization of the file system
- Understand interprocess communication and deadlock situations.

Module-1
Introduction to Operating Systems
OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems
(Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).

L1,L2

Module-2
Process Management: OS View of Processes, PCB, Fundamental State Transitions of a process, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux
(Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2 , Selected scheduling topics from 4.2 and 4.3 , 4.6, 4.7 of Text).

L1,L2,L3

Module – 3
Memory Management: Contiguous Memory allocation, Non-Contiguos Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux
(Topics from Sections 5.5 to 5.9, 6.1 to 6.3 except Optimal policy and 6.3.1, 6.7,6.8 of Text).

L1,L2,L3

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Module-4

File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access
(Topics from Sections 7.1 to 7.8 of Text).   **L1,L2**

Module-5

Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention
(Topics from Sections 10.1 to 10.3, 11.1 to 11.5 of Text).   **L1,L2**

Course Outcomes: At the end of the course, the students will be able to:
1. Explain the goals, structure, operation and types of operating systems.
2. Apply scheduling techniques to find performance factors.
3. Explain organization of file systems and IOCS.
4. Apply suitable techniques for contiguous and non-contiguous memory allocation.
5. Describe message passing, deadlock detection and prevention methods.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
Operating Systems – A Concept based Approach, by Dhamdhere, TMH, 2nd edition.

Reference Books:
1. Operating Systems Concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition,2001.
2. Operating System–Internals and Design System, William Stalling, Pearson Education, 4th ed, 2006.
3. Operating Systems - Design and Implementation, Tanenbaum, TMH, 2001.

ARITIFICAL NEURAL NETWORKS

Course Code	: 18EC642	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to:
- Understand the basics of ANN and comparison with Human brain.
- Acquire knowledge on Generalization and function approximation of various ANN architectures.
- Understand reinforcement learning using neural networks
- Acquire knowledge of unsupervised learning using neural networks.

Module-1
Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – **Architecture**: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.
Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.

L1, L2

Module-2
Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Back propagation Learning Algorithm, Practical consideration of BP algorithm.

L1,L2,L3

Module-3
Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.

L1,L2, L3

Module-4
Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

L1,L2, L3

Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

L1,L2, L3

Course Outcomes: At the end of the course, students will be able to:
1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2. Understand the concepts and techniques of neural networks through the study of important neural network models.
3. Evaluate whether neural networks are appropriate to a particular application.
4. Apply neural networks to particular application.
5. Analyze the steps needed to improve performance of the selected neural network.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
1. **Neural Networks A Classroom Approach**– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books:
1. **Introduction to Artificial Neural Systems-**J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks-**B. Yegnanarayana, PHI, New Delhi 1998.

DATA STRUCTURES USING C++

Course Code	: 18EC643	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to
- Solve the problems using object oriented approach
- Explain fundamentals of data structures and their applications essential for programming/problem solving
- Analyze Linear Data Structures: Stack, Queues, Lists
- Analyze Non Linear Data Structures: Trees
- Assess appropriate data structure during program development/Problem Solving

Module -1
INTRODUCTION: C++ and its features, Data types, Variables, Operators, Expressions, Control structures, classes and Objects, Functions and parameters, function overloading, Recursion, Constructors, Destructors and Operator overloading, Inheritance, Polymorphism, Programming examples.

L1, L2

Module -2
ARRAYS AND MATRICES: Arrays, Matrices, Special matrices, Sparse matrices.
POINTERS: Pointers, Dynamic memory allocation
LINEAR LISTS: Data objects and structures, Introduction to Linear and Non Linear data structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains.

L1, L2

Module -3
STACKS: The abstract data types, Array Representation, Linked Representation, Applications – Parsing and Evaluation of arithmetic expressions, Parenthesis Matching & Towers of Hanoi.

L1, L2, L3

Module -4
QUEUES: The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement, Priority Queues
HASHING: Dictionaries, Linear representation, Hash table representation.

L1, L2, L3

<center>**Module -5**</center>

TREES: Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. Binary search trees operations and implementation. Heaps, Applications-Heap Sorting

<center>**L1, L2, L3**</center>

Course Outcomes: After studying this course, students will be able to:

1. Relate to Dynamic memory allocation, Various types of data structures, operations and algorithms and Sparse matrices and Hashing
2. Apply object-oriented approach to solve problems
3. Understand non-Linear data structures trees and their applications
4. Design appropriate data structures for solving computing problems
5. Analyze the operations of Linear Data structures: Stack, Queue and Linked List and their applications

Text Book:

1. Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

Reference Books:

2. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.

DIGITAL SYSTEM DESIGN USING VERILOG

Course Code	: 18EC644	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to
- Understand the concepts of Verilog Language.
- Design the digital systems as an activity in a larger systems design context.
- Study the design and operation of semiconductor memories frequently used in application specific digital system.
- Inspect how effectively ICs are embedded in package and assembled in PCBs for different application.
- Design and diagnosis of processors and I/O controllers used in embedded systems.

Module -1
Introduction and Methodology:
Digital Systems and Embedded Systems, Real-World Circuits, Models, Design Methodology **(1.1, 1.3 to 1.5 of Text).**
Combinational Basics: Combinational Components and Circuits, Verification of Combinational Circuits **(2.3 and 2.4 of Text)**.
Number Basics: Unsigned integers, Signed Integers, Fixed point Numbers, Floating point Numbers **(3.1.1, 3.2.1, 3.3.1 and 3.4).**
Sequential Basics: Sequential Datapaths and Control Clocked Synchronous Timing Methodology
(4.3 up to 4.3.1, 4.4 up to 4.4.1 of Text). **L1,L2, L3**

Module -2
Memories: Concepts, Memory Types, Error Detection and Correction **(Chap 5 of Text).** **L1,L2, L3**

Module -3
Implementation Fabrics: Integrated Circuits, Programmable Logic Devices, Packaging and Circuit boards, Interconnection and Signal integrity **(Chap 6 of Text).** **L1,L2, L3**

Module -4
I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software
(Chap 8 of Text). **L1,L2, L3**

Module -5

Design Methodology: Design flow, Design optimization, Design for test, Nontechnical Issues

(Chap 10 of Text).   **L1,L2, L3, L4**

Course outcomes: After studying this course, students will be able to:
1.   Construct the combinational circuits, using discrete gates and programmable logic devices.
2.   Describe how arithmetic operations can be performed for each kind of code, and also combinational circuits that implement arithmetic operations.
3.   Design a semiconductor memory for specific chip design.
4.   Design embedded systems using small microcontrollers, larger CPUs/ DSPs, or hard or soft processor cores.
5.   Synthesize different types of I/O controllers that are used in embedded system.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60

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Text Book:
- Peter J. Ashenden, "Digital Design: An Embedded Systems Approach Using VERILOG", Elesvier, 2010.

Reference Books:
1.   Ming-Bo Lin, "Digital System Designs and Practices: Using Verilog HDL and FPGAs", Wiley, 2008
2.   Charles Roth, Lizy K. John, Byeong Kil Lee, "Digital Systems Design Using Verilog", Cengage, 1st Edition.
3.   Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer, Fifth edition.
4.   Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.

NANOELECTRONICS

Course Code	: 18EC645	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs/module)	Exam Hours	: 03
	CREDITS – 03		

Course Learning Objectives: This course will enable students to:
- Enhance basic engineering science and technical knowledge of Nanoelectronics.
- Explain basics of top-down and bottom-up fabrication process, devices and systems.
- Describe technologies involved in modern day electronic devices.
- Know various nanostructures of carbon and the nature of the carbon bond itself.
- Learn the photo physical properties of sensor used in generating a signal.

Module-1
Introduction: Overview of nanoscience and engineering. Development milestones in microfabrication and electronic industry. Moore's law and continued miniaturization, Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giant molecular solids, Free electron models and energy bands, crystalline solids, Periodicity of crystal lattices, Electronic conduction, effects of nanometerlength scale, Fabrication methods: Top down processes, Bottom up processes methods for templating the growth of nanomaterials, ordering of nanosystems
(Text 1).   **L1, L2**

Module-2
Characterization: Classification, Microscopic techniques, Field ion microscopy,scanning probe techniques, diffraction techniques: bulk and surface diffraction techniques **(Text 1).**
Inorganic semiconductor nanostructures: overview of semiconductor physics. Quantum confinement in semiconductor nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states
(Text 1).   **L1, L2**

Module-3
Fabrication techniques: requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth

of vicinal substrates, strain induced dots and wires, electrostatically induced dots and wires, Quantum well width fluctuations, thermally annealed quantum wells, semiconductor nanocrystals, collidal quantum dots, self-assembly techniques.**(Text 1).**

Physical processes: modulation doping, quantum hall effect, resonant tunneling, charging effects, ballistic carrier transport, Inter band absorption, intraband absorption, Light emission processes, phonon bottleneck, quantum confined stark effect, nonlinear effects, coherence and dephasing, characterization of semiconductor nanostructures: optical electrical and structural

(Text 1). **L1, L2**

Module-4

Carbon Nanostructures: Carbon molecules, Carbon Clusters, Carbon Nanotubes, application of Carbon Nanotubes.

(Text 2) **L1, L2**

Module-5

Nanosensors: Introduction, What is Sensor and Nanosensors?, What makes them Possible?, Order From Chaos, Characterization, Perception, NanosensorsBased On Quantum Size Effects, Electrochemical Sensors, Sensors Based On Physical Properties, Nanobiosensors, Smart dust Sensor for the future. **(Text 3)**

Applications: Injection lasers, quantum cascade lasers, single-photon sources, biological tagging, optical memories, coulomb blockade devices, photonic structures, QWIP's, NEMS, MEMS

(Text 1). **L1, L2**

Course Outcomes: After studying this course, students will be able to:
1. Construct the combinational circuits, using discrete gates and pro-grammable logic devices.
2. Describe how arithmetic operations can be performed for each kind of code, and also combinational circuits that implement arithmetic opera-tions.
3. Design a semiconductor memory for specific chip design.
4. Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores.
5. Synthesize different types of I/O controllers that are used in embed-ded system.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:
1. Edited by Robert Kelsall, Ian Hamley and Mark Geoghegan, "Nanoscale Science and Technology", John Wiley, 2007.
2. Charles P Poole, Jr, Frank J Owens, "Introduction to Nanotechnology", John Wiley, Copyright 2006, Reprint 2011.
3. T Pradeep, "Nano: The essentials-Understanding Nanoscience and Nanotechnology", TMH.

Reference Book:
1. Edited by William A Goddard III, Donald W Brenner, Sergey E. Lyshevski and Gerald J Iafrate, "Hand Book of Nanoscience Engineering and Technology", CRC press, 2003.

PYTHON APPLICATION PROGRAMMING

Course Code	: 18EC646	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40(08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services, Network and Database Programs in Python.

Module – 1
Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions,

L1, L2, L3

Module – 2
Iteration, Strings, Files,

L1, L2, L3

Module – 3
Lists, Dictionaries, Tuples, Regular Expressions,

L1, L2, L3

Module – 4
Classes and objects, Classes and functions, Classes and methods,

L1, L2, L3

Module – 5
Networked programs, Using Web Services, Using databases and SQL,

L1, L2, L3

Course outcomes: The students will be able to:

1. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

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Question paper pattern:
- The question paper will have TEN questions.
- There will be TWO questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016 (Chapters 1 – 13, 15).
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015 (Chapters 15,16,17)

References:
1. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13:978-9350232873.
2. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
3. Reema Thareja, "Python Programming using problem solving approach", Oxford university press, 2017

SIGNAL PROCESSING

Course Code	: 18EC651	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course objective: This course will enable students to:
- Understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- Ability to represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain
- Understand the properties of analog filters, and have the ability to design Butterworth filters
- Understand and apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time (without loss of information)
- Able to represent the discrete time signal in the frequency domain
- Able to design FIR and IIR filters to meet given specifications

Module-1
Signal Definition, Signal Classification, System definition, System classification, for both continuous time and discrete time. Definition of LTI systems
(Chapter 1)   **L1, L2**

Module-2
Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems,
(Chapter 3)   **L1, L2**

Module-3
Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications
(Chapter 8)   **L1,L2, L3**

Module-4
Sampling Theorem- Statement and proof, converting the analog signal to a digital signal. Practical sampling. The Discrete Fourier Transform, Properties of DFT. Comparing the frequency response of analog and digital systems. (FFT not included)
(Chapter 3, 4)   **L1,L2, L3**

Definition of FIR and IIR filters. Frequency response of ideal digital filters
Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable
mapping techniques, to meet given specifications. Design of FIR Filters using
the Window technique, and the frequency sampling technique to meet given
specifications Comparing the designed filter with the desired filter frequency
response
(Chapter 8)   **L1,L2,L3**

Course Outcomes: After studying this course, students will be able to:
1. Understand and explain continuous time and discrete time signals and systems, in time and frequency domain
2. Apply the concepts of signals and systems to obtain the desired parameter/representation
3. Analyse the given system and classify the system/arrive at a suitable conclusion
4. Design analog/digital filters to meet given specifications
5. Design and implement *(assignment component)*
        a. the analog filter using components/ suitable simulation tools
        b.the digital filter (FIR/IIR) using suitable simulation tools, and
        c.record the input and output of the filter for the given audio signal

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
- 'Signals and Systems', by Simon Haykin and Barry Van Veen, Wiley.

References:
1. 'Theory and Application of Digital Signal Processing', Rabiner and Gold
2. 'Signals and Systems', Schaum's Outline series
3. 'Digital Signal Processing', Schaum's Outline series

SENSORS and SIGNAL CONDITIONING

Course Code	: 18EC652	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE marks	: 60
Total Number of Lecture Hours : 40 (08 Hrs/module)		Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to:
- Understand various technologies associated in manufacturing of sensors
- Acquire knowledge about types of sensors used in modern digital systems
- Get acquainted about material properties required to make sensors

Module 1
Introduction to sensor based measurement systems:
General concepts and terminology, sensor classification, primary sensors, material for sensors, microsensor technology, magnetoresistors, light dependent resistors, resistive hygrometers,resistive gas sensors, liquid conductivity sensors
(Selected topics from ch.1 & 2 of Text)

L1, L2

Module 2
Reactance Variation and Electromagnetic Sensors: -Capacitive Sensors, Inductive Sensors, Electromagnetic Sensors.
Signal Conditioning for Reactance Variation Sensors-Problems and Alternatives, ac Bridges Carrier Amplifiers, Coherent Detection, Specific Signal Conditioners for Capacitive Sensors, Resolver-to-Digital and Digital-to-Resolver Converters. **L1, L2**

Module 3
Self-generating Sensors-Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors.

L2, L3

Module 4
Digital and intelligent sensors-position encoders, resonant sensors, sensors based on quartz resonators, SAW sensors, Vibrating wire strain gages, vibrating cylinder sensors, Digital flow meters.

L2, L3

Sensors based on semiconductor junctions -Thermometers based on semiconductor junctions, magneto diodes and magneto transistors, photodiodes and phototransistors, sensors based on MOSFET transistors, charge- coupled sensors – types of CCD imaging sensors, ultrasonic-based sensors.

L2, L3

Course Outcomes: After studying this course, students will be able to:
1. Appreciate various types of sensors
2. Describe the manufacturing process of sensors
3. Understand about the material properties required to make sensors
4. Use sensors specific to the end use application
5. Design systems integrated with sensors

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:
"Sensors and Signal Conditioning", Ramon PallásAreny, John G. Webster, 2nd edition, John Wiley and Sons, 2000

B. E. EC/TE			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER – VI			
VIRTUAL INSTRUMENTATION			
Course Code	18EC653	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8Hours/Module)	Exam Hours	03
CREDITS – 03			

Course objective: This course will enable students to:
- Understand the fundamental principles of virtual instrumentation
- Acquire, analyze and present data using LabVIEW

Module-1	RBT Level
Graphical System Design: Introduction, Graphical system design model, Design flow with GSD, Virtual Instrumentation, Virtual instrument and traditional instrument, Hardware and software in virtual instrumentation, Virtual instrumentation for Test, control & design, Graphical system design using LABVIEW, Graphical programming & textual programming.	L1, L2, L3
Module-2	
Introduction to LabVIEW: Introduction, advantages of LABVIEW software environment, palettes, front panel controls & indicators, Block diagram, Data flow program. **Repetition and Loops**: For loops, while loops, structure tunnels, terminals inside or outside loops, shift registers, feed-back nodes, control timing, case structure.	L1, L2, L3
Module-3	
Arrays: Introduction, arrays in LABVIEW, creating one - dimensional array controls, indicators and constants, creating two dimensional arrays, creating multidimensional arrays, initializing array, deleting, inserting, and replacing elements, rows, columns, and pages with in arrays, arrays functions.	L1, L2, L3
Module-4	
Plotting Data: Types of waveforms, waveform graphs, waveform charts, XY graphs, Intensity graphs & charts, Digital waveform graphs, 3D graphs, customizing graphs & charts, configuring a graph or chart, Displaying special planners on the XY graph.	L1,L2, L3
Module-5	
File Input/ Output: File formats, file write &read, generating filenames automatically, **String handling**: string functions, LABVIEW string formats, parsing of strings. **Instrument Control**: Introduction, GPIB communication, Hardware specification, software architecture, Instrument I/O assistant, VISA, Instrument drivers, serial port communications, using other interfaces.	L1, L2, L3

Course Outcomes: After studying this course, students will be able to:
1. Recognize the Graphical system design model and develop programs using the modern tools of Graphical programming & textual programming
2. Develop a virtual instrumentation model using the front panel controls & indicators and loops.
3. Analyze, design the various array and matrix operations using LabVIEW functions.
4. Evaluate the various forms of output representations using graphs & charts
5. Demonstrate Instrument Control, GPIB communication and other interfaces

Students have to conduct the following experiments as a part of CIE marks along with other Activities:

1. Build a VI code to indicate the change in temperature using LabVIEW
2. Develop a code in VI to convert 4-bit binary input to gray output using LabVIEW
3. Generate a VI code to display sinusoidal and triangular waveforms using LabVIEW
4. Build a code using LabVIEW to compute the sum of N numbers (use FOR loop)
5. Develop a VI code using LabVIEW to sort the even numbers (use while loop)
6. Using LabVIEW compute the basic operations of a simple calculator using case structure

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:
1. "Virtual Instrumentation using LABVIEW", Jovitha Jerome, PHI, 2010
2. "Virtual Instrumentation using LABVIEW", Sanjay Gupta, Joseph John, TMH, McGraw Hill Second Edition, 2011.

Reference:
"Learning with LabView", Robert H Bishop, Prentice Hall, 2009.

B. E. EC/TE			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VI			
MICROCONTROLLERS			
Course Code	18EC654	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8Hours/Module)	Exam Hours	03
CREDITS – 03			

Course objective: This course will enable students to:
- Learn architecture of 8051.
- Learn programming skills using Assembly language and C
- Design and interface microcontroller based embedded systems.
- Build projects

Module-1	RBT Level
Microprocessors and Microcontroller: Introduction, Microprocessors and Microcontrollers, Microcontroller Survey. (Text 1- Chapter 1) **The 8051 Architecture**: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization. (Text 1- Chapter 2)	L1, L2
Module-2	
Addressing Modes in 8051 Microcontroller: Introduction, Addressing Modes, External Data Moves, Code Memory Read only Data Moves, PUSH and POP opcodes, Data Exchanges, Example Programs. (Text 1- Chapter 3)	L1, L2
Module-3	
Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. (Text 1- Chapter 4, 5 and 6)	L1, L2, L3
Module-4	
8051 Microcontroller Interfacing and Applications: Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC interfacing and programming. (Text 2 – Chapter 12 and 13)	L1,L2, L3
Module-5	
8051 Microcontroller Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C . (Text 2 – Chapter 9, Chapter 11 -11.1) **8051 Microcontroller Serial Communication**: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C. (Text 2 – Chapter 10- 10.1,10.2, 10.3)	L1, L2, L3

Course Outcomes: After studying this course, students will be able to:
1. Explain the basics of Microprocessor and Microcontroller
2. Relate to the 8051 Microcontroller architecture and Pin description
3. Analyze 8051 Addressing modes and use the 8051 instruction set
4. Program the on-chip peripherals in 8051
5. Design and develop applications using 8051 Assembly language and C program

Students have to conduct the following experiments as a part of CIE marks along with other Activities:
1. Write an 8051 ALP to exchange n = 5 bytes of data at location 0027H and at location 0041H.
2. Write an 8051 ALP to sort an array of n = 6 bytes of data in ascending order stored from location 9000H.(use bubble sort algorithm)

3. Write an 8051 ALP to implement (display) an eight bit up/down binary (hex) counters on watch window.
4. Write a program to toggle all the bits of P1 and P2 continuously using CALL and RETURN instructions
5. Write an 8051 ALP to implement ASCII to hexadecimal conversion
6. Write a Program illustrating timer delay Generate a 1second delay continuously using the on-chip timer in interrupt mode.

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:
1. "The 8051 Microcontroller Architecture, Programming and Applications", Kenneth J Ayala, Thomson learning, 2005.
2. "The 8051 Microcontroller and Embedded Systems-using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D McKinaly, Pearson, 2006.

Reference:
"The 8051 Microcontroller: Hardware, Software and Applications" V. Udayashankara and Mallikarjuna Swamy, TMH., 2009.

B. E. EC/TE			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER – VI			
BASIC VLSI DESIGN			
Course Code	**18EC655**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(8Hours/Module)**	**Exam Hours**	**03**
CREDITS – 03			
Course objective: This course will enable students to: • Understand the fundamental aspects of circuits in silicon • Relate to VLSI design processes and design rules			
Module-1			**RBT Level**
Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, p-well processes, BiCMOS, Comparison of bipolar and CMOS. **Basic Electrical Properties of MOS And BiCMOS Circuits**: Drain to source current versus voltage characteristics, threshold voltage, transconductance.			**L1, L2**
Module-2			
Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio: nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up. **Basic Circuit Concepts**: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, BiCMOS drivers.			**L1, L2**
Module-3			
MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style **Design rules and layout & Scaling of MOS Circuits**: λ - based design rules, scaling factors for device parameters			**L1, L2, L3**
Module-4			
Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS **Examples of structured design**: Parity generator, Bus arbitration, multiplexers, logic function block, code converter.			**L1,L2, L3**
Module-5			
Subsystem Design and Layout-2: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity-Definition & Computation **Practical aspects and testability**: Some thoughts of performance, optimization and CAD tools for design and simulation.			**L1, L2, L3**
Course Outcomes: After studying this course, students will be able to: 1. Identify the CMOS layout levels, and the design layers used in the process sequence. 2. Describe the general steps required for processing of CMOS integrated circuits. 3. Design static CMOS combinational and sequential logic at the transistor level. 4. Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc. 5. Interpret the need for testability and testing methods in VLSI.			

Question paper pattern:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:
"Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3rd Edition, Prentice Hall of India publication, 2005.

References:
1. "CMOS Digital Integrated Circuits, Analysis And Design", Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3rd Edition, 2003.
2. "VLSI Technology", S.M. Sze, 2nd edition, Tata McGraw Hill, 2003.

EMBEDDED SYSTEMS LABORATORY

Course Code : **18ECL66**	CIE Marks : 40	SEE Marks : 60

Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory

RBT Level : L1, L2, L3   Exam Hours : 03

CREDITS– 02

Course Learning Objectives: This course will enable students to:
- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Laboratory Experiments

Conduct the following experiments on an ARM CORTEX M3 evaluation board to learn ALP and using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

PART A:

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.
3. ALP to find the number of 0's and 1's in a 32 bit data
4. ALP to find determine whether the given 16 bit is even or odd
5. ALP to write data to RAM

PART B:

6. Display "Hello world" message using internal UART
7. Interface and Control the speed of a DC Motor.
8. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
9. Interface a DAC and generate Triangular and Square waveforms.
10. Interface a 4x4 keyboard and display the key code on an LCD.
11. Demonstrate the use of an external interrupt to toggle an LED On/Off.
12. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay.
13. Measure Ambient temperature using a sensor and SPI ADC IC.

Course outcomes: After studying this course, students will be able to:

1. Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
2. Develop assembly language programs using ARM Cortex M3 for different applications.
3. Interface external devices and I/O with ARM Cortex M3.
4. Develop C language programs and library functions for embedded system applications.
5. Analyze the functions of various peripherals, peripheral registers and power saving modes of ARM Cortex M3

Conduction of Practical Examination:

- One Question from PART A and one Question from PART B to be asked in the examination.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

COMMUNICATION LABORATORY

Course Code : **18ECL67**	CIE Marks : 40	SEE Marks : 60

Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory

RBT Level : L1, L2, L3   Exam Hours : 03

CREDITS – 02

Course Learning Objectives: This course will enable students to:
- Design and test the communication circuits for different analog modulation schemes.
- Design and demonstrate the digital modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Understand the probability of error computations of coherent digital modulation schemes.

Laboratory Experiments
PART-A: Expt. 1 to Expt. 5 have to be performed using discrete components.
1. Amplitude Modulation and Demodulation: i) Standard AM, ii)DSBSC (LM741 and LF398 ICs can be used)
2. Frequency modulation and demodulation (IC 8038/2206 can be used)
3. Pulse sampling, flat top sampling and reconstruction
4. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
5. FSK and PSK generation and detection
6. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
7. Obtain the Radiation Pattern and Measurement of directivity and gain of microstrip dipole and Yagi antennas.
8. Determination of
   a. Coupling and isolation characteristics of microstrip directional coupler.
   b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
   c. Power division and isolation of microstrip power divider.

PART-B: Simulation Experiments using SCILAB/MATLAB/Simulink or LabVIEW
1. To Simulate NRZ, RZ, half-sinusoid & raised cosine pulses and generate eye diagram for binary polar signaling.
2. Pulse code modulation and demodulation system.

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3.   Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their performance curves.
4.   Digital Modulation Schemes i) DPSK Transmitter and Receiver, ii) QPSK Transmitter and Receiver.

Course Outcomes: On the completion of this laboratory course, the students will be able to:
   1. Design and test circuits for analog modulation and demodulation schemes viz., AM, FM, etc.
   2. Determine the characteristics and response of microwave waveguide.
   3. Determine characteristics of microstrip antennas and devices & compute the parameters associated with it.
   4. Design and test the digital and analog modulation circuits and display the waveforms.
   5. Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes.

Conduct of Practical Examination:
- All laboratory experiments are to be considered for practical   examination.
- For examination one question from **PART-A** and one question from **PART-B or** only one question from **PART-B** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

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BELAGAVI

BE/B.Tech. Scheme of Teaching and Examinations
Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2018 – 19)

MECHANICAL ENGINEERING

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

I SEMESTER B. E. B.Tech (CHEMISTRY GROUP)

Sl. No	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours /Week				Examination				Credits
						Theory Lecture L	Tutorial T	Practical/ Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	18MAT11	Calculus and Linear Algebra	Mathematics	Mathematics	3	2	--	03	40	60	100	4
2	BSC	18CHE12	Engineering Chemistry	Chemistry	Chemistry	3	2	--	03	40	60	100	4
3	ESC	18CPS13	C Programming for Problem Solving	Computer Science and Engineering	Computer Science and Engineering	2	2	--	03	40	60	100	3
4	ESC	18ELN14	Basic Electronics	ECE/E and I/ TC	E and C Engineering	2	2	--	03	40	60	100	3
5	ESC	18ME15	Elements of Mechanical Engineering	ME, Auto, IP, IEM, Mfg Engineering	Mechanical Engineering	2	2	--	03	40	60	100	3
6	BSC	18CHEL16	Engineering Chemistry Laboratory	Chemistry	Chemistry	--	--	2	03	40	60	100	1
7	ESC	18CPL17	C Programming Laboratory	Computer Science and Engineering	Computer Science and Engineering	--	--	2	03	40	60	100	1
8	HSMC	18EGH18	Technical English– I	Humanities	Humanities	--	2	--	03	40	60	100	1
					TOTAL	12	12	04	24	320	480	800	20

Note: BSC: Basic Science Courses, ESC: Engineering Science Courses, HSMC: Humanity, Social Science and Management Courses.

Definition of Credit:	1 hour Lecture (L) per week per semester =1 Credit 2 hour Tutorial (T) per week per semester =1 Credit 2 hour Practical/Laboratory/Drawing (P) per week per semester =1 Credit.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2018 – 19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

I SEMESTER B.E. B.Tech (PHYSICS GROUP)

Sl. No	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours/Week			Examination				Credits
						Theory Lecture L	Tutorial T	Practical Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	18MAT11	Calculus and Linear Algebra	Mathematics	Maths	3	2	-	03	40	60	100	4
2	BSC	18PHY12	Engineering Physics	Physics	Physics	3	2	-	03	40	60	100	4
3	ESC	18ELE13	Basic Electrical Engineering	E and E Engineering	E and E Engineering	2	2	-	03	40	60	100	3
4	ESC	18CIV14	Elements of Civil Engineering and Mechanics	Civil Engineering	Civil Engineering	2	2	-	03	40	60	100	3
5	ESC	18EGDL15	Engineering Graphics	ME, Auto IP, IEM, Mfg Engineering	Mechanical Engineering	2	-	2	03	40	60	100	3
6	BSC	18PHYL16	Engineering Physics Laboratory	Physics	Physics	-	-	2	03	40	60	100	1
7	ESC	18ELEL17	Basic Electrical Engineering Laboratory	E and E Engineering	E and E Engineering	-	-	2	03	40	60	100	1
8	HSMC	18EGH18	Technical English–1	Humanities	Humanities	1	-	-	03	40	60	100	1
					TOTAL	12	10	06	24	320	480	800	20

Note: BSC: Basic Science Courses, ESC: Engineering Science Courses, HSMC: Humanity, Social Science and Management Courses

Definition of Credit:
1 hour Lecture (L) per week per semester = 1 Credit
2 hour Tutorial (T) per week per semester = 1 Credit
2 hour Practical / Laboratory / Drawing (P) per week per semester = 1 Credit

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(Effective from the academic year 2018 – 19)

II SEMESTER B.E. (B.Sc. CHEMISTRY GROUP)

Sl. No	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours /Week			Examination				Credits
						Theory Lecture L	Tutorial T	Practical Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	18MAT21	Advanced Calculus and Numerical Methods	Mathematics	Maths	3	2	—	03	40	60	100	4
2	BSC	18CHE22	Engineering Chemistry	Chemistry	Chemistry	3	2	—	03	40	60	100	4
3	ESC	18CPS23	C Programming for Problem Solving	Computer Science and Engineering	Computer Science and Engineering	2	2	—	03	40	60	100	3
4	ESC	18ELN24	Basic Electronics	ECE E and IT TC	E and C Engineering	2	2	—	03	40	60	100	3
5	ESC	18ME25	Elements of Mechanical Engineering	ME, Auto, IP, IEM, Mfg. Engineering	Mechanical Engineering	2	2	—	03	40	60	100	3
6	BSC	18CHEL26	Engineering Chemistry Laboratory	Chemistry	Chemistry	—	—	2	03	40	60	100	1
7	ESC	18CPL27	C Programming Laboratory	Computer Science and Engineering	Computer Science and Engineering	—	—	2	03	40	60	100	1
8	HSMC	18EGH28	Technical English – II	Humanities	Humanities	—	—	—	03	40	60	100	1
						TOTAL			24	320	480	800	20
						12	12	4					

Note: BSC : Basic Science Courses, ESC : Engineering Science Courses, HSMC: Humanity Social Science and Management Courses

Definition of Credits	
1 hour Lecture (L) per week per semester = 1 Credit	
2 hour Tutorial (T) per week per semester = 1 Credit	
3 hour Practical/ Laboratory/ Drawing (P) per week per semester = 1 Credit	

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II SEMESTER B.E./B.Tech (PHYSICS GROUP)

Sl. No	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours /Week				Examination				Credits
						Theory Lecture L	Tutorial T	Practical/ Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks		
1	BSC	18MAT21	Advanced Calculus and Numerical Methods	Mathematics	Mathematics	3	2	--	03	40	60	100	4
2	BSC	18PHY22	Engineering Physics	Physics	Physics	3	2	--	03	40	60	100	4
3	ESC	18ELE23	Basic Electrical Engineering	E and E Engineering	E and E Engineering	2	2	--	03	40	60	100	3
4	ESC	18CIV24	Elements of Civil Engineering and Mechanics	Civil Engineering	Civil Engineering	2	2	--	03	40	60	100	3
5	ESC	18EGDL25	Engineering Graphics	ME, Auto, IP, IEM. Mfg Engineering	Mechanical Engineering	2	--	2	03	40	60	100	3
6	BSC	18PHYL26	Engineering Physics Laboratory	Physics	Physics	--	--	2	03	40	60	100	1
7	ESC	18ELEL27	Basic Electrical Engineering Laboratory	E and E Engineering	E and E Engineering	--	--	2	03	40	60	100	1
8	HSMC	18EGH28	Technical English – II	Humanities	Humanities	--	2	--	03	40	60	100	1
					TOTAL	12	10	06	24	320	480	800	20

Note: BSC: Basic Science Courses, ESC: Engineering Science Courses, HSMC: Humanity, Social Science and Management Courses.

Definition of Credit:	1 hour Lecture (L) per week per semester =1 Credit
	2 hour Tutorial (T) per week per semester =1 Credit
	2 hour Practical/Laboratory/Drawing (P) per week per semester =1 Credit.

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III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	18MAT31	Mathematics	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18ME32	Mechanics of Materials		3	2	--	03	40	60	100	4
3	PCC	18ME33	Basic Thermodynamics		3	0	--	03	40	60	100	3
4	PCC	18ME34	Material Science		3	0	--	03	40	60	100	3
5	PCC	18ME35A or	Metal cutting and forming				--		40	60	100	3
		18ME35B	Metal Casting and Welding		3	0		03				
6	PCC	18ME36A or	Computer Aided Machine Drawing/		1	4						
		18ME36B	Mechanical Measurements and Metrology		3	0	--	03	40	60	100	3
7	PCC	18MEL37A or	Material Testing lab		--	2	2	03	40	60	100	2
		18MEL37B	Mechanical Measurements and Metrology lab									
8	PCC	18MEL38A	Workshop and Machine Shop Practice (Consists of Fitting, and Machining)		--	2	2	03	40	60	100	2
		18MEL38B	Foundry,Forging and Welding lab									
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
			OR									
		18CPC39	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	17 OR 19	10 OR 14	04	24 OR 26	420 OR 360	480 OR 540	900	24

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39 Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

a) The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				
					Theory Lecture L	Tutorial T	Practical Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	18MAT41	Mathematics	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18ME42	Applied Thermodynamics		3	2	--	03	40	60	100	4
3	PCC	18ME43	Fluid Mechanics		3	0	--	03	40	60	100	3
4	PCC	18ME44	Kinematics of Machines		3	0	--	03	40	60	100	3
5	PCC	18ME45A	Metal cutting and forming		3	0	--	03	40	60	100	3
		18ME45B	Metal Casting and Welding									
6	PCC	18ME46A or	Computer Aided Machine Drawing/		1	4						
		18ME46B	Mechanical Measurements and Metrology		3	0	--	03	40	60	100	3
7	PCC	18MEL47A or	Material Testing lab		--	2	2	03	40	60	100	2
		18MEL47B	Mechanical Measurements and Metrology lab									
8	PCC	18MEL48A	Workshop and Machine Shop Practice (Consists of Fitting, and Machining)		--	2	2	03	40	60	100	2
		18MEL48B	Foundry, Forging and Welding lab									
9	HSMC	18KVK49/49	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK49/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPH49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
						Examination is by objective type questions						
				TOTAL	17 OR 19	10 OR 14	04	24 OR 26	420 OR 360	480 OR 540	900	24

18KVK39 Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

	Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs											
10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a) The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the student have to fulfill the requirements during subsequent semester/s to appear for SEE.

(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18ME51	Management and Economics		2	2	--	03	40	60	100	3
2	PCC	18ME52	Design of Machine Elements I		3	2	--	03	40	60	100	4
3	PCC	18ME53	Dynamics of Machines		3	2	--	03	40	60	100	4
4	PCC	18ME54	Turbo Machines		3	--	--	03	40	60	100	3
5	PCC	18ME55	Fluid Power Engineering		3	--	--	03	40	60	100	3
6	PCC	18ME56	Operations Management		3	--	--	03	40	60	100	3
7	PCC	18MEL57	Fluid Mechanics/Machines lab		--	2	2	03	40	60	100	2
8	PCC	18MEL58	Energy Conversion Lab		--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/ Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
				TOTAL	18	10	04	26	360	540	900	25

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Theory Lecture L	Tutorial T	Practical/ Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	18ME61	Finite Element Methods		3	2	--	03	40	60	100	4
2	PCC	18ME62	Design of Machine Elements II		3	2	--	03	40	60	100	4
3	PCC	18ME63	Heat Transfer		3	2	--	03	40	60	100	4
4	PEC	18ME64X	Professional Elective -1		3	--	--	03	40	60	100	3
5	OEC	18ME65X	Open Elective -A		3	--	--	03	40	60	100	3
6	PCC	18MEL66	Computer Aided Modelling and Analysis Lab		--	2	2	03	40	60	100	2
7	PCC	18MEL67	Heat Transfer Lab		--	2	2	03	40	60	100	2
8	MP	18MEMP68	Mini-project		--	--	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
			TOTAL		15	10	06	24	320	480	800	24

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1

Course code under 18XX64X	Course Title	Course code under 18XX64X	Course Title
18ME641	Non-Traditional Machining	18ME644	Vibrations and Noise Engineering
18ME642	Refrigeration and Air conditioning	18ME645	Composite Materials Technology
18ME643	Theory of Elasticity	18ME646	Entrepreneurship Development

Open Elective -A

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Mini-project work:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-project:

(i) **Single discipline:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) **Interdisciplinary:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

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VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	18ME71	Control Engineering		3	--	--	03	40	60	100	3
2	PCC	18ME72	Computer Aided Design and Manufacturing		3	--	--	03	40	60	100	3
3	PEC	18ME73X	Professional Elective - 2		3	--	--	03	40	60	100	3
4	PEC	18ME74X	Professional Elective - 3		3	--	--	03	40	60	100	3
5	OEC	18ME75X	Open Elective -B		3	--	--	03	40	60	100	3
6	PCC	18MEL76	Computer Integrated Manufacturing Lab		--	2	2	03	40	60	100	2
	PCC	18MEL77	Design Lab		--	2	2	03	40	60	100	2
7	Project	18MEP78	Project Work Phase - 1		--	--	2	--	100	--	100	1
8	Internship	--	Internship	(If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters)								
				TOTAL	15	04	06	18	340	360	700	20

Professional Elective - 2

Course code under 18XX73X	Course Title	Course code under 18XX73X	Course Title
18ME731	Design for Manufacture	18ME734	Total Quality Management
18ME732	Automation and Robotics	18ME735	Operations Research
18ME733	Computational Fluid Dynamics		

Professional Electives - 3

Course code under 18XX74X	Course Title	Course code under 18XX74X	Course Title
18ME741	Additive Manufacturing	18ME744	Mechatronics
18ME742	Emerging Sustainable Building Cooling Technologies	18ME745	Project Management
18ME743	Theory of Plasticity		

Open Elective -B

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).

Selection of an open elective shall not be allowed if,
- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Project work:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or6.

CIE procedure for Project Work Phase - 1:

(i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

(ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the Internship requirements.

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Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18ME81	Energy Engineering		3	--	--	03	40	60	100	3
2	PEC	18ME82X	Professional Elective - 4		3	--	--	03	40	60	100	3
3	Project	18MEP83	Project Work Phase - 2		--	--	2	03	40	60	100	8
4	Seminar	18MES84	Technical Seminar		--	--	2	03	100	--	100	1
5	Internship	18XXI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
			TOTAL		06	--	04	15	260	240	500	18

Note: PCC: Professional Core, PEC: Professional Elective.

Professional Electives - 4			
Course code under 18XX82X	Course Title	Course code under 18XX82X	Course Title
18ME821	CNC Machine Tools	18ME824	Automobile Engineering
18ME822	Tribology	18ME825	Tool Design
18ME823	Non-Destructive Testing and Evaluation	18ME826	Fracture Mechanics

Project Work

CIE procedure for Project Work Phase - 2:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Project Work Phase - 2:

(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
JNAANA SANGAMA, BELAGAVI, 590018

Scheme of Teaching, Examination and Syllabus
B.E. CIVIL ENGINEERING
III to VIII SEMESTER
(Effective from Academic year 2018-19)
www.vtu.ac.in

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Theory Lecture L	Tutorial T	Practical/ Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC	18MAT31	Transform Calculus, Fourier Series and Numerical Techniques (Common to all Branches)	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CV32	Strength of Materials	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV33	Fluid Mechanics	Civil Engg.	3	0	--	03	40	60	100	3
4	PCC	18CV34	Basic Materials and Construction	Civil Engg.	3	0	--	03	40	60	100	3
5	PCC	18CV35	Surveying	Civil Engg.	3	0	--	03	40	60	100	3
6	PCC	18CV36	Engineering Geology	Civil Engg.	3	0	--	03	40	60	100	3
7	PCC	18CVL37	Computer Aided Building Planning & Drawing	Civil Engg.	--	2	2	03	40	60	100	2
8	PCC	18CVL38	Material Testing Lab.	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18KVK39	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
			OR									
		18KAK39	Aadalitha Kannada (Kannada for Administration)									
			OR									
		18CPC39	Constitution of India, Professional Ethics and Cyber Law		1	--	--	03	40	60		
					Examination is by objective type questions							
			TOTAL		17 OR 18	10 OR 08	04	24 OR 27	420 OR 360	480 OR 540	900	24

Note: BSC: Basic Science Course, PCC: Professional Core Course, HSMC: Humanity and Social Science Course, NCMC: Non-Credit Mandatory Course.

18KVK39, Vyavaharika Kannada (Kannada for Communication) is offered for the students of Non-Kannada Speaking, Reading and Writing
18KAK39 Aadalitha Kannada (Kannada for Administration) is offered for the students who speak, read and write in Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses such as Additional Mathematics I and II prescribed for III and IV semesters respectively, Introduced to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, they shall attend the classes during the respective semesters to complete all the formalities of the courses and appear for the University Examination. In case of any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, the candidates shall be awarded F grade. In such a case, the students have to fulfill the CIE requirements during subsequent semester/s to appear for SEE.

(b)These Courses shall not be considered for vertical progression, however completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B.Sc degree holders admitted to III semester of Engineering programs
Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression; however completion of the courses shall be mandatory for the award of degree.
AICTE Activity Points to be earned by students admitted to B E / B Tech / B Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every regular student (Day Scholar) admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively, for the award of degree through AICTE Activity Point Programme. Students migrated from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The respective Activity Points earned by the students shall be reflected in the eighth semester Grade Card. The earning of activities by the students can be spread evenly over the years, students are at a liberty to choose the kind of activities and to complete the them anytime during the semester weekends and holidays which will enhance their personality index, without affecting the academic work load of the semester, However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points within the stipulated period, Eighth semester Grade Card shall be issued only after earning the required activity Points such students shall not be admitted for the award of degree.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P					
1	BSC	18MAT41	Mathematics(Title as per the decision of BoS in Sciences)	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CV42	Analysis of Determinate Structures		3	2	--	03	40	60	100	4
3	PCC	18CV43	Applied Hydraulics		3	0	--	03	40	60	100	3
4	PCC	18CV44	Concrete Technology		3	0	--	03	40	60	100	3
5	PCC	18CV45	Advanced Surveying		3	0	--	03	40	60	100	3
6	PCC	18CV46	Water Supply & Treatment Engineering		3	0	--	03	40	60	100	3
7	PCC	18CVL47	Engineering Geology Laboratory		--	2	2	03	40	60	100	2
8	PCC	18CVL48	Fluid Mechanics and Hydraulics Machines Laboratory		--	2	2	03	40	60	100	2
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for Communication)/	HSMC	--	2	--	--	100	--	100	1
			OR									
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
			OR									
		18CPC39/49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	03	40	60		
					Examination is by objective type questions							
			TOTAL		17	10		24	420	480		
					OR	OR	04	OR	OR	OR	900	24
					18	08		27	360	540		

Note: BSC: Basic Science Course, PCC: Professional Core Course, HSMC: Humanity and Social Science Course, NCMC: Non-Credit Mandatory Course.

18KVK39, Vyavaharika Kannada (Kannada for Communication) is offered for the students of Non-Kannada Speaking, Reading and Writing

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Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP41	Additional Mathematics - II	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses such as Additional Mathematics I and II prescribed for III and IV semesters respectively, Introduced to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, they shall attend the classes during the respective semesters to complete all the formalities of the courses and appear for the University Examination. In case of any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, the candidates shall be awarded F grade. In such a case, the students have to fulfill the CIE requirements during subsequent semester/s to appear for SEE.

(b)These Courses shall not be considered for vertical progression, however completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B.Sc degree holders admitted to III semester of Engineering programs
Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression; however completion of the courses shall be mandatory for the award of degree.
AICTE Activity Points to be earned by students admitted to B E / B Tech / B Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):   Over and above the academic grades, every regular student (Day Scholar) admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively, for the award of degree through AICTE Activity Point Programme. Students migrated from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The respective Activity Points earned by the students shall be reflected in the eighth semester Grade Card.   The earning of activities by the students can be spread evenly over the years, students are at a liberty to choose the kind of activities and to complete the them anytime during the semester weekends and holidays which will enhance their personality index, without affecting the academic work load of the semester, However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.   In case students fail to earn the prescribed activity Points within the stipulated period, Eighth semester Grade Card shall be issued only after earning the required activity Points such students shall not be admitted for the award of degree.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Theory Lecture L	Tutorial T	Practical/ Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	HSMC	18CV51	Construction Management & Entrepreneurship	Civil Engg.	2	2	--	03	40	60	100	3
2	PCC	18CV52	Analysis of Indeterminate Structures	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV53	Design of RC Structural Elements	Civil Engg.	3	2	--	03	40	60	100	4
4	PCC	18CV54	Basic Geotechnical Engineering	Civil Engg.	3	--	--	03	40	60	100	3
5	PCC	18CV55	Municipal & Industrial Wastewater Engineering	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CV56	Highway Engineering	Civil Engg.	3	--	--	03	40	60	100	3
7	PCC	18CVL57	Surveying Practice	Civil Engg.	--	2	2	03	40	60	100	2
8	PCC	18CVL58	Concrete and Highway Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/Environmental [Paper setting Board: Civil Engineering]	1	--	--	02	40	60	100	1
			TOTAL		18	10	4	26	360	540	900	25

Note: PCC: Professional Core Course, HSMC: Humanity and Management Course.

AICTE activity Points: In case students fail to earn the prescribed activity Points within the stipulated period, Eighth semester Grade Card shall be issued only after earning the required activity Points such students shall not be admitted for the award of degree.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	18CV61	Design of Steel Structural Elements	Civil Engg.	3	2	--	03	40	60	100	4
2	PCC	18CV62	Applied Geotechnical Engineering	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV63	Hydrology and Irrigation Engineering	Civil Engg.	3	2	--	03	40	60	100	4
4	PEC	18CV64X	Professional Elective -1	Civil Engg.	3	--	--	03	40	60	100	3
5	OEC	18CV65X	Open Elective -A	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CVL66	Software Application Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
7	PCC	18CVL67	Environmental Engineering Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
8	EP	18CVEP68	Extensive Survey project	Civil Engg.	--	--	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
			TOTAL		15	10	6	24	320	480	800	24

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1		Open Elective -A	
Course code under18CV64X	**Course Title**	**Course code under18CV65X**	**Course Title**
18CV641	Matrix Method of Structural Analysis	18CV651	Remote Sensing & GIS
18CV642	Solid Waste Management	18CV652	Traffic Engineering
18CV643	Alternate Building Materials	18CV653	Occupational Health & Safety
18CV644	Ground Improvement Technique	18CV654	Sustainability Concepts in Civil Engineering
18CV645	Railway, Harbours, Tunnelling & Airports		

Students can select any one of the open electives offered by other Departments expect those, that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).
Selection of an open elective shall not be allowed if,
- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.
Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					Theory Lecture	Tutorial	Practical/ Drawing					
					L	T	P					
1	PCC	18CV71	Quality Surveying & Contract Management		3	--	--	03	40	60	100	3
2	PCC	18CV72	Design of RCC and Steel Structural Elements		3	--	--	03	40	60	100	3
3	PEC	18CV73X	Professional Elective - 2		3	--	--	03	40	60	100	3
4	PEC	18CV74X	Professional Elective - 3		3	--	--	03	40	60	100	3
5	OEC	18CV75X	Open Elective -B		3	--	--	03	40	60	100	3
6	PCC	18CVL76	Computer Aided Detailing of Structures		--	2	2	03	40	60	100	2
7	PCC	18CVL77	Geotechnical Engineering Laboratory		--	2	2	03	40	60	100	2
8	Project	18XXP78	Project Work Phase - 1		--	--	2	--	100	--	100	1
9	Internship	--	Internship	(If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters)								
Note: PCC: Professional core, PEC: Professional Elective				**TOTAL**	**15**	**4**	**6**	**18**	**340**	**360**	**700**	**20**

Professional Elective - 2		Professional Electives - 3		Open Elective -B	
Course code under 18CV73X	Course Title	Course code under 18CV74X	Course Title	Course code under 18CV74X	Course Title
18CV731	Theory of Elasticity	18CV741	Earthquake Engineering	18CV751	Finite Element Method
18CV732	Air Pollution & Control	18CV742	Design Concepts of Building Services	18CV752	Numerical Methods and Applications
18CV733	Pavement Materials & Construction	18CV743	Reinforced Earth Structures	18CV753	Environmental Protection and Management
18CV734	Ground Water Hydraulics	18CV744	Design of Hydraulic Structures		
18CV735	Masonry Structures	18CV745	Urban Transport Planning		

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Project work:
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more

than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: CIVIL ENGINEERING

VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Theory Lecture L	Tutorial T	Practical/ Drawing P	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	18CV81	Design of PSC		3	--	--	03	40	60	100	3
2	PEC	18CV82X	Professional Elective - 4		3	--	--	03	40	60	100	3
3	Project	18CVP83	Project Work Phase - 2		--	--	2	03	40	60	100	8
4	Seminar	18CVS84	Technical Seminar		--	--	2	03	100	--	100	1
5	Internship	18CVI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
Note: PCC: Professional Core, PEC: Professional Elective				**TOTAL**	**06**	**--**	**4**	**15**	**260**	**240**	**500**	**18**

Professional Electives - 4

Course code under 18CV82X	Course Title	Course code under 18CV82X	Course Title
18CV821	Principles of Bridge Engineering	18CV822	Prefabricated Structures
18CV823	Advanced Foundation Engineering	18CV824	Rehabilitation & Retrofitting
18CV825	Pavement Design		

Project Work: CIE procedure for Project Work Phase - 2:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Project Work Phase - 2:
(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.
Internship: Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.
Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
OUTCOME BASED EDUCATION (OBE) &
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD

<table>
<tr><td colspan="4" align="center">B.E CIVIL ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - III
TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
(Common to all Branches)</td></tr>
<tr><td>Course Code</td><td>18MAT31</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Teaching Hours/Week (L:T:P)</td><td>(2:2:0)</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Credits</td><td>03</td><td>Exam Hours</td><td>03</td></tr>
</table>

Course objectives:
1. To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
2. To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transforms: Definition and Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function – problems.

Inverse Laplace Transforms: Inverse Laplace transform - problems, Convolution theorem to find the inverse Laplace transform(without proof) and problems, solution of linear differential equations using Laplace transform.

Revised Bloom's Taxonomy Level	$L_1-¿$ Remembering, $L_2-Understanding$.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis, examples from engineering field.

Revised Bloom's Taxonomy Level	$L_1-¿$ Remembering, $L_2-Understanding$.

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.

Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform. Simple problems.

Revised Bloom's Taxonomy Level	$L_1-¿$ Remembering, $L_2-Understanding$.

Module-4

Numerical Solutions of Ordinary Differential Equations (ODE's): Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Range - Kutta method of fourth order, Milne's and Adam-Bashforth predictor and corrector method (No derivations of formulae), Problems.

Revised Bloom's Taxonomy Level	$L_1-¿$ Remembering, $L_2-Understanding$.

Module-5

Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and corrector method.(No derivations of formulae).

Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Revised Bloom's Taxonomy Level	$L_1-¿$ Remembering, $L_2-Understanding, L_3-Applying$.

<div align="right">Continued</div>

B.E CIVIL ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - III
18MAT31TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

Course outcomes:
At the end of the course the student will be able to:
1. Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
2. Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
3. Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
4. Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
5. Determine the externals of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Graduate Attributes (As per NBA)
Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2016
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C.Ray Wylie, Louis C.Barrett	McGraw-Hill Book Co	6th Edition, 1995
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V.Ramana	McGraw-Hill	11th Edition,2010
4	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publications	2014

Web links and Video Lectures:
1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

TITLE OF THE COURSE: **STRENGTH OF MATERIALS**			
[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III			
Course Code	18CV32	**CIE Marks**	**40**
Teaching Hours/Week (L:T:P)	3:2:0	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course Objectives: This course will enable students:

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To analyse and understand principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials.

5. To evaluate the behavior of torsion members, columns and struts.

Module-1

Simple Stresses and Strain:

Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

L1, L2

Module-2

Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses

Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

1

Module-3
Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.
Module-4
Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion.   **Theories of Failure:** Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory).
Module-5
Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre(only concept)   **Columns and Struts:** Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.
Course outcomes: After studying this course, students will be able;   1. To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion.   2. To suggest suitable material from among the available in the field of construction and manufacturing.   3. To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts   4. To understand the basic concept of analysis and design of members subjected to torsion.   5. To understand the basic concept of analysis and design of structural elements such as columns and struts.

Text Books:
1. B.S. Basavarajaiah, P.Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010
2. Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

Reference Books:

1. D.H. Young, S.P. Timoshenko " Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
3. S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

TITLE OF THE COURSE: **FLUIDS MECHANICS** [As per Choice Based Credit System (CBCS) scheme] III Semester			
Course Code	**18CV33**	**CIE Marks**	**40**
Number of Lecture	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**
Credits – 03			

Course Objectives: The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to practical problem solving
3. Principles of Kinematics and Hydro-Dynamics for practical applications
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements

Module-1

Fluids & Their Properties: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension& Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems).Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems

Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure

Module-2

Hydrostatic forces on Surfaces: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane

surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

Fundamentals of fluid flow (Kinematics): Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irroational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.

L2,L4

Module-3

Fluid Dynamics: Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses).

Vortex motion; forced vortex, free vortex, problems Momentum equation problems on pipe bends.

Applications: Introduction. Venturimeter, Orificemeter, Pitot tube. Numerical Problems

Module-4

Orifice and Mouthpiece: Introduction, classification, flow through orifice, hydraulic coefficients and Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).

Notches and Weirs: Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.

Module-5

Flow through Pipes: Introduction. Major and minor losses in pipe flow. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Pipe Networks, Hardy Cross method, Numerical problems.

Surge Analysis in Pipes: Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems

Course outcomes: After successful completion of the course, the student will be able to:

1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum
2. Compute and solve problems on hydrostatics, including practical applications
3. Apply principles of mathematics to represent kinematic concepts related to fluid flow
4. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
5. Compute the discharge through pipes and over notches and weirs

Text Books:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi

Reference Books:

1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics",

Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)

2. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.

3. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.

4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition

5. 5. Mohd.Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press

TITLE OF THE COURSE: **BUILDING MATERIALS AND CONSTRUCTION** [As per Choice Based Credit System (CBCS) scheme] III Semester			
Course Code	18CV34	**CIE Marks**	**40**
Number of Lecture	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

<div align="center">

Credits – 03

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Course Objectives: This course will develop a student:

1. In recognizing the good materials to be used for the construction work
2. In investigation of soil condition, Deciding and design of suitable foundation for different structures
3. In supervision of different types of masonry
4. In selection of materials, design and supervision of suitable type of floor and roof.
5. To gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning and to take suitable engineering measures.

Building Materials: Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.

Cement Concrete blocks, Stabilized Mud Blocks, Sizes, requirement of good blocks.

Mortar: types and requirements. Timber as construction material

Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

L1 L2

Foundation: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation

Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls

Module-3
Lintels and Arches: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.
Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material, Laying of Concrete, Mosaic, Marble, Granite, Tile flooring, Cladding of tiles. Roof;-Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

Module-4
Doors, Windows and Ventilators: Location of doors and windows, technical terms, Materials for doors and windows, Paneled door, Flush door, Collapsible door, Rolling shutter, PVC Door, Paneled and glazed Window, Bay Window, French window. Ventilators. Sizes as per IS recommendations
Stairs: Definitions, technical terms and types of stairs, Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.   **Formwork:** Introduction to form work, scaffolding, shoring, under pinning.

Module-5
Plastering and Pointing : purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering **Damp proofing**-causes, effects and methods.
Paints- Purpose, types, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.   L4 L5

Course outcomes: After a successful completion of the course, the student will be able to: 1. Select suitable materials for buildings and adopt suitable construction techniques.   2. Adopt suitable repair and maintenance work to enhance durability of buildings.
Text Books: 1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015,Standard Publishers   2. Dr. B.C.Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.   3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.
Reference Books: 1. S.K.Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India   2. P C Vergese, "Buliding Materials", PHI Learning Pvt. Ltd   3. Building Materials and Components, CBRI, 1990, India   4. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.   5. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

TITLE OF THE COURSE: **SURVEYING**			
[As per Choice Based Credit System (CBCS) scheme]			
III Semester			
Course Code	**18CV35**	**CIE Marks**	**40**
Number of Lecture	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course Objectives: This course will enable students to;

1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Module-1

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.

Measurement of Horizontal Distances: Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems

Module-2

Measurement of Directions and Angles: Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Theodolite Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite

L2,L3

Module-3

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems

Tacheometry: basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems
L1, L2

Module-4
Leveling: Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling, trigonometric leveling (heights and distances-single plane and double plane methods.)

Module-5
Areas and Volumes: Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- rapezoidal and prismoidal formula.
Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.
L2,L3

Course outcomes: After a successful completion of the course, the student will be able to:

1. Posses a sound knowledge of fundamental principles Geodetics
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
3. Capture geodetic data to process and perform analysis for survey problems]
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

Text Books:

1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi – 2009.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan, 1988

Reference Books:

1. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi.2009.
2. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. – 2010
3. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi
4. A. Bannister, S. Raymond , R. Baker, "Surveying", Pearson, 7th ed., New Delhi

TITLE OF THE COURSE: **ENGINEERING GEOLOGY** [As per Choice Based Credit System (CBCS) scheme] III Semester			
Course Code	18CV36	**CIE Marks**	**40**
Number of Lecture	03	**SEE Marks**	60
Total Number of Lecture Hours	**40 (08 Hours per Module)**	**Exam Hours**	03

Credits – 04	
Course Objectives: This course will enable students:	

1. To understand the internal structure and composition of the earth.
2. To comprehend the properties, occurrence and uses of minerals in various industries.
3. To learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects.
4. To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways.
5. To learn the application of Topographic maps, remote sensing and GIS in Civil engineering practices and natural resource management.

Module-1

Introduction: Application of Earth Science in Civil Engineering Practices,Understanding the earth, internal structure and composition.

Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chromite (Alloy); Bauxite (aluminum); Chalcopyrite (copper)

Module-2

Petrology: Formation, Classification and Engineering Properties. Rock as construction material, concrete aggregate, railway ballast, roofing, flooring, cladding and foundation. Deformation of rocks, Development of Joints, Folds, Faults and Unconformities. Their impact in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges, Rock Quality Determination (RQD), Rock Structure Rating (RSR),: Igneous Rocks - Granite, Gabbro, Dolerite, Basalt; Sedimentary rocks - Sandstone, Shale, Limestone, Laterite; Metamorphic rocks - Gneiss, Quartzite,Slate, Charnockite: Decorative stones - Porphyries, Marble and Quartzite

Module-3

Geomorphology and Seismology: Landforms – Classification, Rock

aspects in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges. Watershed management, Floods and their control,River valley, Drainage pattern – parameters and development; Coastlines and their engineering considerations.

Earthquake - Causes and Effects,, Seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, Richter Scale, Seismograph, Seismic zones-World and India, Tsunami – causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides – causes and their control

Module-4

Hydrogeology: Hydrological cycle, Occurrence of Groundwater in different terrains -Weathered, Hard and Stratified rocks; Determination of Quality aspects - SAR, RSC and TH of Groundwater. Groundwater Pollution, Groundwater Exploration-Electrical Resistivity and Seismic methods, Resistivity curves, Water Bearing Formations, Aquifer types and parameters - Porosity, Specific yield and retention, Permeability, Transmissibility and Storage Coefficient. Springs and Artesian Wells, Artificial Recharging of Groundwater, Sea water intrusion and remedies.

Module-5

Geodesy: Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) – Concept and their use resource mapping. LANDSAT Imagery–Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation.

Course outcomes: After a successful completion of the course, the student will be able to:

1. Students will able to apply the knowledge of geology and its role in Civil Engineering
2. Students will effectively utilize earth's materials such as mineral, rocks and water in civil engineering practices.
3. Analyze the natural disasters and their mitigation.
4. Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems.
5. Apply and asses use of building materials in construction and asses their properties

Text Books:

1. P.K. Mukerjee, "A Text Book of Geology", World Press Pvt., Ltd. Kolkatta.
2. Parbin Singh, "Text Book of Engineering and General Geology", Published by S.K.Kataria and Sons, New Dehli

Reference Books:

1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
2. Dimitri P Krynine and William R Judd, "Principles of Engineering Geology and

Geotechnics", CBS Publishers and Distributors, New Delhi.

3. K V G K Gokhale, "Principles of Engineering Geology", BS Publications,Hyderabad.

4. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.

5. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills

6. K. Todd, "Groundwater Hydrology", Tata Mac Grow Hill, New Delhi.

7. D. Venkata Reddy, "Engineering Geology", New Age International Publications, New Delhi.

8. S.K Duggal, H.K Pandey and N Rawal, "Engineering Geology", McGraw Hill Education (India) Pvt, Ltd. New Delhi.

9. M.P Billings, "Structural Geology", CBS Publishers and Distributors, New Delhi.

10. K. S. Valdiya, " Environmental Geology",, Tata Mc Grew Hills.

11. M. B. Ramachandra Rao, "Outlines of Geophysical Prospecting- A Manual for Geologists", Prasaranga, University of Mysore, Mysore

Course Title: COMPUTER AIDED BUILDING PLANNING AND DRAWING [As per Choice Based Credit System (CBCS) scheme] SEMESTER:III			
Subject Code	18CVL37	IA Marks	40
Number of Lecture Hours/Week	04 (2hr Instructions + 2hr Drawing)	Exam Marks	60
Total Number of Lecture/Practice	50	Exam Hours	03
	CREDITS – 02	Total Marks-100	

Course objectives: Provide students with a basic understanding

1. Achieve skill sets to prepare computer aided engineering drawings

2. Understand the details of construction of different building elements.

3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

Module:1

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962

Simple engineering drawings with CAD drawing tools : Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings

L1 L2

Module:2

Drawings Related to Different Building Elements:
Following drawings are to be prepared for the data given using CAD Software
a) Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
b) Different types of bonds in brick masonry
c) Different types of staircases – Dog legged, Open we ll
d) Lintel and chajja
e) RCC slabs and beams
f) Cross section of a pavement
g) Septic Tank and sedimentation Tank

h) Layout plan of Rainwater recharging and harvesting system

i) Cross sectional details of a road for a Residential area with provision for all services

j) Steel truss (connections Bolted)

Note: Students should sketch to dimension the above in a sketch book before doing

Module -3:

Building Drawings: Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services *using CAD software* for:

1. Single and Double story residential building

2. Hostel building

3. Hospital building

4. School building

5. *Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws*

    Note:

- Students should sketch to dimension the above in a sketch book before doing the computer drawing

- *One compulsory field visit/exercise to be carried out.*

- Single line diagrams *to be given in the examination.*

Course Outcomes: After studying this course, students will be able to

1. Gain a broad understanding of planning and designing of buildings

2. Prepare, read and interpret the drawings in a professional set up.

3. Know the procedures of submission of drawings and Develop working and submission drawings for building

4. Plan and design a residential or public building as per the given

Program Objectives

- Engineering knowledge

- Problem analysis

- Interpretation of data

Question paper pattern:

- There will be two full questions with sub divisions if necessary from Module 2 with each full question carrying _thirty_ marks. Students have to answer one question.

- There will be two full questions from Module 3 with each full question carrying _fifty_ marks. Students have to answer one question.

- The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. question papers should be given in batches

Text book:

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to B uilt Environment Drawing" , Tata Mc Graw Hill Publishing co. Ltd., New Delhi

Reference Books:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,

2. IS: 962-1989 (Code of practice for architectural and building drawing)

3. National Building Code, BIS, New Delhi

TITLE OF THE COURSE: **MATERIALS TESTING LABORATORY** [As per Choice Based Credit System (CBCS) scheme] III Semester			
Course Code	**18CVL38**	**CIE Marks**	**40**
Number of Lecture	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
RBT Levels	**L1, L2, L3**	**Exam Hours**	**03**
Credits – 02			

Course Objectives: The objectives of this course is to make students to learn:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Experiments:

1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections
4. Bending Test on Wood Under two point loading
5. Shear Test on Mild steel- single and double shear
6. Impact test on Mild Steel (Charpy & Izod)
7. Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's
8. Tests on Bricks and Tiles
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
11. Demonstration of Strain gauges and Strain indicators

NOTE: All tests to be carried out as per relevant latest BIS Codes

Course outcomes: After successful completion of the course, the students will be able to:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

Question paper pattern:
- Group experiments - Tension test, compression test, torsion test and

1

bending test.

- Individual Experiments - Remaining tests.

- Two questions are to be set - One from group experiments and the other as individual experiment.

- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.

- All exercises are to be included for practical examination.

Reference Books:

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.

2. M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education(India)Pvt. Ltd., 2014

3. Fenner, " Mechanical Testing of Materials", George Newnes Ltd. London.

4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.

5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd.New Delhi.

6. Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual",Standard Publishers & Distributors 1996.

7. Relevant **latest IS Codes**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
OUTCOME BASED EDUCATION (OBE) &
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS			
(Common to all branches)			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER - IV			
Course Code	**18MAT41**	**CIE Marks**	**40**
TeachingHours/Week (L:T:P)	**(2:2:0)**	**SEE Marks**	**60**
Credits	**03**	**Exam Hours**	**03**

Course objectives:
- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.
Construction of analytic functions: Milne-Thomson method-Problems.

Revised Bloom's Taxonomy Level	$L_1-\text{¿}$ Remembering, $L_2-Understanding$.

Module-2

Conformal transformations: Introduction. Discussion of transformations:

$w=Z^2, w=e^z, w=z+\dfrac{1}{z}, (z\neq 0).$ Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's

Revised Bloom's Taxonomy Level	$L_1-\text{¿}$ Remembering, $L_2-Understanding$.

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Revised Bloom's Taxonomy Level	$L_1-\text{¿}$ Remembering, $L_2-Understanding, L_3-Applying$.

Module-4

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.
Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-
$y=ax+b, y=a x^b \wedge y=a x^2+bx+c.$

Revised Bloom's Taxonomy Level	$L_1-\text{¿}$ Remembering, $L_2-Understanding, L_3-Applying$.

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance. **Sampling Theory:** Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.		
Revised Bloom's Taxonomy Level	$L_2 - Understanding, L_3 - Applying, L_4 - Analysing$	

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - IV
18MAT41COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

Course outcomes:
At the end of the course the student will be able to:
1. Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
2. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
3. Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
4. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Graduate Attributes (As per NBA)
Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition,2016
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C.Ray Wylie, Louis C.Barrett	McGraw-Hill	6th Edition 1995
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V.Ramana	McGraw-Hill	11th Edition,2010
4	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publications	2014

Web links and Video Lectures:
1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

TITLE OF THE COURSE: ANALYSIS OF DETERMINATE STRUCTURES, [As per Choice Based Credit System (CBCS) scheme] IV Semester			
Course Code	18 CV42	CIE Marks	40
Number of Lecture	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			

Course Objectives: This course will enable students

1. Apply knowledge of mathematics and engineering in calculating slope and deflections
2. Identify, formulate and solve engineering problems
3. Analyse structural systems and interpret data
4. Engage in lifelong learning with the advances in Structural Engineering

Module-1

Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

Module-2

Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions,Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.

Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts.

Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections.

Module-3

Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the
point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit load method.

L2,L4,L5

Module-4
Arches and Cable Structures: Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension
Module-5
Influence Lines and Moving Loads: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses-Reactions, BM and SF in determinate beams using rolling loads concepts. **L2, L4, L6**
Course outcomes: After studying this course, students will be able to: 1. Evaluate the forces i n determinate trusses by method of joints and sections. 2. Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods 3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames. 4. Determine the stress resultants in arches and cables. 5. Understand the concept of influence lines and construct the ILD diagram for
Text Books: 1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi. 2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi,2015. 3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi, 2002.
Reference Books: 1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014 2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi, 2008.

TITLE OF THE COURSE: **APPLIED HYDRAULICS**			
IV Semester			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	18CV43	**CIE Marks**	**40**
Number of Lecture	03	**SEE Marks**	**60**
Total Number of Lecture Hours	40 (08 Hours per Module)	**Exam Hours**	**03**
Credits – 03			

Course Objectives: The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Module-1

Dimensional analysis: Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ð theorem, dimensional analysis, choice of variables, examples on various applications.

Model analysis: Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model

Buoyancy and Flotation: Buoyancy, Force and Centre of Buoyancy, Metacentre and Metacentric height, Stability of submerged and floating bodies, Determination of Metacentric height, Experimental and theoretical method, Numerical problems

L1, L2, L3, L4

Open Channel Flow Hydraulics:

Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems

L3,L4

Non-Uniform Flow: Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems, Control sections

L2,L3,L4

Module 4

Hydraulic Machines:

Introduction, Impulse-Momentum equation. Direct impact of a jet on a stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems

Turbines – Impulse Turbines: Introduction to turbines, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems

Module-5

Reaction Turbines and Pumps: Radial flow reaction turbines: (i) Francis turbine- Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

Course outcomes:

After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

Text Books:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechan ics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hy draulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechan ics and Fluid Machines", Tata McGraw Hill,New Delhi

1. K Subramanya, "Fluid Mechanics and Hydraulic Machin es", Tata McGraw Hill Publishing Co. Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, *"Fluid Mechanics and Machinery"*, Oxford University Publication – 2010
4. J.B. Evett, and C. Liu, *"Fluid Mechanics and Hydraulics "*, McGraw-Hill Book Company.-2009.

TITLE OF THE COURSE: **CONCRETE TECHNOLOGY**			
IV Semester			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	18CV44	**CIE Marks**	40
Number of Lecture	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	03
Credits – 03			

Course objectives: This course will enable students to:

1. Recognize the importance of material characteristics and their contributions to strength development in Concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Module-1

Concrete Ingredients

Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.

L1, L2, L3

Fresh Concrete

Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

L1, L2, L3

Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per

IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

Module-4

Concrete Mix Proportioning

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262

Module-5

Special Concretes

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and aplications

Course outcomes:

After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behaviour based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

Text Books:

1. Neville A.M. "Properties of Concrete"-4th Ed., Long man.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Mi crostructure, Property and Materials", 4th Edition, McGraw Hill Education, 201 4
4. A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (New Edition)

1. M L Gambir, "Concrete Technology", McGraw Hill Educ ation, 2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning , 2015
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete]Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House

TITLE OF THE COURSE: **ADVANCED SURVEYING**			
IV Semester			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CV45**	**CIE Marks**	**40**
Number of Lecture	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

Module 1

Curve Surveying

Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics , numerical problems on Length of Transition curve, Vertical curves –Types – (theory).

L1,L3,L5

Module 2

Geodetic Surveying and Theory of Errors

Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and

stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.

L1,L2, L3

Introduction to Field Astronomy: Earth, celestial sphere, earth and celestial

coordinate

systems, spherical triangle, astronomical triangle, Napier's rule

L4,L5

Module-4
Aerial Photogrammetry
Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax **L2,L3, L5**

Module-5
Modern Surveying Instruments
Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).
Course outcomes: After a successful completion of the course, the student will be able to: 1. Apply the knowledge of geometric principles to arrive at surveying problems 2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems. 3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments; 4. Design and implement the different types of curves for deviating type of alignments.
Text Books: 1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd., New Delhi. 2. Kanetkar T P and S V Kulkarni , Surveying and Levelling Part 2, Pune Vidyarthi Griha Prakashan, 3. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. 4. Sateesh Gopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi **Reference Books:** 1. S.K. Duggal, "Surveying Vol.I & II", Tata McGraw Hi ll Publishing Co. Ltd. New Delhi. 2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi. 3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers 4. B Bhatia, Remote Sensing and GIS , Oxford University Press, New Delhi. 5. T.M Lillesand,. R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India 6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication. 7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill

Course Title: **WATER SUPPLY AND TREATMENT**			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER VI			
Subject Code	**18CV46**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS – 03		**Total Marks- 100**	

Course objectives: This course will enable students to
1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water

Module -1

Introduction: Need for protected water supply. Demand of Water: Types of water

demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period.

Different methods of population forecasting -with merits and demerits. Numerical Problems.

L1,L2,L3

Module -2

Water Treatment: Objectives, Treatment flow chart – significance of each unit
Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques.
Water quality characteristics: Physical, Chemical and Microbiological.

L1,L2,L3

Module -3

Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube
settlers.
Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarriflocculators . Filtration: mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system.
Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pre treatment.

L1,L2,L3

Module -4

Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration:
Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration.
Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.

Module -5

Collection and Conveyance of water: Intake structures - types of intakes –Factors
to be considered in selection of intake structures.
Pumps: Types of pumps with working principles. Numerical Problems.
Pipes: Design of the economical diameter for the rising main; Numerical Problems.
Pipe appurtenances, Valves, Fire hydrants
Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material.
Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination.
Visit to Intake structure, Water treatment plant and report working of each unit Design of water treatment plant units and distribution system with population forecasting for the given city

L1,L2,L3

Course Outcomes: After studying this course, students will be able to: 1. Estimate average and peak water demand for a community. 2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community. 3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system. 4. Design a comprehensive water treatment and distribution system to purify and

Program Objectives:
   1. Engineering knowledge
   2. Problem analysis
   3. Interpretation of data

Question Paper Pattern:
   1. The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
   2. There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
   3. Each full question shall cover the topics as a module
 	
   4. The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books: 1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010
Reference Books: 1. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010. 2. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000 3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

Title of the Course: ENGINEERING GEOLOGY LABORATORY
IV Semester
[As per Choice Based Credit System (CBCS) scheme]

Subject Code	18CVL47	CIE Marks	40
Number of Hours/Week	03(1hrtutorial+2hr laboratory)	SEE Marks	60
Total Number of Hours Lecture	40 hr	Exam Hours	03
RBT Levels	L1, L2, L3, L4		
CREDITS–02			

Course objectives: This course will enable students

1. To identify the minerals and rocks based on their inherent properties and uses in civil engineering

2. To interpret the geological maps related to civil engineering projects.

3. To learn the dip and strike, bore hole problems, thickness of geological formation related to foundation, tunnels, reservoirs and mining.

3. To understand subsurface geological conditions through huge physical techniques and water shed management.

4. To visit the civil engineering projects like dams, reservoirs, tunnels, quarry sites,

Modules	Teaching Hour	RevisedBloom's Taxonomy (RBT Level)
1. Identification of minerals as mentioned in theory, their properties, uses and manufacturing of construction materials.	6 Hours	L1, L2,L3
2. Identification of rocks as mentioned in theory, their engineering properties and uses in construction and	6 Hours	L1,L2, L3
3. Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railwaylines, tunnels, dams etc.)	6 Hours	L3,L4
4. Bore hole problems: Determination of subsurface behavior of rocks, their attitude related	6 Hours	L3, L4
5. Calculation of Vertical, True thickness and width of the outcrops.	3 Hours	L3,L4
6. Interpretationof Electricalresistivitycurvestofind out subsurface information such as thickness	4 Hours	L3, L4
7. Interpretation of Toposheets and geological maps related to Civil Engineering Projects	9	L2,L3, L4

Course outcomes: During this course, students will develop expertise in;

1. Identifying the minerals and rocks and utilize them effectively in civil engineering practices

2. Understanding and interpreting the geological conditions of the area for the implementation of civil engineering projects.

3. Interpreting subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.

Program Objectives(asperNBA):
1. Engineering Knowledge.
2. Problem Analysis.
3. Design/development of solutions (partly).

Reference Books:
1. MPBillings,StructuralGeology,CBSPublishersandDistributors,NewDelhi
2. B.S.SatyanarayanaSwamy, Engineering Geology Laboratory Manual, DhanpatRai Sons, NewDelhi.
3. LRANarayan, Remote sensing and its applications, UniversityPress.
4. P.K.MUKERJEE, Textbook of Geology, WorldPress Pvt. Ltd., Kolkatta
5. JohnIPlattandJohnChallinor,SimpleGeologicalStructures,ThomasMurthy&Co,London

TITLE OF THE COURSE: **FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY** IV Semester			
Course Code	**18CVL48**	**CIE Marks**	**40**
Number of Lecture	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3, L4**		
Credits – 02			

Course Objectives: This course will enable students to;

1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

Experiments:

1. Verification of Bernoulli's equation
2. Determination of Cd for Venturimeter and Orifice meter
3. Determination of hydraulic coefficients of small vertical orifice
4. Calibration of Rectangular and Triangular notch
5. Calibration of Ogee and Broad crested weir
6. Determination of Cd for Venturiflume
7. Experimental determination of force exerted by a jet on flat and curved plates (Hemispherical Vane).
8. Experimental determination of operating characteristics of Pelton turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major and Minor Losses in Pipes
13. Demonstration Experiments:
    a. Reynold's experiment to understand laminar and turbulent flow
    b. Flow Visualization
    c. Calibration of Sutro-weir

Course outcomes: During the course of study students will develop understanding of:

1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:

1. Sarbjit Singh , *Experiments in Fluid Mechanics* - PHI Pvt. Ltd.- New Delhi
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi & D r S.M. Seth, Standard Book House- New Delhi, 2009 Edition

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

OBE & CBCS

CIVIL ENGINEERING BOARD

Course Title: CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:V			
Subject Code	18CV51	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –03		Total Marks - 100	

Course Objectives: This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties.

Module -1

Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans

Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles

Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node.

L1,L2,L3

Module -2

Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

Construction Equipments: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance

Materials: material management functions, inventory management.

L1,L2,L3

Module -3

Construction Quality , safety and Human Values:

Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation.Storage of materials. Safety through legislation, safety campaign. Insurances.

Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics,Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

L1,L2,L3

Module -4

Introduction to engineering economy :

Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

Interest and time value of money: concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.

Comparison of alternatives : Present worth, annual equivalent , capitalized and rate of return methods , Minimum Cost analysis and break even analysis

L1,L2,L3

Module -5

Ent repreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC

Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Understand the construction management process.
2. Understand and solve variety of issues that are encountered by every professional in discharging professional duties.
3. Fulfill the professional obligations effectively with global outlook

Program Objectives:
1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Question Paper Pattern:
1. The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
2. There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
3. Each full question shall cover the topics as a module
4. The students shall answer five full questions, selecting one full question from each

Text Books:
1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education
2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw- Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
4. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output

Reference Books:
1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
2. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, New Delhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw-Hill Education
5. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pitsburgh
6. James L.Riggs , David D. Bedworth , Sabah U. Randhawa " Engineerng Economics" 4 ed tata Mc Graw hill.

TITLE OF THE COURSE: ANALYSIS OF INDETERMINATE STRUCTURES				
B.E., V Semester, Civil Engineering				
[As per Choice Based Credit System (CBCS) scheme]				

Course Code	18CV52	CIE Marks	40
Number of Lecture Hours/Week	04	**SEE Marks**	60
Total Number of Lecture Hours	50 (10 Hours per Module)	**Exam Hours**	03
Credits – 04			

Course Objectives: This course will enable students to
1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. communicate effectively in design of structural elements

Module-1

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3

L2, L4,L5

Module-2

Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of 08 Hours orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3

L2, L4,L5

Module-3

Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway

L2, L4,L5

Module-4

Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3

L2, L4,L5

Module-5

Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic

indeterminacy ≤3	
	L2, L4,L5

Course outcomes: After studying this course, students will be able to:

1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams and frames using flexibility method
5. Analyze the beams and indeterminate frames by system stiffness method.

Text Books:

1. Hibbeler R C, " **Structural Analysis",** Pearson Publication
2. L S Negi and R S Jangid, **"Structural Analysis",** Tata *McGraw-Hill* Publishing Company Ltd.
3. D S Prakash Rao, **"Structural Analysis: A Unified Approach"** , Universities Press
4. K.U. Muthu, H.Narendra etal, **"Indeterminate Structural Analysis",** IK International Publishing Pvt. Ltd.

Reference Books:

1. Reddy C S, **"Basic Structural Analysis",** *Tata McGraw-Hill* Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, **"Theory of Structures"**, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M M Ratwani, **"Analysis Of Structures** ", Vol. 2, Khanna Publishers
4. Wang C K, **"Intermediate Structural Analysis",** McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, **"Computational Structural Mechanics",** PHI Learning Pvt. Ltd.,

TITLE OF THE COURSE: DESIGN OF RC STRUCTURAL ELEMENTS B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CV53**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03:02**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course objectives: This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.

2. Follow a procedural knowledge in designing various structural RC elements.

3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.

4. Provide knowledge in analysis and design of RC elements for the success in competitive examinations.

Module-1

Introduction to Limit State Design and Serviceability: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

L1, L2

Module-2

Limit State Analysis of Beams:
Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear

L2, L4

Module-3

Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams for shear, design for combined bending and torsion as per IS-456

L2, L4

Module-4
Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.   **L2, L4**
Module-5
Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment   **L2, L4**
Course outcomes: After studying this course, students will be able to: 1. understand the design philosophy and principles   2. solve engineering problems of RC elements subjected to flexure, shear and torsion   3. demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings   4. owns professional and ethical responsibility
• The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.
Text Books: 1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi   2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press   3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.
Reference Books: 1. P C Varghese, "Limit State design of reinforced concrete" , PHI, New Delhi   2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publisher s   3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications   4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press   5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

TITLE OF THE COURSE: BASIC GEOTECHNICAL ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	18CV54	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

Credits – 03

Course objectives: This course will enable students to

1. To appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also to become familiar broadly with geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering.
2. To know the basic engineering properties and the mechanical behaviour of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils.
3. To determine the improvement in mechanical behaviour by densification of soil deposits using compaction.
4. To know how the properties of soils that can be measured in the lab

Module-1

Introduction: Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their inter relationships.

Determination of Index properties-Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis)

Atterberg's Limits, consistency indices, relative density, activity of clay, Plasticity chart, unified and BIS soil classification.

L1,L2,L3

Module-2

Soil Structure and Clay Mineralogy

Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering

Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control - compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

L1,L2,L3

Module -3:

Flow through Soils: Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena

Seepage Analysis: Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications. Flow nets for sheet piles and below the dam section.
Unconfined flow, phreatic line (Casagrande's method –with and without toe filter), flow through dams, design of dam filters.
Effective Stress Analysis:
Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena

Module -4:
Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumption and limitations. Derivation of Governing differential Equation Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils. Consolidation characteristics of soil (C_C, a_V, m_V and C_V. Laboratory one dimensional consolidation test, characteristics of e-log(σ') curve, Determination of consolidation characteristics of soils- compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.
Module-5
Shear Strength of Soil: Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. Total and effective stress paths.**L1, L2, L3 L4**

Course outcomes: On the completion of this course students are expected to attain the following outcomes;
1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Text Books:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India

Reference Books:
1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications
4. Debashis Moitra, "Geotechnical Engineering", Universities Press.,
5. Malcolm D Bolton, "A Guide to soil mechanics", Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications

MUNICIPAL WASTE WATER TREATMENT			
MUNICIPAL WASTE WATER TREATMENT **B.E IN CIVIL ENGINEERING(CV-2018-19)** **Outcome Based Education (OBE) and Choice Based Credit System (CBCS)** **SEMESTER - V**			
Course Code	18CV55	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course objectives: This course will enable students to;
1. Understand the varies water demands and population forecasting methods .
2. Understand and design different unit operations and unit process in involved in waste water treatment process
3. Understand the concept and design of various physicochemical treatment units
4. Understand the concept and design of various biological treatment units
5. Understand the concept of various advance waste water and low cost treatment processes for rural areas.

Modules	Teaching in Hours	RBT Level
Module-1		
Introduction, need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm flow, time of concentration flow, material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers. Sewer appurtenances, manholes, catch basins, basic principles of house drainage, typical layout plan showing house drainage connections	10	L1,L2,L3
Module-2		
Design of sewers, hydraulic formula for velocity, effects of variation on velocity, regime velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions. Reaction kinetics(zero order, 1st order and 2nd order) Disposal of effluents by dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents, Streeter-Phelps equation.	10	L1,L2,L3
Module-3		
Waste water characteristics, sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water treatment, unit operations. Theoretical principles and design: screens, equalization basin, grit chamber, primary and secondary settling tanks.	10	L1,L2,L3
Module-4		
Working principles and design: Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors. Principles and design of stabilization ponds. Sequential batch reactors, moving bed bio reactors Sludge Processing: Separation - sludge thickeners, volume reduction, co nditioning and digestion – aerobic and anaerobic.	10	L1,L2,L3
Module-5		
Advanced Wastewater Treatment: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advance oxidation rocesses (AOPs), Elecrtocoagulation, Numerical Problems. Rural wastewater systems: Septic tanks, two-pit latrines, eco-toilet, soak pits and numerical problems.	10	L1,L2,L3

Course outcomes:
After studying this course, the students will be able to:
1. Select the appropriate sewer appurtenances and materials in sewer network.
2. Design the sewers network and understand the self purification process in flowing water.
3.Deisgn the varies physic- chemical treatment units
4. Design the various biological treatment units
5. Design various AOPs and low cost treatment units.

Graduate Attributes (As per NBA)
Program Objectives:
- Engineering knowledge
- Problem analysis

- Interpretation of data

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60
- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition
Textbook/s				
1	Environmental Engineering -. New York, 2000	Howard S. Peavy, Donald R. Rowe, George T	Tata McGraw Hill	Indian Edition, 2013
2.	"Wastewater Engineering - Treatment and Reuse", , Publishing Co. Ltd., New Delhi.	Metcalf and Eddy Inc	Tata McGraw Hill	4th Edition, 2009
3	Environmental Engineering vol-II,	B C Punmia	Laxmi Publications	2nd, 2016
4	"Wastewater Treatment Concepts and Design Approach"	Karia G.L., and Christian R.A.,	Prentice Hall of India Pvt. Ltd., New Delhi.	$3^{rd,}$ Edition, 2017
5	Environmental Engineering vol-II, Water supply Engineering	S.K.Garg,	Khanna Publishers, – New Delhi	28th edition and 2017
Reference Books				
1	CPHEEO manual on sewage treatment	Ministry of Urban Development, Government of India, New Delhi.		1999
2	Water & Waste Water Technology,	Mark.J Hammer,	John Wiley & Sons Inc., New York,	2008
3	Biological Process Design for Wastewater Treatment	Benefield R.D., and Randal C.W	Prentice Hall, Englewood Chiffs, New Jersey	2012

Course Title: Highway Engineering			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:V			
Subject Code	18CV56	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals	10 hours	L1,L2
Module -2		
Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects Highway Geometric Design: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of	10 Hours	L2,L3,L4
Module -3		
Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material Pavement Design: Pavement components of flexible and rigid	10 Hours	L3,L4,L5
Module -4		
Pavement Construction: Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads	10 Hours	L2,L3,L4

Module -5		
Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location Highway Economics: Highway user benefits, VOC using charts	10 Hours	L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. S K Khanna and C E G Justo, " Highway Engineering", Nem Chand Bros, Roorkee
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K.P.subramanium, "Transportation Engineering", SciTech Publications, Chennai.

Reference Books:
1. Relevant IRC Codes
2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kent lal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

Course Title: SURVEYING PRACTICE
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – V

Subject Code	**18CVL57**	**IA**	**40**
Number of Lecture Hours/Week	**03**	**Exam**	**60**
Total Number of Lecture Hours	**42**	**Exam**	**03**

CREDITS – 02

Course objectives: This course will enable students to

1. Apply the basic principles of engineering surveying and measurements
2. Follow effectively field procedures required for a professional surveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice..

Modules	Teaching Hours	Revised Bloo m's Taxonomy (RBT)
1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.	03	L3, L4
2. Obstacles in chaining and ranging – Chaining but not ranging, ranging but not chaining, both ranging and chaining	03	L3
3. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass	03	L3
4. Measurement of bearings of sides of a closed traverse and adjustment of closing error by	03	L3
5. Determination of distance between two inaccessible points using compass and	03	L4
6. Determination of reduced levels of points using dumpy level/auto level (simple leveling)	03	L4
7. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling)	03	L4
8. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error	03	L4
9. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph	03	L3
10. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using	03	L4

11.	Determination of horizontal distance and vertical height to a base inaccessible object using theodolite by single plane and double	03	L4
12.	To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight	03	L3
13.	Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule	03	L3
14.	Demonstration of Minor instruments like Clinometer, Ceylon Ghat tracer, Box sextant, Hand level, Planimeter	03	L3

Course outcom es:

After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying and for linear and angular measurements.

2. comprehend effectively field procedures required for a professional surveyor.

3. Use techniques, skills and conventional

Program Objecti ves (as per NBA)

1. *Engineering Knowledge.*

2. *Problem Analysis.*

3. *Interpretation of data.*

Question paper pattern:

- All are individual experiments.

- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.

- All exercises are to be included for practical examination.

Text Books:

1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi – 2009.

2. Kanetkar T P and S V Kulkarni , Surveying and Levelling Part I, Pune VidyarthiGrihaPrakashan , 1988

Reference Books:

1. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi. – 2009.

2. K.R. Arora, " Surveying Vol. 1" Standard Book House, New Delhi. – 2010

TITLE OF THE COURSE: CONCRETE AND HIGHWAY MATERIALS LABORATORY B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CVL58**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3,**		
Credits – 02			

Course objectives: This course will enable students

1. To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

Modules

Part A: Concrete Lab

1. Tests on Cement:

    a. Normal Consistency
    b. setting time
    c. compressive strength
    d. fineness by air permeability test
    e. specific gravity

2. Tests on Concrete:

    a. Design of concrete mix as per IS-10262
    b. Tests on fresh concrete:
        i. slump,
        ii. compaction factor and
        iii. Vee Bee test
    c. Tests on hardened concrete:
        i. compressive strength test,
        ii. split tensile strength test,
        iii. flexural strength test
    d. NDT tests by rebound hammer and pulse velocity test.

3. Tests on Self Compacting Concrete:

    a. Design of self compacting concrete,
    b. slump flow test,
    c. V-funnel test,
    d. J-Ring test,
    e. U Box test and
    f. L Box test

Part B: High way materials Lab

1. Tests on Aggregates

    a. Aggregate Crushing value
    b. Los Angeles abrasion test
    c. Aggregate impact test
    d. Aggregate shape tests (combined index and angularity number)

2. Tests on Bituminous Materials

	a. Penetration test
	b. Ductility test
	c. Softening point test
	d. Specific gravity test
	e. Viscosity test by tar viscometer
	f. Bituminous Mix Design by Marshall Method (Demonstration only)
3. Tests on Soil	a. Wet sieve analysis
	b. CBR test

Course outcomes: During this course, students will develop expertise in;

1. 1. Conduct appropriate laboratory experiments and interpret the results
2. Determine the quality and suitability of cement
3. Design appropriate concrete mix
4. Determine strength and quality of concrete
5. Test the road aggregates and bitumen for their suitability as road material.
6. Test the soil for its suitability as sub grade soil for pavements.

Question paper pattern:

- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. 1. M.L.Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand & Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual ", Nem Chand Bros, Roorkee
7. L R Kadiyali, "Highway Engineering ", Khanna Publishers, New Delhi

ENVIRONMENTAL STUDIES			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – V			
Course Code	18CIV59	CIE Marks	40
Teaching Hours / Week (L:T:P)	1:0:0	SEE Marks	60
Credits	01	Exam Hours	02

Course objectives: This course will enable students to

1. **To identify the major challenges in environmental issues and evaluate possible solutions.**
2. **Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development.**
3. **To analyze an overall impact of specific issues and develop environmental management plan.**

Modules	Teaching in Hours	RBT Level
Modules - 1		
Introduction: Environment - Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. Impacts of Agriculture & Housing Impacts of Industry, Mining & transportation Environmental Impact Assessment, Sustainable Development.	04	L1,L2
Modules - 2		
Natural Resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cyc le & Sulphur Cycle. Energy – Different types of energy, Conventional so urces & Non Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	04	L1,L2
Modules - 3		
Environmental Pollution – Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management.	04	L1,L2
Modules - 4		
Air Pollution & Automobile Pollution: Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods.	04	L1,L2
Modules - 5		
Introduction to GIS & Remote sensing, Applications of GIS & Remote Sensing in Environmental Engineering Practices. Environmental Acts & Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs), Environmental Education & Women Education	04	L1,L2

Course outcomes: After studying this course, students will be able to:
1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment,
3. Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components
4. Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues

Question paper pattern:

Question Paper Pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

The Question paper will have 100 objective questions.

Student will have to answer all the questions in a OMR Sheet.

The Duration of Exam will be 2 hours.

Text Books:
- Benny Joseph (2005), **"Environmental Studies"** , Tata McGraw – Hill Publishing Company Limited.
- S.M. Prakash, **"Environmental Studies",** 3rd Edition, Elite Publishers Mangalore, 2018.
- R Rajagopalan, **"Environmental Studies – From Crisis to Cure** ", Oxford 2005

Aloka Debi, **"Environmental Science and Engineering",** Universities Press (India) Pvt. Ltd. 2012

Reference Books:
1. Raman Sivakumar, **"Principals of Environmental Science and Engineering",** 2nd edition, Cengage learning Singapur, 2005.
2. G.Tyler Miller Jr., **"Environmental Science – working with the Earth"**, Eleventh Edition, Thomson Brooks /Cole, 2006
3. Dr.Pratiba Sing, Dr.AnoopSingh and Dr.Piyush Malaviya, **"Text Book of Environmental and Ecology"** , Acme Learning Pvt. Ltd. New Delhi.
4. P. Meenakshi, **"Elements of Environmental Science and Engineering" ,** Prentice Hall of India Private Limited, New Delhi, 2006

Course Title: DESIGN OF STEEL STRUCTURAL ELEMENTS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	18CV61	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course Objectives: This course will enable students to
1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Module -1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

L1,L2,L3

Module -2

Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip(HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member,
Advantages and Disadvantages of Bolted and Welded Connections.

L1,L2,L3

Module -3

Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

L1,L2,L3

Module -4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Module -5
Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behaviour of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams. Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems] **L1,L2,L3**

Course Outcomes: After studying this course, students will be able to:

1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:
- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:
1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi

Reference Books:
1. Dayarathnam P, "Design of Steel Structures", S Chand and Company Ltd., New Delhi.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau

of Indian Standards, New Delhi.

TITLE OF THE COURSE: APPLIED GEOTECHNICAL ENGINEERING
B.E., VI Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	18CV62	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			

Course objectives: This course will enable students to
1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geotechnology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

Module-1

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

L1,L2,L3

Module-2

Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart Foundation Settlement - Approximate method for stress distribution on a horizontal plane, Types of settlements and importance, Computation of immediate and consolidation settlement

L2,L3,L4

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.
Stability of Slopes : Assumptions, infinite and finite slopes, factor of safety, use of

Taylor's stability charts, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle

L2,L4,L5

Module-4

Bearing Capacity of Shallow Foundation: Types of foundations, **10 Hours**
determination of bearing capacity by Terzaghi's and BIS method (IS: 6403),
Effect of water table and eccentricity, field methods - plate load test and SPT
Proportioning of shallow foundations- isolated and combined footings (only
two columns)

L2,L4,L5,L6

Module-5

Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static formula, efficiency of file group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation)

L1, L2, L3 L4

Course outcomes: On the completion of this course students are expected to attain the following outcomes;
6. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
7. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
8. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
9. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
10. Capable of estimating load carrying capacity of single and group of piles

Text Books:
5. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
6. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
7. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
8. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India

Reference Books:
7. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons
8. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
9. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications
10. Debashis Moitra, "Geotechnical Engineering", Universities Press.,

11. Malcolm D Bolton, "A Guide to soil mechanics", Universities Press.,
12. Bowles J E , Foundation analysis and design, McGraw- Hill Publications

Course Title: HYDROLOGY AND IRRIGATION ENGINEERING				
[As per Choice Based Credit System (CBCS) scheme]				
SEMESTER:VI				
Subject Code		18CV63	IA Marks	40
Number of Lecture Hours/Week		04	Exam Marks	60
Total Number of Lecture Hours		50	Exam Hours	03
		CREDITS – 04	Total Marks-100	

Course Objectives: This course will enable students to;

1. Understand the concept of hydrology and components of hydrologic cycle such as pricipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

Module -1

Hydrology: Introduction, Importance of hydrology, Global and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

L2, L3

Module -2

Losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control
Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation,
Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

L2, L3

Module -3

Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.
Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm

hydrographs, S curve and its computations, Conversion of UH of different durations

L2, L4

Module -4

Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation.

Water Requirements of Crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

L2, L4

Module -5

Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.

Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

L2, L4

Course outcomes: After studying this course, students will be able to:

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.
4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

Program Objectives:

• Engineering knowledge

• Problem analysis

• Interpretation of data

Text Books:

1) K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2) Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
3) Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.

Reference Books:

1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"-. Standard book house, Delhi.

5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi.

Course Title: MATRIX METHOD OF STRUCTURAL ANALYSIS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	18CV641	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to
1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses.
3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.
4. Gain knowledge of solving problems involving temperature changes and lack of fit.

Module -1

Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements

L2, L4,L5

Module -2

Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4,L5

Module -3

Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4,L5

Module -4

Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

L2, L4,L5

Module -5

Direct Stiffness Method: Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses

L2, L4,L5

Course Outcomes: After studying this course, students will be able to:
1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of

direct stiffness method as applied to continuous beams and trusses.
Program Objectives: • Engineering knowledge   • Problem analysis   • Interpretation of data
Text Books: 1. Weaver W and Gere J H, **"Matrix Analysis of Framed Structures"**, CBS publications, New Delhi.   2. Rajasekaran S, **"Computational Structural Mechanics"**, PHI, New Delhi.   3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, **"Matrix and Finite Element Analysis of Structures"**, Ane Books Pvt. Ltd.
Reference Books: **1.** Godbole P N et.al, "Matrix Method of Structural Analysis", PHI ltd, New Delhi.   **2.** Pundit and Gupta, "Theory of Structures Vol II", TMH publications, New Delhi   **3.** A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee.   **4.** Manikaselvam, "Elements of Matrix Analysis and Stability of Structures", Khanna Publishers, New Delhi.   **5.** H C Martin, "Introduction to Matrix Methods in Structural Analysis", International textbook company, McGraw Hill.

Course Title: SOLID WASTE MANAGEMENT			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	**18CV642**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to
1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Module -1

Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.
Collection: Collection of solid waste- services and systems, equipments,
Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.

L1,L2,L3

Module -2

Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control,Mechanical   volume   reduction   (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

L1,L2,L3

Module -3

Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems.
Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill-   Gas and Leachate movement, Control of gas and leachate movement,   Design of sanitary landfill. Numerical Problems

L1,L2,L3

Module -4

 Sources, collection, treatment and disposal of :-
Biomedical waste ,E-waste ,Hazardous waste and construction waste

L1,L2,L3

Module -5

Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolsis ,design criteria for incineration
Energy recovery technique from solid waste management

Course outcomes: After studying this course, students will be able to:
1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd.,

Reference Books:
1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solidwaste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

Course Title: ALTERNATIVE BUILDING MATERIALS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	18CV643	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
	CREDITS –03	**Total Marks- 100**	

Course objectives: This Course will enable students to:
1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

Module -1

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions

L1,L2,L3

Module -2

Elements of Structural Masonry : Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as
per BIS, characteristics and requirements of mortar, selection of mortar.
Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear,   Elastic properties   of   masonry materials and masonry, Design of masonry compression elements subjected to axial load.

L1,L2,L3

Module -3

Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes

L1,L2,L3

Module -4

Alternative Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials   and specifications, Properties, Construction methods, Applications.
Top down construction, Mivan Construction Technique.

Alternative Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes

L1,L2,L3

Module -5

Equipment for Production of Alternative Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Program Objectives:
• Engineering knowledge
• Problem analysis
• Interpretation of data

Text Books:
1. KS Jagadish, BV Venkatarama Reddy and KS Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers

Reference Books:
1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

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Course Title: GROUND IMPROVEMENT TECHNIQUES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VI

</div>

Subject Code	18CV644	IA Marks	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to
1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and Injection.

Module -1

Formation and Development of Ground : Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits;
Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.

Compaction: Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.

L1, L2 , L3

Module -2

Drainage Methods: Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.

Pre-compression and Vertical Drains: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading

L1, L2 , L3

Module -3

Chemical Modification-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.

Chemical Modification-Ii: Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

L2, L3 , L4

Module -4

Vibration Methods: Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibroflotation, sand compaction piles, stone columns, heavy tamping

GROUTING AND INJECTION: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting

L2 , L3, L5

Module -5

Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of

Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,

Miscellaneous Methods (Only Concepts & Uses): Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.

L1 , L3, L5

Course Outcomes: After studying this course, students will be able to:
1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
2. Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", Mc Graw Hill Pub. Co.

Reference Books:
1. Manfred Hausmann , "Engineering principles of ground modification", Mc Graw Hill Pub. Co.,
2. Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London.
3. Nelson J.D. and Miller D.J, "Expansive soils", John Wiley and Sons.
4. Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths

TITLE OF THE COURSE: RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS
B.E., V Semeester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	18CV645	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.

2. Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction

3. Understand various aspects of geometric elements, points and crossings, significance of maintenance of tracks.

4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids

5. Apply design features of tunnels, harbours, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

Module-1

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.

L1,L2

Module-2

Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

L1,L2,L3

Module-3

Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design
Principles – Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works. Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

L2,L3,L4

Module-4
Airport Planning: Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics,and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area. **L3,L4**
Module-5
Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting. **L3,L4,L5,L6**
Course outcomes: After studying this course, students will be able to: 1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway. 2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive. 3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same. 4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.
Text Books: 1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi. 2. Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi. 3. Khanna S K, Arora M G and Jain S S, "Airport Planni ng and Design", Nemchand and Brothers, Roorkee, 4. C Venkatramaiah, " Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press 5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi **Reference Books:** 1. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co., 2. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill 3. Srinivasan R. Harbour, "Dock and Tunnel Engineering ", 26th Edition 2013

TITLE OF THE COURSE: REMOTE SENSING AND GIS			
B.E., VI Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CV651**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**
Credits – 03			

Course Objectives: This course will enable students to
1. Understand the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required units.
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic maps for various applications.

Module-1

Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

L1,L2,L3

Module-2

Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

L2,L3,L4

Module-3

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

L2,L3,L4

Module-4

Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.
L3,L4,L5

Module-5
Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications.
L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Collect data and delineate various elements from the satellite imagery using their spectral signature.

2. Analyze different features of ground information to create raster or vector data.

3. Perform digital classification and create different thematic maps for solving specific problems

4. Make decision based on the GIS analysis on thematic maps.

Text Books:
1. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press 2008.
2. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press 2011
3. Kang – Tsurg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited 2015.
   Lillesand, Kiefer, Chipman, "Remote Sensing and Image Interpretation", Wiley 2011.

Reference Books:
1. Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006
2. John R. Jensen, "Remote sensing of the environment", An earth resources perspective – 2nd edition – by Pearson Education 2007.
3. Anji Reddy M., "Remote sensing and Geograperhical information system", B.S. Publications 2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications 2004.
5. S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005.

TITLE OF THE COURSE: TAFFIC ENGINEERING **B.E., VI Semester, Civil Engineering** **[As per Choice Based Credit System (CBCS) scheme]**			
Course Code	18CV652	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	03
Credits – 03			

Course Objectives: This course will enable students to
1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analysing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
1. Understand and analyse traffic issues including safety, planning, design, operation and control.
2. Apply intelligent transport system and its applications in the present traffic scenario.

Module-1

Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

L1,L2,L3

Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.

L1,L2,L3,L4,L5

Module-3

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks

L1,L2,L3,L4

Module-4
Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport. **L1,L2,L3**

Module-5
Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education. **L1,L2,L3,L4**

Course outcomes: After studying this course, students will be able to:

1. Understand the human factors and vehicular factors in traffic engineering design.
2. Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Text Books:

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning ", Khanna Publishers, Delhi, 2013
2. S K Khanna and CEG Justo and A Veeraragavan, "Highway Engineering", Nem Chand and Bros.
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

Reference Books:

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996
1. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005

TITLE OF THE COURSE: OCCUPATIONAL HEALTH AND SAFETY			
B.E., VI Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			

Course Code	18CV653	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to
1. Gain an historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

L1,L2,L3

Module-2

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations

L2,L3,L4,L5

Module-3

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.
Electrical Safety, Product Safety: Technical Requirements of Product safety.

L2,L3,L4,L5

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

L2,L3,L4,L5

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment

plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Text Books:

1. Goetsch D.L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
2. Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3. "Industrial Safety and Pollution Control Handbook

Reference Books:

1. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
2. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

TITLE OF THE COURSE: SUSTAINABILITY CONCEPTS IN ENGINEERING B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	18CV654	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	03
Credits – 03			

Course Objectives: This course will enable students to
1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frameworks and their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

Module-1

Introduction: Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act

L1,L2,L3

Module-2

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking

L1,L2,L3

Module-3

Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

L1,L2,L3,L4

Module-4

Clean Technology and Energy: Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

L1,L2,L3

Module-5

Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
5. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

Text Books:

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning

Reference Books:

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice
6. Daniel A. Vallero and Chris Brasier, " Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers

Course Title: SOFTWARE APPLICATION LAB			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	18CVL66	IA Marks	40
Number of Lecture Hours/Week	1I+2P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –02		Total Marks- 100	

Course objectives: This course will enable students to

1. Use industry standard software in a professional set up.
2. understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design
3. Develop customized automation tools

Module -1

Use of civil engineering softwares:
Use of softwares for:
   1.   Analysis of plane trusses, continuous beams, portal frames
   2.   3D analysis of multistoried frame structures
 L1,L2,L3

Module -2
1. **Project Management- Exercise on Project planning and scheduling of a building project using any project management software:** a. Understanding basic features of Project management software b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software. c. Identification of Predecessor and Successor activities with constrain d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non Critical paths, Project duration, Floats. e. Study on various View options available f. Basic understanding about Resource Creation and allocation g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project (9hrs) 1. **GIS applications using open source software:** a. To create shape files for point, line and polygon features with a map as reference. b. To create decision maps for specific purpose.   (3hrs) **L1,L2,L3**
Module -3
Use of EXCEL spread sheets: Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation **L1,L2,L3**
Course Outcomes: After studying this course, students will be able to: use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Program Objectives:
  • Engineering knowledge
  • Problem analysis
  • Interpretation of data

Question paper pattern:
  • The question paper will have 3 modules comprising of 6 questions.
  • There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
  • Each full question shall cover the topics as a module
  • Module-1: 40 Marks, Module-2: 20 Marks, Module-3: 20 Marks
  • The students shall answer three full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each

module.
Reference Books: Training manuals and User manuals and Relevant course reference books

Course Title: ENVIRONMENTAL ENGINEERING LABORATORY			
As per Choice Based Credit System (CBCS) scheme			
SEMESTER:VII			
Subject Code	18CVL67	IA Marks	40
Number of Lecture Hours/Week	1I+2P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS –02	Total Marks- 100	

Course objectives: This course will enable students,

4. To learn different methods of water & waste water quality
5. To conduct experiments to determine the concentrations of water and waste water
6. To determine the degree and type of treatment
7. To understand the environmental significance and application in environmental engineering practice

Revised Bloom's Taxonomy (RBT) Level	L1,L2,L3
1. Determination of pH, Acidity and Alkalinity	
2. Determination of Calcium, Magnesium and Total Hardness.	
3. Determination of Dissolved Oxygen. 4. Determination of BOD.	
5. Determination of Chlorides	
6. Determination of percentage of available chlorine in bleaching powder, 7. Determination of Residual Chlorine	

8. Determination of Solids in Sewage:
    I)   Total Solids,
    II)   Suspended Solids,
    III)   Dissolved Solids,
    IV)   Volatile Solids, Fixed Solids,
    V)   Settle able Solids.
 9. Determination of Turbidity by Nephelometer
 10. Determination of Optimum Dosage of Alum using Jar test apparatus.	

11. Determination of sodium and potassium using flame photometer.	
12. Determination Nitrates by spectrophotometer. 13. Determination of Iron & Manganese.	
14. Determination of COD. (Demonstration)	
15. Air Quality Monitoring (Ambient, stack monitoring , Indoor air pollution) (Demonstration)	
16. Determination of Sound by Sound level meter at different location(Demonstration)	

Course Outcomes: After studying this course, students will be able to:

1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.
3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental

stream.
Program Objectives:
1. Evaluation of the test results and assesses the impact on water and waste water treatment.
2. Train student to undertake student project work in 8th semester in the field of environmental engineering.
Question paper pattern:
1. Two experiments shall be asked from the above set
2. One experiment to be conducted and for the other student should write detailed procedure.
Reference Books:
1. Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal
2. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science" , McGraw-Hill Series in Civil and Environmental Engineering

Course Title: EXTENSIVE SURVEY PROJECT /CAMP			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	18CVEP68	**IA Marks**	40
Number of Practice Hours/Week	04	**Exam Marks**	60
Total Number of Practice Hours	50	**Exam Hours**	03
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to
1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

3. **NEW TANK PROJECTS:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design and preparation of drawing with report.

4. **WATER SUPPLY AND SANITARY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparation of village map by using total station.
   d. Survey work required for laying of water supply and UGD
   e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   f. Design of all elements and preparation of drawing with report.

5.	**HIGHWAY PROJECT:** The work shall consist of;
	a. Reconnaissance survey for selection of site and conceptualization of project.
	b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
	c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
	d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.
6.	**RESTORATION OF AN EXISTING TANK:** The work shall consist of;
	a. Reconnaissance survey for selection of site and conceptualization of project.
	b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
	c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
	d. Design of all elements and preparation of drawing with report.
7.	**TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of;
	a. Reconnaissance survey for selection of site and conceptualization of project.
	b. Detailed survey required for project execution like contour surveys
	c. Preparation of layout plans as per regulations
	e. Centerline marking-transfer of centre lines from plan to ground
	f. Design of all elements and preparation of drawing with report as per regulations

Course outcomes: After studying this course, students will be able to:
1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general
5. Establishing trust based relationships in teams & organizational environment
6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Reference Books:
Training manuals and User manuals
Relevant course reference books

Course Title: QUANTITY SURVEYING AND CONTRACTS MANAGEMENT				
As per Choice Based Credit System (CBCS) scheme				
SEMESTER:VIII				
Subject Code	18CV71		**IA Marks**	40
Number of Lecture Hours/Week	04		**Exam Marks**	60
Total Number of Lecture Hours	50		**Exam Hours**	03
		CREDITS –03	**Total Marks- 100**	

Course objectives: This course will enable students to;
1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project
2. Understand and apply the concept of Valuation for Properties
3. Understand, Apply and Create the Tender and Contract document.

Module -1

Quantity Estimation for Building; study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method.
Estimate of R.C.C structures including Slab, beam, column, footings, with bar bending schedule.

L2,L3

Module -2

Estimate of Steel truss, manhole and septic tanks.
Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads.

L1,L2,L3

Module -3

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings,
Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost
 Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

L1,L2,L3

Module-4

Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).
Law of Contract as per Indian Contract act 1872 , Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub

Contracting.

Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC

L1,L2,L3

Module -5

Contract Management-Post award : Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, **Disputes & its resolution mechanism,** Contract management and administration

Valuation: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation, valuation for mortgage, valuation of land.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
1. Prepare detailed and abstract estimates for roads and building.
2. Prepare valuation reports of buildings.
3. Interpret Contract document's of domestic and international construction works

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi
2. B.S. Patil, " Civil Engineering Contracts and Estimates",   Universities Press
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi

Reference Books:
1. Kohli D.D and Kohli R.C, " Estimating and Costing",12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, " Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi
7. David Pratt , " Fundamentals of Construction Estimating" – 3ed ,
8. PWD Data Book ,CPWD Schedule of Rates (SoR). and NH SoR – Karnataka
9. FIDIC Contract forms
10. B.S. Ramaswamy " Contracts and their Management" 3ed , Lexis Nexis (a division of Reed Elsevier India Pvt Ltd)

Course Title: DESIGN OF RCC AND STEEL STRUCTURAL ELEMENTS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	18CV72	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to

6. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
7. Identify, formulate and solve engineering problems in RC and Steel Structures
8. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
9. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
10. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

 Footings: Design of rectangular slab type combined footing.

Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.

Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base).

Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV)**

Design of portal frames with fixed and hinged based supports.

L1,L2,L3

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.

Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks

Gantry Girder: Design of gantry girder with all necessary checks

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

6. Students will acquire the basic knowledge in design of RCC and Steel Structures.
7. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Program Objectives:

• Engineering knowledge
• Problem analysis
• Interpretation of data

Question Paper Pattern:

• Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
• One full question should be answered from each module.
• Each question carries 40 marks.

3. Code books – IS 456, IS 800, IS 3370 (Part IV), SP (6) – Steel Tables, shall be referred for designing
4. The above charts shall be provided during examinations

Text Books:

4. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
5. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
6. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:

1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behaviour"**, Pearson Publications
2. Nether Cot, et.al, **"Behaviour and Design of Steel Structures to EC -III"**, CRC Press
3. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
4. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

TITLE OF THE COURSE: THEORY OF ELASTICITY **B.E., VII Semester, Civil Engineering** **[As per Choice Based Credit System (CBCS) scheme]**			
Course Code	18CV731	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	03
Credits – 03			

Course Objectives: This course will enable students to
3. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials into more general, two and three-dimensional problems.
4. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
5. Introduction to the stress – strain relationship, basic principles and mathematical expressions involved in continuum mechanics. also solution of problems in 2- dimensional linear elasticity

Module-1

Concepts of continuum, Stress at a point, Components of stress, Differential equations of equilibrium, Stress transformation, Principal stresses, Maximum shear stress, Stress invariants.

Strain at a point, Infinitesimal strain, Strain-displacement relations, Components of strain, Compatibility Equations, Strain transformation, Principal strains, Strain invariants, Measurement of surface strains, strain rosettes

L1,L2,L3

Module-2

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only).

L1,L2,L3

Module-3

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only). equations of equilibrium, compatibility equation, stress function.

L3,L4

Module-4

Axisymmetric stress distribution - Rotating discs, Lame's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

L3,L4

Module-5
Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections **L3,L4**

Course outcomes: After studying this course, students will be able to:

1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum
2. Ability to formulate boundary value problems; and calculate stresses and strains
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints;
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

Text Books:
1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publish ers, 2012
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford & IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003

Reference Books:
2. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York, 1953
3. G. W. Housner and T. Vreeland, Jr., "The Analysis o f Stress and Deformation", California Institute of Tech., CA, 2012. [Download as per user policy from http://resolver.caltech.edu/CaltechBOOK:1965.001]
4. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", Prentice Hall, 2003.
5. Abdel-Rahman Ragab and Salah Eldinin Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press,1998

TITLE OF THE COURSE: AIR POLLUTION AND CONTROL			
B.E., VII Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	18CV731	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	03
Credits – 03			

Course Objectives: This course will enable students to
1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

Module-1

Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

L1,L2

Module-2

Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model

L1,L2,L3

Module-3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)

L2,L3,L4

Module-4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP.

L3,L4

Module-5

Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards. Environmental issues, global episodes, laws, acts, protocols

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:
1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air

quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Text Books:
1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication.
2. H. C. Perkins, "Air pollution". Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell, "Introduction t o Environmental Engineering" McGraw-Hill Co.

Reference Books:
1. Noel De Nevers, "Air Pollution Control Engineering" , Waveland Pr Inc.
2. Anjaneyulu Y, "Text book of Air Pollution and Contr ol Technologies", Allied Publishers

Course Title: GROUND WATER & HYDRAULICS				
[As per Choice Based Credit System (CBCS) scheme]				
SEMESTER:VII				
Subject Code	**18CV734**		**IA Marks**	**40**
Number of Lecture Hours/Week	**03**		**Exam Marks**	**60**
Total Number of Lecture Hours	**40**		**Exam Hours**	**03**
	CREDITS – 03		**Total Marks-100**	

Course objectives: This course will enable students

- To characterize the properties of ground water and aquifers.

- To quantify the ground water flow.

- To locate occurrence of ground water and augment ground water resources.

- To synthesize ground water development methods.

Module -1

Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.

L1, L2

Module -2

Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, unisotropic layered soils, steady one dimensional flow: cases with recharge.

L2, L3

Module -3

Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory.

L2, L3, L4

Module -4

Ground Water Exploration: Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.

L2, L3

Module -5

Ground Water Development: Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.

Ground Water Recharge: Artificial recharge, groundwater runoff

L2, L3

Course outcomes: After studying this course, students will be able to:

1. Find the characteristics of aquifers.
2. Estimate the quantity of ground water by various methods.
3. Locate the zones of ground water resources.
4. Select particular type of well and augment the ground water storage.

Program Objectives:

3. Engineering knowledge
4. Problem analysis
5. Interpretation of data

Text Books:

1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.

Reference Books:

1. Garg Satya Prakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

TITLE OF THE COURSE: MASONRY STRUCTURES			
B.E., VII Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			

Course Code	18CV735	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Module-1

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties o f mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

L1,L2,L3

Module-2

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

L1,L2,L3

Module-3

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

L1,L2,L3

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls,

solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

L2,L3,L4,L5

Module-5

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.

Introduction to reinforced brick masonry, lintels and slabs.

In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

L2,L3,L4,L5

Course outcomes: After studying this course, students will be able to:

1. Explain engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.

2. Summarize various formulae's for finding compressive strength of masonry units.

3. Explain permissible stresses and design criteria as per IS: 1905 and SP-20.

4. Design different types of masonry walls for different load considerations.

Text Books:

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd., 1990.

2. Dayaratnam P, "Brick and Reinforced Brick Structures", Oxford & IBH, 1987.

3. M. L. Gambhir, "Building and Construction Materials", Mc Graw Hill education Pvt. Ltd.

Reference Books:

1. IS 1905–1987 "Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi.

2. SP 20 (S&T) – 1991, "Hand book on masonry design and construction (1st revision) BIS, New Delhi.

Course Title: EARTHQUAKE ENGINEERING
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	**18CV741**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**

Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS –03	Total Marks-	100

Course Objectives: This course will enable students to learn about

1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Module -1

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake)

L1,L2,L3

Module -2

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

L1,L2,L3

Module -3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

L1,L2,L3

Module -4

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

L2,L3,L4

Module -5

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per

IS-13920. Retrofitting of RC buildings

Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

L2,L3,L4

Course outcomes: After studying this course, students will be able to:

5. Acquire basic knowledge of engineering seismology

6. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.

7. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios

8. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.

9. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry structures thorough exposure to different IS-codes of practices.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
- Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
- S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
- Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
- T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

Reference Books:
1. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

Course Title: DESIGN CONCEPT OF BUILDING SERVICES			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	**18CV742**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks- 100**	

Course Objectives: This course will enable students to
4. learn the importance of sanitation, domestic water supply, plumbing and fire services
5. Understand the concepts of heat, ventilation and air conditioning
6. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply, Drainage and Solid Waste Disposal:
Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps – quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit

Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers

Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods

L1,L2

Module -2

Heat Ventilation and Air Conditioning (HVAC):
Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

L1,L2

Module -3

Electrical and Fire Fighting Services:
Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires,
Wiring systems and their choice , planning electrical wiring for building, Main and distribution boards, Principles of illumination,

Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of

materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc.
Provisions of NBC.

L1,L2,L3

Module -4

Plumbing and Fire Fighting Layout of Simple Buildings:
Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

L2,L3

Module -5

Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.
Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift
codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,

Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
5. Describe the basics of house plumbing and waste water collection and disposal.
6. Discuss the safety and guidelines with respect to fire safety.
7. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
8. Understand and implement the requirements of thermal comfort in buildings

Program Objectives:
4. Engineering knowledge
5. Problem analysis
6. Interpretation of data

Reference Books:

1. National Building Code
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & DL Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
4. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
5. M.David Egan, Concepts in Building Fire Safety.
6. O.H.Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom
7. V.K.Jain, Fire Safety In Building 2edition, New Age International Publishers
8. E.G.Butcher, Smoke control in Fire-safety Design.

9. E.R.Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York
10. Handbook for Building Engineers in Metric systems, NBC, New Delhi

Course Title: REINFORCED EARTH STRUCTURES				
As per Choice Based Credit System (CBCS) scheme]				
SEMESTER:VII				
Subject Code	18CV743	**IA Marks**		40
Number of Lecture Hours/Week	03	**Exam Marks**		60
Total Number of Lecture Hours	40	**Exam Hours**		03
CREDITS –03		**Total Marks- 100**		

Course Objectives: This course will enable students to;
1. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module -1

  Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics

Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties

L1,L2,L3

Module -2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken

L1,L2,L3,L4

Module -3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

L2,L3,L4

Module -4

Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes

L2,L3,L4

Module -5

GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability (No Numerical Problems)

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems)

L2,L3,L4

Course outcomes: After studying this course, students will be able to:
1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geosynthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geosynthetics in drainage requirements and landfill designs

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Koerner. R.M, "Design with Geosynthetics", Prince Hall Publications
2. Koerner. R.M. & Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York,.
3. SivakumarBabu G. L., "An introduction to Soil Reinforcement and Geosynthetics", Universities Press, Hyderabad
4. Swami Saran, "Reinforced Soil and its Engineering Applications", I. K. International Pvt. Ltd, New Delhi
5. Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, "Engineering with Geosynthetics", Tata McGraw Hill publishing Company Limited., New Delhi.

Reference Books:
1. Jones, "Earth reinforcement and Soil structure", CJEP Butterworths, London
2. Ingold, T.S. & Millar, K.S, "Geotextile Hand Book", Thomas, Telford, London.
3. Hidetoshi Octial, Shigenori Hayshi& Jen Otani, "Earth Reinforcement Practices",Vol. I, A.A. Balkema, Rotterdam
4. Bell F.G, "Ground Engineer's reference Book", Butterworths, London
5. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.
6. Sarsby R W- Editor, "Geosynthetics in Civil Engineering", Woodhead Publishing Ltd & CRC Press, 2007

Course Title: URBAN TRANSPORT PLANNING			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	18CV745	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

3. Understand and apply basic concepts and methods of urban transportation planning.
4. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
5. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
6. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

Module -1

Urban transport planning: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

L1,L2,L3

Module -2

Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

L1,L2,L3

Module -3

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above**

L3,L4

Module -4

Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above**

L2,L3,L4,L5

Module -5

Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Introduction to land use planning models, land use and transportation interaction.

Course outcomes: After studying this course, students will be able to:

5. Design, conduct and administer surveys to provide the data required for transportation planning.
6. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
7. Develop and calibrate modal split, trip generation rates for specific types of land use developments.

8. Adopt the steps that are necessary to complete a long-term transportation plan.

Program Objectives:

5. Engineering knowledge
6. Problem analysis
7. Interpretation of data

Text Books:

- Kadiyali.L.R., 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi.
- Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
- Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
- Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

Reference Books:

1. Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
2. Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
3. Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

Course Title: FINITE ELEMENT METHOD				
As per Choice Based Credit System (CBCS) scheme]				
SEMESTER:VI				
Subject Code	18CV751		**IA Marks**	40
Number of Lecture Hours/Week	03		**Exam Marks**	60
Total Number of Lecture Hours	40		**Exam Hours**	03
CREDITS –03			**Total Marks- 100**	

Course objectives: This course will enable students to;

6. Develop analytical skills.
7. Learn principles of analysis of stress and strain.
8. Develop problem solving skills.
9. Understand the principles of FEM for one and two dimensional problems.

Module -1

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions

L1,L2

Module -2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates , Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples

L1,L2

Module -3

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisymmetric Element

L1,L2,L3

Module -4

Isoparametric concepts; isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems

L1,L2,L3

Module -5

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.
Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

L1,L2,L3

Course outcomes: The student will have the knowledge on advanced methods of analysis of structures

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

6. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill
7. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
8. Cook R D et.al., "Concepts and applications of Finite Element analysis ", John Wiley

Reference Books:
1. Daryl L Logan," A first course on Finite element Method " , Cengage Learning
2. Bathe K J - " Finite Element Procedures in Engineering analysis "- Prentice Hall

| Course Title: NUMERICAL METHODS AND APPLICATIONS || As per Choice Based Credit System (CBCS) scheme] || SEMESTER:VII ||||

<table>
<tr><td colspan="4" align="center">Course Title: NUMERICAL METHODS AND APPLICATIONS
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII</td></tr>
<tr><td>Subject Code</td><td>18CV752</td><td>IA Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="2" align="center">CREDITS –03</td><td>Total Marks-</td><td>100</td></tr>
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Course objectives: This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

Module -1

Solution of Equations and Eigen value Problems: Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method

L1,L2,L3

Module -2

Interpolation and Approximation: Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

L1,L2,L3

Module -3

Numerical Differentiation and Integration: Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

L1,L2,L3

Module -4

Initial Value Problems for Ordinary Differential Equations : Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

L1,L2,L3

Module -5

Boundary Value Problems in Ordinary and Partial Differential Equations:
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

L1,L2,L3

Course Outcomes: After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from
Industry, management and other engineering fields.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna
   Publishers, 9th Edition, New Delhi
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi

Reference Books:
5. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi
6. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi
7. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi

ENVIRONMENTAL PROTECTION AND MANAGEMENT			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER:VII			
Subject Code	18CV753	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to gain knowledge in Environmental protection and Management systems

Module -1   Environmental Management Standards

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.
L1,L2,L3

Module -2 Environmental Management Objectives

Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies
L1,L2,L3

Module -3 Environmental Management System

EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.
L1,L2,L3

Module -4 Environmental Audit

  Environmental management system audits   as per ISO 19011-   – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit
L1,L2,L3

Module -5 Applications

Applications of EMS, Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, , Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.
L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards
2. Lead pollution prevention assessment team and implement waste minimization options
3. Develop, Implement, maintain and Audit Environmental Management systems for Organisations

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Reference Books:

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice", McGraw- Hill International, Boston,2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

Course Title: COMPUTER AIDED DETAILING OF STRUCTURES			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	18CVL76	IA Marks	40
Number of Lecture Hours/Week	03 (1I+2D)	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS –02	Total Marks- 100	

Course objectives: This course will enable students to
- Be aware of the Scale Factors, Sections of drawings,
- Draft the detailing of RC and Steel Structural member.

RBT LEVEL   L1,L2,L3

Module -1 Detailing of RCC Structures

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Beams with Bolted and Welded
6. Gantry Girder

Course outcomes: After studying this course, students will be able to:
4. Prepare detailed working drawings

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:
8. Two questions shall be asked from each Module.
9. One full question should be answered from each Module.
10.   Each question carries 40 marks.

Text Books:
e. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
f. Krishna Murthy, "Structural Design and Drawing – Concrete Structures"¸ CBS Publishers, New Delhi

Reference Books:
g. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards
h. IS 13920:2016,Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard

TITLE OF THE COURSE: GEOTECHNICAL ENGINEERING LAB **B.E., VII Semester, Civil Engineering** **[As per Choice Based Credit System (CBCS) scheme]**			
Course Code	**18CVL77**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT LEVEL L1,L2			
Credits – 02			

Course Objectives: This course will enable students to;

1. To carry out laboratory tests and to identify soil as per IS codal procedures

2. To perform laboratory tests to determine index properties of soil

3. To perform tests to determine shear strength and consolidation characteristics of soils

Modules

1. Visual soil classification. Water content determination by oven drying method and infrared moisture method. Specific gravity test (pycnometer and density bottle method).

2. Grain size analysis
   i. Sieve analysis
   ii. Hydrometer analysis

3. In-situ density tests
   i. Core-cutter method
   ii. Sand replacement method

4. Consistency limits
   i. Liquid limit test (by Casagrande's and cone penetration method)
   ii. Plastic limit test
   iii. Shrinkage limit test

5. Standard compaction test (light and heavy compaction)

6. Co-efficient of permeability test
   i. Constant head test
   ii. Variable head test

7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (undrained unconsolidated)

8. Consolidation test : Determination of compression index and co- efficient of consolidation

9. Laboratory vane shear test

10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

Course outcomes: Students will be able to conduct appropriate laboratory/field

experiments and interpret the results to determine

1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shear strength and consolidation parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics (SPT- Demonstration)

Question paper pattern:

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:

1. Punmia B C, Soil Mechanics and Foundation Engineering- (2017), 16th Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4. Bowles J.E., "Engineering Properties of Soil and Their Measurements",- McGraw Hill Book Co. New York.
5. Relevant BIS Codes of Practice: 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 1 0) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1 966, IS 2720 (Part-60) 1965.

Course Title: DESIGN OF PRE STRESSED CONCRETE			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	18CV81	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to learn Design of Pre Stressed Concrete Elements

Module -1

Introduction and Analysis of Members: Concept of Prestressing - Types of Prestressing - Advantages - Limitations –Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.

Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete - prestressed concrete - Force concept - Load balancing concept - Kern point -Pressure line.

L1,L2

Module -2

Losses in Prestress: Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.

Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

L1,L2

Module -3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members

L1,L2,L3

Module -4

Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

L1,L2,L3

Module -5

Composite Sections: Types of composite construction - Analysis of composite sections - Deflection –Flexural and shear strength of composite sections.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
8. Understand the requirement of PSC members for present scenario.
9. Analyse the stresses encountered in PSC element during transfer and at working.
10. Understand the effectiveness of the design of PSC after studying losses
11. Capable of analyzing the PSC element and finding its efficiency.
12. Design PSC beam for different requirements.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
5. Krishna Raju, N. "Prestressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006
6. Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt.Ltd., New Delhi.
7. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi

Reference Books:
7. Praveen Nagarajan, "Advanced Concrete Design", Person
8. P. Dayaratnam, "Prestressed Concrete Structures", Oxford & IBH-Pubs Company, Delhi, 5th Edition
9. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York
10. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi
11. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
12. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi

Course Title: BRIDGE ENGINEERING			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	18CV821	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
		CREDITS –03	Total Marks- 100

Course objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Module -1

Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth

Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

L1,L2

Module -2

Design of Slab Bridges: Straight and skew slab bridges

L2,L3

Module -3

Design of T beam bridges(up to three girder only)

Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

L2,L3,L4

Module -4

Other Bridges:

Design of Box culvert (Single vent only)

Design of Pipe culverts

L2,L3,L4

Module -5

Substructures - Design of Piers and abutments,

Introduction to Bridge bearings, Hinges and Expansion joints.(No design)

L2,L3,L4

Course outcomes: After studying this course, students will be able to:
1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints and
5. Design Piers and abutments.

Program Objectives:
1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:
1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.

2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

Reference Books:
5. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2., Nem Chand Brothers.
6. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
7. "Concrete Bridges", The Concrete Association of India

Course Title: PREFABRICATED STRUCTURES				
As per Choice Based Credit System (CBCS) scheme				
SEMESTER:VIII				
Subject Code	18CV822	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to
5. Understand modular construction, industrialised construction
6. Design prefabricated elements
7. Understand construction methods.

Module -1

Introduction: Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.

L1,L2

Module -2

Prefabricated Components: Behaviour of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels
–Columns–Shear walls

L1,L2

Module -3

Design Principles: Disuniting of structures-Design of cross section based on efficiency of material used–Problems in design because of joint flexibility
–Allowance for joint deformation.

L2,L3

Module -4

Joint In Structural Members: Joints for different structural connections–Dimensions and detailing–Design of expansion joints

L1,L2,L3

Module -5

Design For Abnormal Loads: Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Use modular construction, industrialised construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
4. CBRI, Building materials and components, India, 1990
5. Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

Reference Books:
- Koncz T.,"Manual of precast concrete construction", Vol.I, II and III, Bauverlag, GMBH,1976.
- "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

Course Title: ADVANCED FOUNDATION DESIGN			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	18CV823	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
	CREDITS –03	**Total Marks-**	**100**

Course objectives: This course will enable students to

9. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course (15CV53)
10. Develop profound understanding of shallow and deep foundation analyses
11. Develop understanding of choice of foundation design parameters
12. Learn about cause and effect of dynamic loads on foundation

Module -1

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

L1,L2

Module -2

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure

L2,L3

Module -3

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

L1,L2,L3

Module -4

Well Foundations: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.
Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

L1,L2,L3

Module -5

Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

7. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.

8. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles

9. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons

10. Understand basics of analysis and design principles of machine foundations

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., India
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

Reference Books:
1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India
4. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

Course Title: REHABILITATION AND RETROFITTING As per Choice Based Credit System (CBCS) scheme SEMESTER:VIII			
Subject Code	**18CV824**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;
- Investigate the cause of deterioration of concrete structures.
- Strategies different repair and rehabilitation of structures.
- Evaluate the performance of the materials for repair

Module -1

General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

L1,L2

Module -2

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems

L1,L2

Module -3

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

L1,L2,L3

Module -4

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

L1,L2,L3

Module -5

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
6. Understand the cause of deterioration of concrete structures.
7. Able to assess the damage for different type of structures
8. Summarize the principles of repair and rehabilitation of structures
9. Recognize ideal material for different repair and retrofitting technique

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

3. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
4. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.

Reference Books:

1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Course Title: PAVEMENT DESIGN			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	18CV825	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS –03	Total Marks-	100

Course objectives: This course will enable students to
1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

Module -1

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above

L2, L3,L4

Module -2

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above

L5,L6

Module -3

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflectometer, GPR method. Design factors for runway pavements, Design methods for
Airfield pavement and problems on above

L4,L5

Module -4

Stresses in Rigid Pavement : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars,

Design factors for Runway pavements, Design methods for airfield pavements, problems of the above

L4,L5,L6

Module -5

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of subgrade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints

L4,L5

Course outcomes: After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, burmister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky

Reference Books:
1. Yoder & wit zorac , "Principles of pavement design", John Wiley & Sons.
2. Subha Rao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design" , University Press.
4. Relevant recent IRC codes

Course Title: INTERNSHIP /PROFESSIONAL PRACTICE			
As per Choice Based Credit System (CBCS) scheme			
SEMESTER:VIII			
Subject Code	18CV185	**IA Marks**	40
Number of Lecture Hours/Week	Industry Oriented	**Exam Marks**	60
Total Number of Lecture Hours	Industry Oriented	**Exam Hours**	03
	CREDITS –02	**Total Marks-**	100

Course objectives: This course will enable students to get the field exposure and experience

Note: Internship /Professional Practice:

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organisations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.

2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions

3. The industry/organisation should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.

4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.

5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by

university and internship guide from the institute.

6. The College shall facilitate and monitor the student internship program.

7. The internship should be completed during vacation after VI and VII semesters.

Group No	Course Code	Course Title
1	20CSE13	Advanced Design of RC Structures.
1	20CGT12	Sub-surface Investigations and Ground Improvement Techniques
1	20CWM13	Advanced Waste Water Treatment Engineering
1	20CEE14	Solid Waste Engineering and Management
1	20WRM13	Water Resources System Planning and Management
1	20CCT12	Construction Project and Managements
1	20CEM14	Construction Equipments and Management
1	20CIM15	Advances in Pre-stressed Concrete
1	20CTE13	Pavement Materials
1	20CHT15	Traffic Engineering and Management
1	20CTM11	Applied Statistics for Highway Engineering
1	20CSE14	Mechanics of Deformable Bodies
1	20CCS23	Structural Stability Analysis Classical & FE Approach
1	20CCS334	Green Building Technology
1	20WLM12	Surface Water Hydrology

Group No	Course Code	Course Title
2	20CSE15	Structural Dynamics
2	20CGT11	Forensic Geotechnical Engineering
2	20CWM12	Water Pollution & Treatment Technology
2	20CEE22	Atmospheric Environmental Pollution and Control
2	20WRM14	Open Channel Hydraulics
2	20CCT14	Advanced Construction Materials and Green Buildings
2	20CEM243	Disaster Mitigation & Management
2	20CIM23	Pre-fabricated Structures
2	20CTE15	Urban Transport Planning
2	20CHT23	Pavement Management System
2	20CTM14	Soil Mechanics for Highway Engineers
2	20CSE22	Finite Element Method of Analysis
2	20CCS244	Structural Health Monitoring
2	20CSE331	Fracture Mechanics Applied to Structural Engineering
2	20CTE23	Geometric Design of Transportation Facilities

Group No	Course Code	Course Title
3	20CSE21	Advanced Design of Steel Structures
3	20CGT21	Reinforced Soil Structures
3	20CWM14	Environmental Pollution and Control Management
3	20CEE241	Environmental Geo Technology
3	20WRM23	Watershed Conservation Management
3	20CCT15	Mechanization in Construction
3	20CEM244	Urban Hydrology, Storm Drainage and Management
3	20CIM241	Construction Equipment and Safety Management
3	20CTE21	Pavement Design and Analysis
3	20CHT242	Design of Bridge and Grade Separated Structures
3	20CTM241	Transportation Infrastructure Design
3	20CSE242	Design of Precaste and Composite Structures
3	20CCS253	Composite and Smart Materials
3	20CSE31	Design of Bridges
3	20WLM22	Ground Water Hydrology

4	20CSE23	Earthquake Resistant Structures
4	20CGT22	Soil Dynamics
4	20CWM22	Industrial Effluent Treatment and Engineering
4	20CEE31	Environmental Impact Assessment
4	20WRM252	Climate Change and Adaption
4	20CCT21	Construction Economics and Finance
4	20CTM324	Railway Infrastructure Planning & Designing
4	20CIM243	Ground Improvement Techniques
4	20CTE31	Pavement Construction Technology
4	20CHT254	Low Volume Roads Engineering
4	20CTM31	Road Asset Management
4	20CSE251	Design of Industrial Structures
4	20CCS321	Structural Optimization – Theory and Computations
4	20CCT251	Building Cost and Quality Management
4	20WLM251	Irrigation Technology and Irrigation Water Management

5	20CSE243	Advanced Concrete Technology
5	20CGT23	Design of Deep Foundations
5	20CWM241	Occupational Safety and Health Management
5	20CEE242	Risk Assessment and Hazardous Waste Management
5	20WRM31	Sediment Transport
5	20CCT22	Pre Engineered Construction Technology
5	20CEM31	Construction Quality and Safety Management
5	20CIM332	Building Services and Maintenance
5	20CTE322	Intelligent Transportation System
5	20CHT31	Construction Planning & Economics
5	20CTM321	Road Safety and Management
5	20CSE252	Advances in Artificial Intelligence
5	20CCS331	Design of Stack, Tower and Water Storage Structural Systems
5	20CCT331	Energy and Buildings
5	20WLM333	Global Warming and Climate change

6	20CSE332	Design of Masonry Structures
6	20CGT254	Soil Structure Interaction
6	20CWM243	Aquatic Chemistry and Microbiology
6	20CEE251	Water Resource Engineering and Applied Hydraulics
6	20WRM322	Water Power and Dam Engineering
6	20CCT31	Construction Contracts, Specification and Estimation
6	20CEM241	Infrastructure for Smart City Planning
6	20CIM334	Construction and Demolition Waste Management
6	20CTE333	Pavement Evaluation and Management
6	20CHT323	Special Problems in Road Construction
6	20CTM333	Remote Sensing and GIS in Transport Planning
6	20CSE254	Design of Tall Structures.
6	20CCS12	Computational Structural Mechanics- Classical & FE Approach
6	20CTM22	Advanced Traffic Engineering

Visvesvaraya Technological University, Belagavi.

Ph.D. Coursework Courses – 2020 in Civil Engineering.

(Group-1): 20CSE13	ADVANCED DESIGN OF RC STRUCTURES

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

- Design of R C slabs by yield line method
- Design of flat slabs

Module-2

- Design of grid or coffered floors
- Design of continuous beams with redistribution of moments

Module-3

. Design of R C Chimneys

Module-4

- Design of R C silos
- Design of R C bunkers

Module-5

Formwork:

Introduction, Requirements of good formwork, Materials for forms, choice of formwork, Loads on formwork, Permissible stresses for timber, Design of formwork, Shuttering for columns, Shuttering for slabs and beams, Erection of Formwork, Action prior to and during concreting, Striking of forms. Recent developments in form work.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Unified Theory of Concrete Structures	Hsu T. T. C. and Mo Y. L.	John Wiley & Sons	2010
2	Limit design of reinforced concrete structures	Krishnamurthy, K.T., Gharpure S.C. and A.B. Kulkarni	Khanna Publishers	1985
3	Reinforced Concrete Design	Lin T Y and Burns N H	Wiley	2004
4	Reinforced Concrete Structures	Park & Paunlay	Wiley	2004
5	Comprehensive RCC Design	Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain	Laxmi Publications, New Delhi	
6	Reinforced Concrete Structural Elements: Behaviour Analysis and Design	Purushothaman. P.	Tata McGraw-Hill	1986
7	Fundamentals of Reinforced Concrete	Sinha. N.C. and Roy S.K.	S. Chand and Company Limited, New Delhi	2003
8	Reinforced concrete Design	Unnikrishna Pillai and Devdas Menon	Tata McGraw Hill Publishers Company Ltd., New Delhi	2006
9	Limit State Design of Reinforced Concrete	Varghese P.C.	Prentice Hall of India	2007
10	Advanced Reinforced Concrete Design	Varghese P.C.	Prentice Hall of India, New Delhi	2000
11	Advanced Reinforced Concrete Design	Krishna Raju. N.	CBS Publishers & Distributors	
12	Reinforced Concrete Design	Pillai S. U. and Menon D.	Tata McGraw-Hill, 3rd Ed	1999
13	Relevant IS Code Books			
14	Reinforced Concrete, Vol-1 and Vol-2	Shah H. J	Charotar	8th Edition–2009 and 6th Edition–2012
	Design of Reinforced Concrete Structures	Gambhir M. L	PHI Pvt. Ltd, New Delhi	2008

(Group-1): 20CGT12	SUB-SURFACE INVESTIGATIONS AND GROUND IMPROVEMENT TECHNIQUES
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

SITE INVESTIGATION:
Planning and experimental programme, investigations, exploration for preliminary design, exploration for detailed design, Geo-physical explorations, soundings, probings, boring, boring methods, excavation methods for explorations, ground water investigations, rock boring, miscellaneous exploratory techniques. Numerical problems

Module-2

SAMPLING AND IN-SITU FIELD TESTS: Types of samples, samplers, preservation, shipment and storage of samples, bore log, pore pressure measurements, core recovery, rock strength, rock quality designation
In-situ field testing and laboratory investigation of soils and rock, measurement techniques: SPT, SCPT, DCPT, pressure meter, dilatometer, plate load test. Numerical problems.

Module-3

DATA INTERPRETATION: Data interpretation for determination of engineering properties of soils and their application to geotechnical design, preparation of site investigation reports

Module-4

SITE IMPROVEMENT: General methods of stabilization – shallow and deep, factors governing suitable method, compaction.
Drainage: soil and filter permeability, filter criteria, drainage layout and pumping system, Pre-compression and consolidation: principles, sand drains, pore pressure distribution, electro-osmotic and chemical osmotic consolidation. Numerical problems

Module-5

STABILIZATION: Mechanical stabilization, lime, cement, bitumen, chemical etc. Grouting: Injection and principles, grouting pressure criteria, grouting equipment, injection chemicals,
Thermal methods: heating and cooling effects on soils, equipment, Miscellaneous: moisture barriers and preventing techniques

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Engineering Principles of Ground Modifications	Hausmann	McGraw Hill	
2	Foundation Analysis and Design	J E Bowles	Tata McGraw Hill	
3	Subsurface Exploration and Sampling of Soils for Civil Engg. Purposes	Hvorslev M J		
4	Ground Improvement Techniques	P. Purushotham Raj		
5	Foundation Engineering	S P Brahma		
6	Soil Mechanics	T.W. Lambe and R.V. Whitman	John Wiley & Sons	1969
7	Geotechnical Engineering	Donold P	Coduto Phi Learning Private Limited, New Delhi	
8	Geotechnical Engineering	Shashi K. Gulathi & Manoj Datta. (4009)	Tata Mc Graw Hill	
9	Soil Mechanics and Foundation Engg	Muni Budhu (4010), 3rd Edition	John Wiely &Sons	
10	Soil Mechanics for Road Engineers	HMSO.		

(Group-1): 20CWM13	ADVANCED WASTE WATER TREATMENT ENGINEERING
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction – Objectives of wastewater treatment system, Need for sanitation, classification of sewerage systems, dry weather and wet weather flow, factors affecting dry weather flow and wet weather flow, Design of sewers.
Characteristics of waste water and flow variations. Types of reactors and reactors analysis.

Module-2

Primary Treatment of wastewater- Flow chart on Community waste water treatment system, screenings, grit chamber, Oil and Grease removal, Aeration, Equalization basin, primary and secondary settling tanks and design.
Bio-kinetic coefficients– Definition, Significance in Biological treatment and their determination.

Module-3

Wastewater Treatment – Aerobic and Anaerobic treatment methods.
Theoretical principles and design considerations; **suspended growth system**- Conventional activated sludge process and its modifications.

Module-4

Sludge Processing – Separation - sludge thickeners, volume reduction, conditioning and digestion – aerobic and anaerobic. Principles and design of stabilization ponds.
Nitrification and De-nitrification Processes, Phosphorous removal. Wastewater disinfection.

Module-5

Role of microorganisms in wastewater treatment - Degradation of Carbonaceous and Nitrogenous matter, high concentrated toxic pollutants.
Rural wastewater systems – Septic tanks, two-pit latrines, Eco-toilet, soak pits.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Wastewater Engineering - Treatment and Reuse	Metcalf and Eddy Inc., 4th Edition	Tata McGraw Hill Publishing Co. Ltd., New Delhi.	2003
2	Wastewater Treatment Concepts and Design Approach	Karia G.L., and Christian R.A.	Prentice Hall of India Pvt. Ltd., New Delhi.	2001
3	Water-wastewater Engineering	Fair G.M., Geyer J.G and Okun		
4	Wastewater Engineering - Treatment and Reuse	Metcalf and Eddy Inc., 4th Edition	Tata McGraw Hill Publishing Co. Ltd., New Delhi.	2003

(Group-1): 20CEE14	SOLID WASTE ENGINEERING & MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Sources and engineering classification, characterization, generation and quantification; Objectives, principles, functional elements of solid waste management system – Regulatory aspects of solid waste management, major problems. Environmental implications of open dumping, Construction debris – management &handling, E- Waste Management, Rag pickers and their role

Module-2

Waste Generation: Rate of generation, frequency, storage and refuse collection, physical and chemical composition, quantity of waste, engineering properties of waste, prediction, modeling concepts.

Collection, Segregation and Transport: Handling and segregation of wastes at source, Collection (primary & secondary) and storage of municipal solid wastes, collection equipment, transfer stations, collection route optimization and economics, regional concepts. System dynamics

Module-3

Waste Minimization: 4R: reduce, recover, recycle and reuse, case study, guidelines

Treatment Methods: Refuse processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery: composting, vermin composting, vermin gradation, fermentation. Incineration of solid wastes.

Module-4

Disposal Methods: Impacts of open dumping, site investigation and selection, sanitary land filling - Types, geotechnical considerations, design criteria and design, Liners - earthen, geo membrane, geo synthetics and geo textiles.

Operational aspects of MSW Landfills: Daily cover, leachate disposal, Ground Water monitoring, leachate and gas collection systems – Design, leachate treatment. Landfill Final Cap Design and Water Balance, Modeling (HELP–Hydraulic Evaluation of Landfill Performance), post-closure environmental monitoring; landfill remediation.

Module-5

Recent Developments in Solid Wastes Reuse and Disposal: Power Generation, Blending with construction materials and Best Management Practices (BMP). Community based waste management, Waste as a Resource concept, Public private partnership (PPP)

Role of various organizations in Solid Waste Management: Governmental, Non - Governmental, Citizen Forums.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Solid Waste Engineering Principles and Management Issues	Tchobanoglous G, Theissen H and Eliassen R.	McGraw Hill, New York	
2	Handbook of Solid Waste Disposal	Pavoni J. L.		
3	Environmental Engineering	Peavy, Rowe and Tchobanoglous	McGraw Hill	
4	SolidWaste Management		CPHEEO Manual	
5	Solid Waste Management		WHO Manual	
6	Management of Solid Wastes in Developing Countries	Flintoff F	WHO 4. Regional Publications, South East Asia, New Delhi	1976

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Ph.D. Coursework Courses – 2020 in Civil Engineering.

(Group-1): 20WRM13	WATER RESOURCES SYSTEMS PLANNING & MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: General Principles of Systems Analysis to Problems in Water Resources Engineering, Objectives of Water Resources Planning and Development, Nature of Water Resources Systems, Socio Economic Characteristics.

Module-2

Economic Analysis of Water Resources System: Principles of Engineering Economy, Capital, Interest and Interest Rates. Time Value of Money, Depreciation, Benefit Cost Evaluation, Discounting Techniques, Economic and Financial Evaluation, Socio-Economic Analysis.

Module-3

Methods of Systems Analysis: Linear Programming Models, Simplex Method, Sensitivity Analysis, Dual Programming, Dynamic Programming Models, Classical Optimization Techniques, Non-linear Programming, Gradient Techniques, Genetic Algorithm, Stochastic Programming, Simulation, Search Techniques, Multi Objective Optimization

Module-4

Water Quantity Management: Surface Water Storage Requirements, Storage Capacity and Yield, Reservoir Design, Water Allocations for Water Supply, Irrigation, Hydropower and Flood Control, Reservoir Operations, Planning of an Irrigation System, Irrigation Scheduling, Groundwater management, Conjunctive Use of Surface and Subsurface Water Resources, Design of Water Conveyance and Distribution Systems.

Module-5

Water Quality Management: Water Quality Objectives and Standards, Water Quality Control Models, Flow Augmentation, Wastewater Transport Systems, River Water Quality Models and Lake Quality models. Legal Aspects of Water & Environment Systems: Principles of Law applied to Water Rights and Water Allocation, Water Laws, Environmental Protection Law, Environmental Constraints on water Resources Development.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Water Resources Systems Planning and Analysis	Loucks, D.P., Stedinger, J.R. and Haith, D.A.	Prentice Hall Inc. N York	1982
2	Water Resources Systems Planning and Management	Chaturvedi, M.C	Tata McGraw Hill Pub. Co., N Delhi	1987
3	Water Resources Systems	Hall. W.A. and Dracup, J.A.	Tata McGraw Hill Pub. N Delhi	1975
4	Economics of Water Resources Planning	James, L.D. and Lee	McGraw Hill Inc. N York	1975
5	Water Resources Development, Planning, Engineering and Economics	Kuiper, E	Buttersworth, London	1973
6	Systems Approach to Water Management	Biswas, A.K.	McGraw Hill Inc. N York	1976
7	Applied Water Resources System Planning	Major, D.C. and Lenton, R.L.	Prentice- Hall Inc, N.Jersey	1979
8	Operations Research	Taha h A	Prentice Hall of India, N Delhi.	1996

(Group-1): 20CCT12 CONSTRUCTION PROJECT AND MANAGEMENT	
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Construction Projects- Concept, Project Categories, Characteristic of projects, project life cycle phase. Project Management- Project Management Function, Role of Project Manager.

Module-2

Project Feasibility Reports: Introduction, Significance in feasibility report- Technical analysis, Financial analysis, Economic analysis, Ecological analysis, Flow diagram for feasibility study of a project.
Project planning Scope: Planning Process, Objectives, Types of Project plans, Resource Planning Process.

Module-3

Scheduling: Introduction to software's in construction scheduling (MSP, Primavera, Construction manager), Project Monitoring & Controlling Bar Charts, Work Breakdown Structure, Time estimates, Applications of CPM and PERT, A- O-N Network-Logic and Precedence diagrams, advantages, Drawing A-O-N network from A-O-A network and related problems.

Module-4

Time Cost relationship: Direct and indirect cost, step in optimization of cost, related problem. Allocation of resources: Histogram, Resource smoothening, Resource leveling and related problem. Project updating using CPM network and related numerical problems.

Module-5

Resources: Scheduling, Monitoring and Updating. Line of Balance Scheduling. Resource Planning-Leveling and Allocation. Introduction to Building Information Model (BIM).

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Construction Project Management: Planning, Scheduling and Control	Chitkara, K.K	Tata McGraw-Hill Publishing Company, New Delhi	1998
2	Project Management	Choudhury S	McGraw-Hill Publishing Company, New Delhi	1988
3	Project Management for Construction– Fundamental Concepts for Owners, Engineers, Architects and Builders	Chris Hendrickson and Tung Au	Prentice Hall, Pittsburgh	2000
4	PERT and CPM	Srinath L.S	East West Press Pvt Ltd New Delhi	
5	Modern Construction Management	Frank Harris and Roland McCaffer	4th Ed. Blackwell Science Ltd.	

(Group-1): 20CEM14	CONSTRUCTION EQUIPMENTS AND MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Plants and Equipment for production of materials- Crushers, mixers, bituminous mixing plants, concrete mixing plants, transit mixers, advantages, choice, production rate calculation

Module-2

Construction Equipment – Operations, applications and performance of dozers, excavators, graders, compactors, pavers, haulers, crawler, wheel tractors, power shovels, pile driving equipments, hauling equipments, and drilling, blasting and tunneling equipment.

Module-3

Miscellaneous Equipments - Equipment for: Dredging, tunneling, dewatering. Equipment for flooring- dewatering and floors finishing. Sprayers, kerb casting equipment, screening equipment.

Module-4

Selection of Construction Equipment- Task considerations, cost considerations, engineering Considerations, equipment acquisition options.

Module-5

Management of Construction Equipment: Need for mechanization of construction–planning and financing construction plant and equipment–Owning and operating equipment versus hiring–planning for infrastructure mechanization equipment management–equipment maintenance and repair, log maintenance, safety during operation, economical life of equipment.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Construction Planning, Equipment and Methods	Peurifoy, R.L., Ledbette. W.B.	McGraw Hill Co.	
2	Civil Engineering Construction	Antil J.M.	McGraw Hill Book Co.	
3	Principles and Practice of Heavy Construction	Smith, R.C, Andres, C.K.	Prentice Hall	
4	Construction equipment	SC Sharma		
5	Construction Project Management: Panning, Scheduling and Control	Chitkara, K. K.	Tata McGraw Hill Publishing Company, New Delhi	1998

(Group-1): 20CIM15	ADVANCES IN PRE-STRESSED CONCRETE
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction – Theory, Behaviour and Materials

Introduction: Basic concept of pre-stressing (including advantages and disadvantages), Basic Definitions; Pre-stressing methods-Thermo elastic, chemical, Electrical; Material Properties - Concrete and Pre-stressing steel; Pre-stressing Systems-Pre-tensioning and Post-tension systems.

SDA: Group activity – Simple model preparation: Tendons, anchorage, strand, pre- stress concrete element.

Module-2

Losses in Pre-stress

Purpose of calculating losses – Elastic loss; creep; shrinkage; relaxation; anchorage losses and Friction loss.

SDA: Understand reasons for losses in PSC structures through digital resources.

Module-3

Analysis and Design for Flexure

Analysis of stresses by stress method, force method and load balancing method; Pre-Basic assumptions for calculating flexural stresses, Limit state of Serviceability–Stress (IS 1343-1987); Limit state of Collapse – Flexure and Shear (IS 1343-2012).

SDA: Calculation for the stresses and flexural moment carrying capacity of PT element as per IS 1343 using

Module-4

Deflection and Design of Anchorage Zone

Factors influencing Deflections – Short term Deflections of un-cracked members; Prediction of long-term deflections due to creep and shrinkage.

Check for transfer bond length in pre-tensioned beams; Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS 1343 method; Design of anchorage zone reinforcement.

SDA: Prepare calculation for the deflection (short and long term) of PT elements using appropriate tools.

Module-5

Special Topics

Detailing of Post-tensioned Beams and Slabs, Composite Construction of Pre- stressed and in-situ concrete; Pre-stressed Concrete Poles, Piles, Railway Sleepers – concepts; Construction Methodology of Bonded and Un-bonded PT Slabs.

SDA: Group activity to prepare detailing and quantities of materials for PT slab and PT beam using appropriate software tool or conventional methods.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Design of Pre-stressed Concrete Structures	T. Y. Lin	John Wiley & Sons, 3rd ed.	2010
2	Pre-stressed Concrete	N Krishna Raju	Tata McGraw Hill Publishing Co. Ltd, New Delhi, 6th ed.	2018
3	Pre-stressed Concrete	Raja Gopalan N	Narosa Publishing House, New Delhi, 2nd ed.	2010
4	Pre-stressed concrete	Pandit and Gupta	CBS	2009

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
5	Fundamentals of Pre-stressed Concrete	Sinha N.C. & Roy	S. C & Co	1985
6	Fundamentals of pre-stressed concrete design		Precast/Pre-stressed Concrete Institute Manual ISBN-0-937040-02-9. IS: 1343-1987, IS: 1343-2012.	
7	Design Guide Post-Tensioned Concrete Floors	Sami Khan and Marin Williams	Butterworth-Heinemann Ltd., UK, ISBN: 0750616814	1995
8	Handbook on Precast Concrete Buildings		Indian Concrete Institute, Chennai	2016

(Group-1): 20CTE13	PAVEMENT MATERIALS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Basic road construction materials–types, source, functional, requirements and properties, tests and specifications for use in various components of road.

Basic soil properties, methods to determine strength of soil, Soil Compaction for use in fill and sub grade of roads, compaction studies in laboratory and field, properties of compacted soils.

Module-2

Aggregates–Origin, classification, equipments, properties. Tests and specifications on road aggregates for flexible and rigid pavements. Importance of aggregate gradation problems on Rothfutch's and Critical sieve methods and Shape factor in mix design.

Module-3

Bituminous binders– different types, properties and uses, physical tests on bitumen, Rheological and pavement performance related properties, Modified binders, ideal pavement binders, characteristics and applications in road construction, criteria for selection of different binders.

Bituminous mixes, types, requirements, properties, tests, Marshall Method of mix design, Criteria and super pave mix design, Additives & Modifiers in Bituminous mixes, problems on mix design.

Module-4

Portland cement and cement concrete for use in road works– Requirements, design of mix for CC pavement, use of additives, IRC specifications & Tests, joint filler and sealer materials.

Module-5

Soil stabilization– Principle, methods and tests, proportioning of materials and mix design, application of Roth fetch's method.

Marginal and waste materials in road construction, their properties and scope in road construction. Use of Fly-ash in road Embankment and cement concrete mixes, use of chemical stabilizers in road construction.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Highway Engineering	Khanna and Justo	Nem Chand and Bros., Roorkee	
2	Hot Mix Asphalt Materials, mixture design and construction	Freddy L Roberts, Prithvi S Kandhaletal	2nd Edition, National Asphalt Pavement Association Research and Education Foundation, Maryland, USA	
3	Bituminous materials in Road Construction		HMSO Publication	
4	Specifications for Roads and Bridges Works	MoRTH	Indian Roads Congress IS73, revised 2006, IS 2720, IS 2386, IS 1201 to 1220, IS 8887-1995, IS 217-1986	
5	Compaction of earth work and subrade		State of art, special report 3, IRC, HRB, 1999 IRC: 51-1992, 63-1976, 74–1979, 88-1984, Indian Roads Congress. IRCSP: 53–2002, IRCSP: 58–2000, Indian Roads Congress.	

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
6	Guidelines for use of Geo textiles in Road Pavements and Associated works		Indian Roads Congress	2002
7	Highway Materials Testing	Khanna and Justo	Nem Chand and Bros., Roorkee	
8	Soil Mechanics for Road Engineers		HMSO Publication	
9	Highway Hand Book	FAW	NUS, Singapore	
10	Standard Data Book on Highway Technology		P.G Examination of VTU	

(Group-1): 20CHT15	TRAFFIC ENGINEERING AND MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Traffic Studies & Analysis: Scope, traffic elements-Characteristics-vehicle, road user :and road - Traffic studies-speed & delay, traffic volume, O & D, parking and accidents-Sample size, study methodology - Data analysis & inferences.

Module-2

Traffic Flow Analysis: Macroscopic, Microscopic & Mesoscopic approach–Types of Flow-Traffic stream characteristics–Space–Time diagram–Relationship between speed, flow & density-Level of service & capacity analysis–Shockwave theory.

Module-3

Intersection Design: Types of intersections - Conflict diagrams –Control hierarchy- Design of rotaries & at-grade intersections – Signal design - Grade separated intersections & their warrants.

Module-4

Geometric Design : Cross sections–Sight distances–Super elevation–Horizontal & vertical alignments–Safety considerations

Road Safety Audit : Global & Local perspective–Road safety issues–Road safety programmes–Types of RSA, planning, design, construction & operation stage audits – Methodology – Road safety audit measures

Module-5

Traffic Regulation & Traffic Safety Management : Speed, vehicle, parking, enforcement regulations-Mixed traffic regulation - Management techniques, one-way, tidal flow, turning restrictions etc.–Transportation System Management Process–TSM planning & Strategies

Use of software: PTV VISSIM / VISUM (Traffic Flow Simulations), SIDRA (intersections), etc.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Traffic Engineering and Transportation Planning	Kadiyali L.R.	Khanna Publication,New Delhi	
2	Traffic and Highway Engineering	Nicholas J. Garber, Lester A. Hoel	Third Edition Thompson Learning	
3	Highway, Traffic Analysis and Design	Salter R J and Hounsell NB	Macmillan Press Ltd., London	
4	Traffic Engineering	Matson T M, Smith W S , Hurd F W	McGraw Hill Book Co, NY, USA	
5	Traffic Flow Theory and Control	Drew D R	McGraw Hill Book Co, NY, USA	
6	Traffic System Analysis of Engineers and Planners	Wohl and Martin	McGraw Hill Book Co, New York, USA	
7	Traffic Flow Fundamentals	May, A.D.	Prentice – Hall, Inc., New Jersey	1990
8	Highways-Traffic Planning & Engineering	O'Flaherty C A	Edward Arnold, UK	

9	Traffic Engineering	Pignataro	John wiley & sons. Nicholas J Garber, Lester A Hoel	
10	Traffic & Highway Engineering		Third edition, IRC: SP 43 1994 and other Relevant IRC codes	
11	Highway Engineering	S.K. Khanna, C.E.G Justo and A. Veeraragavan	Nem Chand and Bros., Roorkee. Revised 10th Edition.	
12	Indian Highway		Capacity Manual (Indo-HCM) CSIR, New Delhi, 2012-2017	

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Ph.D. Coursework Courses – 2020 in Civil Engineering.

(Group-1): 20CTM11	APPLIED STATISTICS FOR HIGHWAY ENGINEERING
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction to statistical methods, scope aim and limitations, sample, attribute and types of data, sources and collection of data. Accuracy of data.
Representation and summarizing data. Frequency distribution, histogram and frequency curves. O give curve, Measure of central tendency–arithmetic mean, median and mode dispersion-range, standard deviation, variance and co-efficient of variation, skewness and kurtosis.

Module-2

Introduction to probability & statistics for Traffic Engineering Design– Introduction, Random variables and statistical measures: arithmetic mean, measures of dispersion, basic laws of probability, probability laws for discrete random variables: binomialand Poisson distribution, probability laws for continuous random variables: normal distribution, Poisson distribution

Module-3

Sampling Techniques– objective, basics of sampling, advantages of sampling, sampling techniques, sampling distributions–sampling distribution of the sample mean, central limit theorem, chisquare, t and F– distributions. Sampling error, sample size and design.

Module-4

Statistical decisions–point estimation, properties of parameters, Testing of Hypothesis–Type I and II errors.
Tests of significance–tests for mean and variance. Tests for proportions.

Module-5

Chi-square test of goodness of fit, student's t test, Confidence interval.
Curve fitting by the method of least squares, Linear correlation & regression, multiple linear regression. Analysis of variance
Use of soft-wares in statistical analysis–MATLAB, MINITAB

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Statistics–Principles and methods	Johnson Rand G Bhattacharya	John Wiley &sons, Newyork	1985
2	Traffic Engineering	L. R Kadiyali	Khanna Publishers, NewDelhi	
3	Introduction to statistics	Medhi	New Age Pub, New Delhi	
4	Probability Statistics & Decisions for Civil Engineers	Benjamin Jack Rand Cornell C Allin	McGraw Hill Co.	
5	Basic Statistics	Agarwal, B. L	3rd Edition, New Age Pub. New Delhi	
6	Traffic System Analysis	Martin Wohl, Brian V Martin	McGrawHill Series	

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Ph.D. Coursework Courses – 2020 in Civil Engineering.

(Group-1): 20CSE14	MECHANICS OF DEFORMABLE BODIES
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Theory of Elasticity: Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint of Cartesian and polar coordinates. Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases.

Module-2

Transformation of stress and strain at a point, Principal stresses and principal strains, invariants ofstress and strain, hydrostatic and deviatric stress, spherical and deviatric strains max. shear strain.

Module-3

Plane stress and plane strain: Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams. Solution of axisym metric problems, stress concentration due to the presence of a circular hole in plates.

Module-4

Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations in elasticity.

Module-5

Theory of Plasticity: Stress – strain diagram in simple tension, perfectly elastic, Rigid – Perfectly plastic, Linear work – hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials, Failure theories, yield conditions, stress – space representation of yield criteria through Westergard stress space, Tresca and Von-Mises criteria of yielding

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Theory of Elasticity	Timoshenko & Goodier	McGraw Hill	
2	Advanced Mechanics of Solids	Srinath L. S.	10th print, Tata McGraw Hill Publishing company, New Delhi	1994
3	Theory of Elasticity	Sadhu Singh	Khanna Publishers	
4	Theory of Elasticity	Verma P.D.S	Vikas Publishing Pvt. Ltd	
5	Plasticity for Structural Engineers	Chenn W.P and Hendry D.J	Springer Verlag	
6	Continuum Mechanics Fundamentals	Valliappan C	Oxford IBH Publishing Co. Ltd.	
7	Applied Stress Analysis	Sadhu Singh	Khanna Publishers	
8	Theory of Elasticity	Xi Lu	John Wiley	

(Group-1): 20CCS23	STRUCTURAL STABILITY ANALYSIS – CLASSICAL AND FE APPROACH
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Beam column: Differential equation. Beam column subjected to (i) lateral concentrated load, (ii) several concentrated loads, (iii) continuous lateral load. Application of trigonometric series. Euler's formulation using fourth order differential equation for pinned- pinned, fixed-fixed, fixed-free and fixed-pinned columns.

Module-2

Buckling of frames and continuous beams. Elastic Energy method: Approximate calculation of critical loads for a cantilever, Exact critical load for hinged-hinged column using energy approach. Buckling of bar on elastic foundation, Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation, Bars with varying cross section, Effect of shear force on critical load. Columns subjected to pulsating forces.

Module-3

Stability analysis by finite element approach: Derivation of shape functions for a two noded Bernoulli-Euler beam element (lateral and translational DOF)–element stiffness and Element geometric stiffness matrices–Assembled stiffness and geometric stiffness matrices for a discretised column with different boundary conditions–Evaluation of critical loads for a discretised (two elements) column (both ends built-in). Algorithm to generate geometric stiffness matrix for four noded and eight noded isoparametric plate elements, Buckling of pin jointed frames (maximum of two active DOF)-symmetrical single bay Portal frame.

Module-4

Lateral buckling of beams: Differential equation–pure bending–cantilever beam with tip load–simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin – walled bars of open cross section. Non–uniform Torsion of thin–walled bars of open cross section

Module-5

Expression for strain energy in plate bending with in plate forces (linear and non – linear): Buckling of simply supported rectangular plate– uniaxial load and biaxial load. Buckling of uniformly compressed rectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Theory of Elastic Stability	Timoshenko, S.P. and Gere, J.M.	2nd Ed., McGraw Hill Book Co., New York	1961
2	Fundamentals of Structural Stability	Simitses, G.J. and Hodges, D.H.	Butterworth & Heinemann	2006
3	Stability Analysis and Design of Structures	Gambhir, M.L.	Springer	2009
4	Elements of Matrix and Stability Analysis of Structures	Manicka Selvam, V.K.	6th Ed., Khanna Publishers, New Delhi	2004
5	Advanced Mechanics of Solids	Srinath, L.S.	3rd Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi	2017
6	Computational Structural Mechanics	Rajashekaran. S	Prentice-Hall, India	2001
7	Dynamics of Structures	Ray W Clough and J Penzien	2nd Edition, McGraw-Hill, New Delhi	1968

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Ph.D. Coursework Courses – 2020 in Civil Engineering.

(Group-1): 20CCS334	GREEN BUILDING TECHNOLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control-Internal and external factors on energy use and the attributes of the factors-Characteristics of energy use and its management-Macro aspect of energy use in dwellings and its implications.

Module-2

Indoor environmental requirement and management-Thermal comfort-Ventilation and air quality–Air-conditioning requirement-Visual perception-Illumination requirement-Auditory requirement.

Module-3

Climate, solar radiation and their influences-Sun-earth relationship and the energy balance on the earth's surface-Climate, wind, solar radiation, and temperature-Sun shading and solar radiation on surfaces-Energy impact on the shape and orientation of buildings.

Module-4

End-use, energy utilization and requirements-Lighting and day lighting - End-use energy requirements-Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through the glazed window and the wall-Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

Module-5

Energy management options-Energy audit and energy targeting-Technological options for energy management. Building rating systems.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Natural Hazards	Bryant Edwards	Cambridge University Press, U.K.	2005
2	National Building Code of India, Vol. 1 and 2		Bureau of Indian Standards	2016
3	Disaster Management	Carter, W. Nick	Asian Development Bank, Manila	1991
4	Disaster Mitigation Experiences and Reflections	Sahni, Pardeep, Medury Uma and Dhameja Alka	Prentice Hall of India, New Delhi	2002
5	Hand book of Green Building Design and Construction	Sam Kubba	LEED, BREEAM and Green Globes	2012
6	Sustainable Construction: Green Building Design and Delivery	Charles J Kibbart	J Wiley and Sons	2016

(Group-1): 20WLM12	**SURFACE WATER HYDROLOGY**
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Scope and importance of hydrology, Hydrologic cycle, Global and India's Water resources, Applications of hydrology.

Watershed Concept: Catchment, Topographic and Ground water divide, Description of the catchment, demarking a catchment, stream patterns. Location of rain-gauges and optimum number of rain-gauges, Analysis of rainfall data, Rainfall mass curve and hyetograph, Intensity-Duration analysis, Intensity-Frequency-Duration analysis, Depth-Area-Duration analysis, Double mass curve.

Module-2

Abstractions from precipitation: Evaporation-Process, Measurement, Empirical equations and Estimation by Water budget method and Energy budget method.

Evapo-transpiration-AET & PET, Estimation by Penman's equation, Reference Crop Evapo-transpiration by Blaney Criddle formula.

Infiltration-Process, Factor affecting infiltration, Measurement, Horton's equation and Philip's equation. Infiltration indices.

Module-3

Runoff:-Process, Factors affecting runoff, API, Basin yield, Curve number method, water budgeting.

Correlation, Regression analysis-simple linear and Multiple linear regression, Curvilinear regression.

Classification of models, Model formulation, Lumped parameter conceptual models, Physically based models, Model performance testing.

Module-4

Hydrograph and its features, Methods of hydrograph separation, Unit hydrograph and its derivation, Unit hydrographs from complex storms and for various durations, S-curve hydrograph and its uses, Synthetic unit hydrograph.

Module-5

Flood: Design flood and its estimation- Rational method, Frequency analysis Gumbel's and Log-Pearson's type III distribution, Selection of design return period.

Flood routing- Reservoir routing: Modified Pul's method, Goodrich method, Channel routing- Prism and Wedge storage, Muskingum method.

Flood control: Structural and Non-structural measures.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Engineering Hydrology	Subramanya K	Tata McGraw Hill	1998
2	A text book of Hydrology	Jaya Rami Reddy, P	Laxmi Publications	2009
3	Principles of Hydrology	Putty, M. R.Y.	I.K. Int. Publishing House, New Delhi	2010
4	Hydrology for Engineers	Linsley R K, Kohler and Paulhus	McGraw Hill, NY, USA	1958
5	Applied Hydrology	Mutreja, K. N.	Tata McGraw Hill Pub. Co., New Delhi, India	1986
6	Handbook of Applied Hydrology	Chow, V.T.	McGraw Hill, NY	1964

(Group-2): 20CSE15	STRUCTURAL DYNAMICS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles.

Dynamics of Single degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems system, Free vibration response of damped and undamped systems including methods for evaluation of damping.

Module-2

Response of Single-degree-of-freedom systems to harmonic loading including support motion, vibration isolation, transmissibility.

Numerical methods applied to Single-degree-of-freedom systems – Duhamel integral.

Principle of vibration measuring instruments–seismometerand accelerometer.

Module-3

Dynamics of Multi-degree freedom systems: Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems–Natural frequencies and mode shapes–Orthogonality of modes.

Module-4

Response of Shear buildings for harmonic loading without damping using normal mode approach. Response of Shear buildings for forced vibration for harmonic loading with damping using normal mode approach.

Module-5

Approximate methods: Rayleigh's method, Dunkarley's method, Stodola's method.

Dynamics of Continuous systems: Flexural vibration of beams with different end conditions.

Stiffness matrix, mass matrix (lumped and consistent).

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Dynamics of Structures – "Theory and Application to Earthquake Engineering	Anil K. Chopra	2nd ed., PearsonEducation	
2	Earthquake Resistant Design of Building Structures	Vinod Hosur	WILEY (India)	
3	Vibrations, structural dynamics	M. Mukhopadhaya	Oxford IBH	
4	Structural Dynamics	Mario Paz	CBS publishers	
5	Structural Dynamics	Clough & Penzien	TMH	
6	Vibration Problems in Engineering	Timoshenko S,	Van-Nostrand Co.	

(Group-2): 20CGT11   FORENSIC GEOTECHNICAL ENGINEERING

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Earth and Rock fill Dams: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Stress measurements, Seismic measurements.

Failures, Damages and Protection of Earth Dams: Nature and importance of failure, piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters.

Module-2

Embankment Construction: Equipment for excavating, hauling, spreading, blending, compacting and separating oversized rocks and cobbles, construction procedures and quality control of impervious and semi-pervious embankment sections, handling dry and wet materials, construction problems caused by fines, construction procedures of hard and soft rock fill embankments, field test on rock fill embankments, slope treatment and rip-rap.

Module-3

Slope Stability Analysis: Types of Failure: Failure surfaces - Planar surfaces, Circular surfaces, Non-circular surfaces, Limit equilibrium methods, Total stress analysis versus effective Stress analysis, Use of Bishop's pore pressure parameters, Short term and Long term stability in slopes. Taylor Charts.

Special Design problems and details: Design considerations in earthquake, ground movements, earthquake intensity scales, periods and amplitudes of ground motion, influence of foundation material, earthquake waves, slope stability analysis during earthquake as per BIS, problems in loose sand, soft clay and silt foundation.

Module-4

Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Janbu Analysis, Sliding Block Analysis, Introduction to Seismic stability, Stabilization of slopes: Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime treatment), surface protection (vegetation/erosion control mats/shotcrete).

Module-5

Slope Protection and Rockfill Dams: Stabilization of slopes: Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime treatment), surface protection (vegetation/erosion control mats/shotcrete). Requirements of compacted rockfill, Shear strength of rockfill, Rockfill mixtures, Rockfill embankments, Earth-core Rockfill dams, Stability, Upstream & Downstream slopes

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Earth and earth-rock dams	Sherard J L, Woodward R J, Gizienski S F and Clevenger W A	John Wiley & Sons, NY	
2	Earth and rockfill dam engineering	Sowers G P and Sally H L	Asia Publishing House, New Delhi	
3	Engineering for Dams	Creager W P, Justin J D and Hinds J	John Wiley & Sons, NY	
4	Earth and Earth-Rock Dams	Sherard, Woodward, Gizienski and Clevenger	John Wiley &. Sons	1963
5	Earth and Rockfill Dams	Bharat Singh and Sharma, H. D.		1999
6	Indian storage resources with earthen dams	Strange W L	R&FN Spon Ltd., London	

(Group-2): 20CWM12	WATER POLLUTION AND TREATMENT TECHNOLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Objectives and necessity for Treatment of water. Water pollution, Sources of water pollution and control methods. Point and non-point sources of water pollution. Ground water pollution and its characteristics. Water Borne diseases and control. Characteristics of water.

Analysis for quality of water: Drinking water quality standards as per BIS & WHO guidelines. Importance of Bacteriological examination of water, Plate Count Test and MPN Test. Problems on determination of E-coli using MPN equation.

Module-2

Water Purification System: Flow Diagram on overall water supply Project. Various types of Unit flow diagrams used on Water Treatment System. Water Intake Structures and their classifications.

Purification of water: Water Aeration, Importance and limitations. Gas Transfer two film model; Water in Air system and Air in Water system with their types. Significance of Dissolved Oxygen in Water. Principles of Sedimentation Process and Separation of Solids. Design Criteria and design of Sedimentation tank in the removal of Discrete particles.

Module-3

Coagulation and Flocculation: Coagulation and Flocculation process of water. Theory of Coagulation and Principle. Types of Coagulants used with their merits and demerits. Coagulants chemical reaction with water. Coagulant Aids, Chemical feeding system. Determination of Optimum Coagulant Dosage using Flocculator. Numerical design problems on estimation of Coagulants.

Module-4

Water Filtration Process– Basic principles and theory on Filtration. Classification of sand filters used in treatment of water. Operational system and Operational troubles and troubleshooting method used in SSF and RSF in treatment of water. Design criteria used and Design of Slow and Rapid Sand Filters required for water treatment plant.

Module-5

Water Disinfection Process – Sterilization and Disinfection. Methods of disinfection and their suitability. Theory of Disinfection, characteristics of a good disinfectant. Forms of Chlorination, Chemical reactions, Break point Chlorination. Determination of Chlorine Demand of water. Estimation of quantity of Chlorine and Bleaching powder required for treatment of water.

Miscellaneous Treatment of water- Hardness of water and significance. Numerical problems on determination of Hardness in water sample and Studies on effect of hardness. Fluoridation and De fluoridation techniques.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Water supply Engineering Vol- I	Fair, G.M., Geyer J.C and Okun	John Wiley Publications	1969
2	Physico - Chemical Processes for Water Quality Control	Weber W.J.		1975
3	Water Supply and Treatment Engineering	CPHEEO Manual	GOI- Publications, New Delhi	2003
4	Environmental Engineering	Peavy, H.S., Rowe and Tchobonoglous, G.	McGraw Hill	1985
5	Water Supply and Pollution Control	PHI Learning, New Delhi		2009
6	Environmental Engineering and Science	Clair N. Sawyer, Perry L. McCarty and Gene F. Parkin	McGraw Hill Education Pvt. Ltd, New Delhi	2014

(Group-2): 20CEE22	ATMOSPHERIC ENVIRONMENTAL POLLUTION AND CONTROL
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Definition of Air Pollution, sources, characterization and classification of atmospheric pollutants, air pollution episodes.

Effects of air **pollutants** on human health, vegetation, animals and materials and monuments. Composition and structure of the atmosphere; Visibility and other related atmospheric characteristics.

Module-2

Meteorology: Wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth, Temperature Inversions, plume behaviour, Wind rose diagram, general characteristics of stack emissions, heat island effect. **Monitoring of particulate matter:** Respirable, non-respirable and nano-particulate matter. Monitoring of gaseous pollutants–CO, CO2, Hydrocarbons, SOX and NOX, photochemical oxidants. Monitoring equipment and sampling devices–stack sampling (Isokinetic sampling), air samplers, gas exhaust analyzer. Air Pollution Index.

Module-3

Pollutants' dispersion models: Point, line and areal sources models. Box model, Gaussian plume dispersion model – for point source (with and without reflection), Gaussian dispersion coefficient, Determination of ground level concentrations. Infinite line source Gaussian model. Plume rise and effective stack height calculations.

Module-4

Air Pollution Control Equipment: Mechanisms, Control equipment for particulate matter–gravity settling chambers, centrifugal collectors, wet collectors, scrubbers, fabric filters, electrostatic precipitator (ESP)-Design principles and criteria with design **Control Equipment for gaseous pollutants**–adsorption, absorption, condensation and combustion. Design principles.

Module-5

Indoor Air Pollution: Sources, indoor air contaminants, effects and control. air changes per hour (ACH), IAQ Standards

Noise - sources, measurements, effects and occupational hazards.

Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Environmental pollution control engineering	C.S Rao	New age international publishers	2006
2	Air Pollution	M. N Rao and H. V. N Rao.	Tata McGraw-Hill Publishing Company Limited, New Delhi.	1999
3	Air Pollution	Wark, K., Warner, C.F., and Davis, W.T		1998
4	Air Pollution Control Theory	Crawford, M.	TATA McGraw Hill.	1980
5	Environmental Engineering	Howard S. Peavy, Donald R. Rowe and George Technobanoglous	McGraw Hill International Publications.	2017
6	Environmental Engineering and Science	Clair N. Sawyer, Perry L. McCarty and Gene F. Parkin	McGraw Hill Education Pvt. Ltd, New Delhi	2014
7	Air Pollution Vol I, II, III.	Stern, A.C.		
8	Air Pollution: The Effects of Air Pollution	Stern, A. C.	3rd- Edition, Academic Press	1977

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(Group-2): 20WRM14	OPEN CHANNEL HYDRAULICS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Basic Concepts of Free Surface Flow, classification of flow, velocity & pressure distribution. Conservation laws, continuity equation, momentum equation, Specific energy, Application of momentum & energy equation, Channel transition, Hydraulic jump. Critical flow.

Module-2

Uniform flow: flow resistance, equation of flow resistance, compound channel, Computation of normal flow depth.

Module-3

Gradually varied flow, Governing equation, classification of water surface profiles, and computation of GVF. Unsteady Rapidly Varied Flow. Application of conservation laws. Positive and Negative Surges. Moving hydraulic Jump, Spillways, Energy dissipaters.
Critical slope and limit slope.

Module-4

Hydraulics of Mobile bed channel, Initiation of Motion of sediment, Critical analysis of Shield's diagram, Bed forms, and Predication of bed form. Sediment load: Suspended load, Bed load, total bed material load, measurement and estimation of sediment load. Design of Stable Channels: Regime and Tractive force Methods.

Module-5

Introduction to Bridge Hydraulics: Water ways, Afflux, Scour: Local scour, abutment scour, Indian practice of design for scour.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Open Channel Hydraulics	Chow, V.T.	McGraw Hill. N York	1979
2	Open Channel Flow	Henderson	McMillan Pub. London	1966
3	Flow in Open Channels	Subramanya, K	Tata McGraw Hill Pub.	1996
4	Mechanics of Sediment Transportation and Alluvial Stream Problems	Grade and Ranga Raju, K.G.	Wiley Eastern, N Delhi	1980
5	Open – Channel Flow	Chaudhry M.H.	Prentice Hall of India, N Delhi	1994
6	Open Channel Hydraulics	French, R.H.	McGraw Hill Pub Co., N York	1986
7	Bridge Hydraulics	Hamill L.	E & FN Spon, London	1999

(Group-2): 20CCT14	ADVANCED CONSTRUCTION MATERIALS AND GREEN BUILDINGS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings IGBC and LEED manuals–mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.

Module-2

Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers-metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes.
Construction and demolition wastes

Module-3

Special Concretes: Definition & Introduction, General properties, Advantages, Disadvantages, Applications, High density concrete, Shrinkage compensating concrete, Mass concrete, Roller compacted concrete. Light weight concrete, High strength concrete, Ultra-high strength concrete (reactive powder concrete), High workability concrete/Self compacting concrete, Fiber reinforced concrete, Polymer-concrete composites.

Module-4

Introduction and definition of Sustainability. Carbon cycle and role of construction material such as concrete and steel, etc. CO_2 contribution from cement and other construction materials. Control of energy use in building, ECBC code, codes in neighboring tropical countries, features of LEED and TERI Griha ratings, Performance ratings of green buildings.

Module-5

Non-renewable sources of energy and Environmental aspects – energy norm, coal, oil , natural gas, Nuclear energy, Global temperature, Green house effects, global warming. Acid rain - Causes, effects and control methods. Regional impacts of temperature change.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Alternative Building Materials and Technologies	K. S. Jagadish, B. V. Venkatarama Reddy and KS Nanjunda Rao	New Age International Publishers	
2	Concrete Technology	Gambhir M. L.	McGraw Hill Education	2006
3	Concrete Technology	Shetty M.S.	S. Chand and Company Ltd. Delhi	2003
4	Building Materials	M. L. Gambhir	Neha Jamwal, Tata McGraw Hill Publ.	
5	Sustainable Construction: Green Building Design and delivery	C. J. Kibert	3rd Ed., John Wiley, Hoboken, New Jersey	2008
6	Building Materials in Developing Countries	RJS Spence and DJ Cook	Wiley pub.	
7	Concrete- Microstructure, Properties and Materials	Mehta. P. K., and Paulo J.M. Monteiro	(Indian Ed., Indian Concrete Institute), McGraw Hill. National Building Code 2005, Part 0-10, Bureau of Indian Standards	
8	Living in the Environment: Principles, Connections and Solutions	G.T. Miller Jr.	14th Ed., Brooks Cole, Pacific Grove, California, Washington DC,	April 1989 & 2004

(Group-2): 20CEM243	DISASTER MITIGATION & MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction To Disasters Definition: Disaster, Hazard, Vulnerability, Resilience, Risks–Disasters: Types Of Disasters–Earthquake, Landslide, Flood, Drought, Fire Etc–Classification, Causes, Impacts Including Social, Economic, Political, Environmental, Health, Psychosocial, Etc.-Differential Impacts-In Terms Of Caste, Class, Gender, Age, Location, Disability–Global Trends In Disasters: Urban Disasters, Pandemics, Complex Emergencies, Climate Change-Dos And Don'ts During Various Types Of Disasters.

Module-2

Approaches To Disaster Risk Reduction Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural non structural measures in DRR, Factors affecting Vulnerabilities, , Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Rehabilitation measures and long term reconstruction.

Module-3

Inter-Relationship Between Disasters And Development Factors Affecting Vulnerabilities, Differential Impacts, Impact Of Development Projects Such As Dams, Embankments, Changes In Land-Use Etc.- Climate Change Adaptation- IPCC Scenario And Scenarios In The Context Of India–Relevance Of Indigenous Knowledge, Appropriate Technology And Local Resource

Module-4

Disaster Risk Management In India Hazard And Vulnerability Profile Of India, Components Of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional Arrangements (Mitigation, Response And Preparedness, Disaster Management Act and Policy–Other Related Policies, Plans, Programmes And Legislation–Role Of GIS And Information Technology Components In Preparedness, Risk Assessment, Response And Recovery Phases Of Disaster–Disaster Damage Assessment.

Module-5

Disaster Management: Applications And Case Studies Cases Studies : Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, south India Tsunami, Bihar floods, Plague Surat, Landslide in North East, Heat waves of AP& Orissa, 278 Cold waves in UP. Bengal famine, best practices in disaster management, Local Knowledge Appropriate Technology and local Responses, Indigenous Knowledge, Development projects in India (dams, SEZ) and their impacts.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Environmental Geography	R.B.Singh (Ed)	Heritage Publishers, New Delhi	
2	Environmental Geography	Savinder Singh	Prayag Pustak Bhawan	
3	The Environment as Hazards	Kates B .I & White G.F	oxford, New York	
4	Disaster Management	R.B. Singh (Ed)	Rawat Publication, New Delhi	
5	Disaster Management	H.K. Gupta (Ed)	Universies Press, India	
6	Disaster Management in Hills	Dr. Satender	Concept Publishing Co., New Delhi	

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Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
7	Action Plan For Earthquake, Disaster, Mitigation	A.S. Arya	(V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi	
8	An overview on Natural & Manmade Disaster & their Reduction	R.K. Bhandani	CSIR, New Delhi	
9	Manuals on Natural Disaster management in India	M.C. Gupta	National Centre for Disaster Management, IIPA, New Delhi	
10	Disaster Mitigation Experiences & Reflections	Pardeep Sahni, Alka Dhameja and Uma Medury		
11	Disaster Management Report	Department of Agriculture and Cooperation, Govt. of India.		

(Group-2): 20CIM23	PREFABRICATED STRUCTURES

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Basic Definitions - Types of prefabrication-prefabrication systems and structural schemes-Prefabricated Elements–columns, beams, floor, roof, footing and wall panels.
SDA: Group activity - Prepare simple models on elements like slab, beam, and column to understand their behavior in prefab structures.

Module-2

Functional Design Principles: Modular coordination–Standardization-Disuniting, Diversity of prefabricates–Material properties-Production–Transportation–Erection-Codal provisions-Lateral load resistance-Location and types of shear walls.
SDA: Prepare simple building plan (prefab structure) using modular coordinate system.

Module-3

Precast concrete Floors: Types of floor slabs–flooring arrangements, limit state Serviceability–Deflection, limit state of flexure-Ultimate strength calculations in shear and flexure.
SDA: Prepare detailing of conventional slab, flat slab using appropriate tools.

Module-4

Precast concrete Beams: Introduction-Types of beams–non composite and composite beams - design and detailing of R C precast non composite beams.
Walls: Types of wall panels - load bearing wall-stability of wall panels–construction procedure of pre-cast walls.
Different Types of joints-their behavior and design–Leak prevention, Joint sealants.
SDA: Prepare the detailing of conventional beams and column manually through sketches/appropriate software tools.

Module-5

Components of Industrial Building (Single-Storey) - Purlins, Principle Rafter, Roof Truss, Gantry Girders, Corbel, Column, Bracings.
Precast Reinforced Concrete Truss–General, Requirement for Design of Truss, Reinforcement as per IS: 3201-1988, Construction Sequence.
Purlins–Design Procedure only.
Pre–Cast Columns–Design Procedure only.
Corbel- General Consideration as per IS-456:2000, Initial Dimensioning of Corbels as per BS 8110, Design of Corbel - Step by Step Procedure as per BS 8110.
SDA: Visit to nearby site or pre-cast plant.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Precast concrete design and Applications	Hass, A. M.	Applied Science Publishers	1983
2	Handbook on Precast concrete for buildings		ICI Bulletin 02, Indian Concrete Institute	2016
3	National Building Code of India		BIS, New Delhi	2016
4	Precast concrete structures	Kim S Elliott	Butterworth Heinemann Publications, ISBN-0750650842, 2002	
5	Precast Concrete Structures	Hubert Bachmann and Alfred Steinle	Berlin: Ernst & Sohn, ISBN: 978-3433029602, 2011.	

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(Group-2): 20CTE15	URBAN TRANSPORT PLANNING

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Urban Transportation Problems & Policy: Urban transportation Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; NUTP, Recommendations of 12th FYP and NTDP

Travel Demand Modelling: Trends, Overall Planning process, Long term - Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques, Tour based models, and Activity based models.

Module-2

Data Collection and Inventories: Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data–Income– Population– Employment– Vehicle Ownership

Trip Generation Models: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis. Household Models, Trip Attraction models, Commercial Trip Rates.

Module-3

Trip Distribution Models: Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

Mode Split Analysis:

Mode Choice Behavior, Competing Modes, Mode Split Curves, Models and Probabilistic Approaches–Logit Model

Module-4

Traffic Assignment Techniques:

Diversion Curves, Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment, Multipath Assignment Technique.

Module-5

Corridor Identification-Plan preparation and evaluation: Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; TOD; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities; Pivot Point Analysis, Environmental and Energy Analysis.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Transportation Engineering: An Introduction	C. JotinKhisty and B. Kent Lall	3rd Edition, Pearson	2016
2	Transportation Engineering and Planning	C.S. Papacostas and P.D. Prevedouros	Third Edition, Prentice Hall of India Pvt. Ltd.	2015
3	Principles of Urban Transport Systems Planning	Hutchinson, B.G.	McGraw Hill	1974
4	Modelling Transport	Juan de Dios Ortuzar and Luis G. Willumsen	4th Edition, JohnWiley and Sons	2011
5	Transportation Planning Handbook	Michael D. Meyer	Fourth Edition, Institute of Transportation Engineers, John Wiley & Sons Inc.	2016

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Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
6	Urban Transportation Planning: A decision oriented Approach	Michael D. Meyor and Eric J. Miller	Second Edition, McGraw Hill	2001
7	Introduction to Transportation Planning	Michael J. Bruton	UCL Press, London, UK	2000

(Group-2): 20CHT23	PAVEMENT MANAGEMENT SYSTEM
Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction: Components & principals of pavement management systems, pavement maintenance measures, planning investment, research management. Pavement Management Data Needs, Inventory Data Needs

Characterizing Pavement performance: Serviceability Performance concept, Pavement Roughness, Equipment for evaluating roughness, Universal roughness standard, Calibration needs, relating roughness to serviceability, Applications of Roughness data

Evaluation of Pavement Structural Capacity - Nondestructive measurement and analysis, Destructive structural evaluation, Structural Capacity Index concepts, Network versus Project level applications of structural capacity evaluation

Module-2

Evaluation of Pavement Surface distress condition surveys – purpose, methods- manual and automated, types of distress, distress survey procedures, equipment used

Evaluation of Pavement Safety: skid resistance evaluation - basic concepts , importance of surface texture, methods of measuring skid resistance, friction management in Pavement Management, Combined measures of Pavement Quality, Data Base Management, **Present status of Pavement networks** – Performance measures, Strategic level pavement management, state of road network in terms of IRI, in terms of Asset value.

Module-3

Determining Present and future needs and priority programming of rehabilitation and maintenance – Establishing criteria, prediction models for pavement deterioration, determining needs, Rehabilitation & Maintenance alternatives and priority programming, **Structural design and economic analysis –** MEPDG process for pavement design, Economic evaluation of alternative pavement design strategies and selection of optimal strategy, Implementation of pavement management system.

Module-4

Design alternatives and Selection: Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, reliability concepts in pavement engineering, life cycles costing, analysis of alternate pavement strategies based on distress and performance, case studies and Problems.

Module-5

Expert systems and Pavement Management: Role of computers in pavement management, applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge–based expert systems, case studies. Implementation of Pavement Management Systems.

Use of softwares: HDM-4/dTIMS.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Pavement Asset Management	Ralph Hass, W. Ronald Hudson with Lyne Cowe Falls	Scrivener Publisher, copyright	2015
2	Modern Pavement Management	Ralph Hass, W. Ronald Hudson. W. R., Zaniewisti .J.	Krieger Publishing Company, Florida	1994
3	Managing Pavement Managing Pavement		Proceedings of North American Conference	
4	Structural Design of Asphalt Pavements	Juan de Dios Ortuzar and Luis G. Willumsen	Proceedings of International Conference, NCHRP, TRR and TRB Special Reports	

(Group-2): 20CTM14	SOIL MECHANICS FOR HIGHWAY ENGINEERS

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction to Soil and their Engineering Properties: Functions of Sub grades oil, Influence of soil properties on design and performance of pavement, embankments and foundations. Laboratory and field tests for the soil classification, methods of soil classification useful for highway, Importance of cohesion, plasticity and volume change of soils. Frost action in soils- factors, mechanics, depth of frost penetration, measures to decrease the damaging effects.

Module-2

Strength of Soils: Stress-strain relationships under different types of loadings- incremental, sustained and repeated loading, time dependent deformations.
Soil Water: Movement of water in soil, gravitational water, held water, soil moisture movements, soil suction and soil vapour.
Soil Compaction: Introduction, Lab Tests, Factors affecting, Structure & Engg behavior of compacted cohesive oil, Field compaction specifications, Field compaction control, Different types of Equipments used for compaction, their choice.

Module-3

Soil Investigations: Soil survey sin highway projects. Methods of soil exploration–boring, geo physical methods, disturbed and undisturbed sampling. Investigations on detrimental matters -organic matters, sulphate sand carbonates.
Permeability of soil: Darcy's Law, Validity, Soil- water system, Types, Determination of permeability, problems.

Module-4

Highway Drainage: Introduction, Importance, Surface drainage, Sub surface drainage, methods, Design of sub surface drainage system, Road construction in water logged areas, Landslides–definition, classifies, factors producing.

Module-5

Stability of slopes: Introduction, Types, Different methods of analysis of slopes for Ø u + 0 & C- Ø soil, Location of most critical circle, Earth dam slopes stability, Taylor's stability number. Effect of Earthquake Force, problems on above.
Reinforced Earth structures Introduction, Components, advantages, types of stability– external, Internal, (No problems), Geo textiles–types, Functions, their uses in road embankments and railway works, other uses.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Basic and Applied soil Mechanics	Gopal Ranjan, A S R Rao	New Age International Publishers	
2	Soil Mechanics & Foundation Engg	Dr. B. C. Punmia, Ashok Kumar Jain, Arun KumarJain	Laxmi Publications(P)Ltd,16th edition	
3	Highway Engg	S. K. Khanna	C.E.G. Justo, 5thedition	
4	Soil Mechanics & Foundation Engg	K. R. Arora	Standard Publishers Distributors	
5	Soil Mechanics for road Engineers		HMSO, London. IRC–Relevant Codes	

Visvesvaraya Technological University, Belagavi.

Ph.D. Coursework Courses – 2020 in Civil Engineering.

(Group-2): 20CSE22	FINITE ELEMENT METHOD OF ANALYSIS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Basic concepts of elasticity, Kinematic and Static variables for various types of structural problems, approximate methods of structural analysis–Rayleigh–Ritz method, Finite difference method, Finite element method. Variation method and minimization of Energy approach of element formulation, Principles of finite element method, advantages and disadvantages, Finite element procedure, Finite elements used for one, two and three dimensional problems, C0, C1 and C2 type elements, Element aspect ratio, Mesh refinement vs. higher order elements, Numbering of nodes to minimize bandwidth.

Module-2

Nodal displacement parameters, Convergence criterion, Compatibility requirements, Geometric invariance, Shape function, Polynomial form of displacement function, Generalized and Natural coordinates, Lagrangian interpolation function, shape functions for one, two &three dimensional elements.

Module-3

soparametric elements, Internal nodes and higher order elements, Serendipity and Lagrangian family of Finite Elements, Sub-parametric and Super- parametric elements, Condensation of internal nodes, Jacobian transformation Matrix, Development of strain-displacement matrix and stiffness matrix, consistent load vector, numerical integration.

Module-4

Application of Finite Element Method for the analysis of one & two dimensional problems: Analysis of plane trusses and beams, Application to plane stress/strain, Axisymmetric problems using CST and Quadrilateral Elements

Module-5

Application to Plates and Shells, Non-linearity: material, geometric and combined non- linearity, Techniques for Non-linear Analysis.

Question paper pattern:
* The question paper will have ten questions.
* Each full question is for 20 marks.
* There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
* Each full question with sub questions will cover the contents under a module.
* Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	The Finite Element Method for Solid and Structural Mechanics	Zeinkeiwich, O.C. and Tayler, R.L.	Butterworth-Heinemann	2013
2	Finite Element Analysis: Theory and programming	Krishnamoorthy, C. S.	Tata McGraw Hill Publishing Co. Ltd.	2017
3	Introduction to the Finite Element Method: A Numerical method for Engineering Analysis	Desai, C., and Abel, J. F.	East West Press Pvt.Ltd.	1972
4	Concepts and applications of Finite Element Analysis	Cook, R.D., Malkas, D.S. and Plesha., M.E.	John Wiley and Sons	2007
5	An Introduction to Finite Element Methods	Reddy, J.	McGraw Hill Co.	2013
6	Finite Element Procedures in Engineering Analysis	Bathe K J	PrenticeHall	
7	Energy and Finite Element Methods in Structural Mechanics	Shames, I. H and Dym, C. J.	McGraw Hill, New York	1985

(Group-2): 20CCS244	STRUCTURAL HEALTH MONITORING

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction to Structural Health Monitoring Definition of structural health monitoring (SHM), Motivation for SHM, SHM as a way of making materials and structures smart, SHM and biomimetics, Process and pre-usage monitoring as a part of SHM, SHM as a part of system management, Passive and active SHM,NDE, SHM and NDECS, Variety and multi disciplinarity: the most remarkable characters of SHM, Birth of the SHM Community.

Module-2

Vibration-Based Techniques for SHM Basic vibration concepts for SHM, Local and global methods, Damage diagnosis as an inverse problem, Model-based damage assessment, Mathematical description of structural systems with damage, General dynamic behavior, Statespace description of mechanical systems, Modeling of damaged structural elements, Linking experimental and analytical data, Modal Assurance Criterion (MAC) for mode pairing, Modal Scaling Factor (MSF), Co-ordinate Modal Assurance Criterion (COMAC), Damping, Expansion and reduction, Updating of the initial model, Damage localization and quantification, Change of the flexibility matrix, Change of the stiffness matrix, Strain- energy-based indicator methods and curvature modes, MECE error localization technique, Static displacement method, Inverse eigen sensitivity method, Modal force residual method, Kinetic and strain energy-based sensitivity methods, Forced vibrations and frequency response functions, Solution of the equation system, Regularization, Parameter subset selection, Other solution methods, Variances of the parameters, Neural network approach to SHM, The basic idea of neural networks, Neural networks in damage detection, localization and quantification, Multi-layer Perceptron (MLP), A simulation example, Description of the structure, Application of damage indicator methods, Application of the modal force residual method and inverse eigen sensitivity method, Application of the kinetic and modal strain energy methods, Application of the Multi- Layer Perceptron neural network, Time-domain damage detection methods for linear systems, Parity equation method, Kalman filters, AR and ARX models, Damage identification in non-linear systems, Extended Kalman filter, Localization of damage using filter banks, A simulation study on a beam with opening and closing crack, Applications, I-40 bridge, Steelquake structure, Application of the Z24 bridge, Detection of delamination in a CFRP plate with stiffeners.

Module-3

Fiber-Optic Sensors Classification of fiber-optic sensors, Intensity-based sensors, Phase modulated optical fiber sensors, or interferometers, Wavelength based sensors, or Fiber Bragg Gratings (FBG), The fiber Bragg grating as a strain and temperature sensor, Response of the FBG to uniaxial uniform strain fields, Sensitivity of the FBG to temperature, Response of the FBG to a non-uniform uniaxial strain field, Response of the FBG to transverse stresses, Photo- elasticity in a plane stress state, Structures with embedded fiber Bragg gratings, Orientation of the optical fiber optic with respect to the reinforcement fibers, Ingress/egress from the laminate, Fiber Bragg gratings as damage sensors for composites, Measurement of strain and stress variations, Measurement of spectral perturbations associated with internal stress release resulting from damage spread, Examples of applications in aeronautics and civil engineering, Stiffened panels with embedded fiber Bragg gratings, Concrete beam repair.

Module-4

SHM with Piezoelectric Sensors The use of embedded sensors as acoustic emission (AE) detectors, Experimental results and conventional analysis of acoustic emission signals, Algorithms for damage localization, Algorithms for damage characterization, Available industrial AE systems, New concepts in acoustic emission, State-the-art and main trends in piezoelectric transducer-based acousto-ultrasonic SHM research, Lamb wave structure interrogation, Sensor technology, Tested structures (mainly metallic or composite parts), Acousto-ultrasonic signal and data reduction methods, The full implementation of SHM of localized damage with guided waves in composite materials, Available industrial acousto ultrasonic systems with piezoelectric sensors, Electromechanical impedance, E/M impedance for defect detection in metallic and composite parts, The piezoelectric implant method applied to the evaluation and monitoring of visco elastic properties.

Module-5

SHM Using Electrical Resistance Composite damage, Electrical resistance of unloaded composite, Percolation concept, Anisotropic conduction properties in continuous fiber reinforced polymer, Influence of temperature, Composite strain and damage monitoring by electrical resistance, 0° unidrectional laminates, Multidirectional laminates, Randomly distributed fiber reinforced polymers, Damage localization. Low Frequency Electromagnetic Techniques Theoretical considerations on electromagnetic theory, Maxwell's equations, Dipole radiation, Surface impedance, Diffraction by a circular aperture, Eddy currents, Polarization of dielectrics, Applications to the NDE/NDT domain, Dielectric materials, Conductive materials, Hybrid method, Signal processing, Time- frequency transforms, The continuous wavelet transform, The discrete wavelet transform, Multi resolution, Denoising, Application to the SHM domain, General principles, Magnetic method, Electric method, Hybrid method.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Structural Health Monitoring	Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes	Wiley ISTE	2006
2	Health monitoring of structural materials and components- Methods with Applications	Douglas E Adams	John Wiley and Sons	2007
3	Structural Health Monitoring and Intelligent Infrastructure, Vol-1	J. P. Ou, H. Li and Z. D. Duan	Taylor and Francis Group, London, U.K	2006
4	Structural Health Monitoring with Wafer Active sensors, smart materials and structures	Victor Giurglutiu	Gandhi and Thomson	2007
5	Structural Health Monitoring: current status and perspective	Fu Kuo Chang	CRC Press, Inc.	1997

(Group-2): 20CSE331	FRACTURE MECHANICS APPLIED TO STRUCTURAL ENGINEERING

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Stress concentration in elastic materials
Theory of stress concentration in elastic materials, stress concentration factors around circular and elliptic holes.
Influence of ratio of radii on stress concentration factor in elliptic hole.

Module-2

Linear Elastic Fracture mechanics
Modeling a crack as a flat elliptic hole by Inglis and the limitations of the model, Griffith theory of brittle fracture Theories of linear elastic fracture mechanics, stress intensity factors, Irwin's definition. Fracture toughness KIc, KIIc, KIIIc & corresponding values of GC.

Module-3

Elasto-plastic fracture mechanics
Crack-tip plasticity in metals. Irwin's modification for elasto-plastic material.
J integral, CMOD, CTOD. Mixed mode problems and evaluation of critical fracture parameters.

Module-4

Fracture of Concrete
Limitations of theories of linear elastic fracture mechanics in concrete, Review of concrete behaviour in tension and compression.
Kaplan's experiments, concept of fracture energy, definition of a quasi-brittle material, concept of softening.

Module-5

Advanced concepts in fracture behavior of concrete
Definition of fracture energy by RILEM, Influence of size on fracture behavior, Bazant's size effect law.
Size dependent & independent fracture energies. Application of fracture mechanics in design of concrete structures.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Theory of Elasticity	Timoshenko & Goodier	McGraw Hill	
2	Continuum Mechanics Fundamentals	Valliappan S.	Oxford IBH, ND. New Delhi	1982
3	Elementary Engineering Fracture Mechanics	Broek, D.	4th edition, Martinus Nijhoff	1987
4	Fracture Mechanics-Fundamentals and Applications	T. L. Anderson	CRC press	
5	Advanced Mechanics of Solids	Srinath L.S.	10th print, Tata McGraw Hill Publishing company, New Delhi	1994
6	Fracture mechanics and structural concrete	Bhushan L Karihaloo	John Wiley & Sons Inc	
7	Fracture and Size Effect in Concrete and Other Quasibrittle Materials	Zdenek P. Bazant, Jaime Planas	CRC press	

(Group-2): 20CTE23	GEOMETRIC DESIGN OF TRANSPORTATION FACILITIES
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Classification of rural highways and urban roads. Objectives and requirements of highway geometric design
Design Controls: Topography, vehicle characteristics and design vehicle, driver characteristics, speed, traffic flow and capacity, levels of service, pedestrian and other facilities, environmental factors

Module-2

Design Elements: Sight distances-types, analysis, factors affecting, measurements,
Horizontal alignment-design considerations, stability at curves, super elevation, widening, transition curves; curvature at intersections, vertical alignment-grades, ramps, design of summit and valley curves, combination of vertical and horizontal alignment, express ways, IRC standards and guidelines for design problems

Module-3

Cross Section Elements: Right of way and width considerations, roadway, shoulders, kerbs, traffic barriers, medians, Pavement surface characteristics-types, cross slope, skid resistance, unevenness.

Module-4

Design Considerations: Design considerations for rural and urban arterials, freeways and other rural and urban roads-design speeds, volumes, levels of service and other design considerations.

Module-5

Design of Inter sections & Parking lots: Characteristics and design considerations of at-grade inter sections; Different types of islands, channelization; median openings; Rotary intersections; Grade separations and interchanges-types, warrants, adaptability and design details; ramps. Computer applications for intersection and inter change design.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Highway Engineering	Khanna S. K and Justo,C.E.G. Justo	Nem Chandand Bros.	
2	Planning and Design Guide: At-Grade Intersections'	Jack E Leishand Associates	Illinios	
3	A Policy on Geometric Design of Highways and Streets'	AASHTO	American Association of State Highway and Transportation Officials, Washington D.C.	
4	Roads in Urban Areas	DSIR	HMSO, London, Relevant IRC publications	

(Group-3): 20CSE21	ADVANCED DESIGN OF STEEL STRUCTURES

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Laterally Unrestrained Beams:
Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discrete lateral restraints, Mono-symmetric and non-uniform beams–Design Examples. Concepts of-Shear Center, Warping, Uniform and Non-Uniform torsion.

Module-2

Beam- Columns in Frames:
Behaviour of Short and Long Beam-Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns, Methods in IS 800-Examples

Module-3

Steel Beams with Web Openings:
Shape of the web openings, practical guide lines, and Force distribution and failure patterns. Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties. Vierendeel girders (design for given analysis results)

Module-4

Cold formed steel sections:
Techniques and properties, Advantages, Typical profiles, Stiffened and un stiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions- numerical examples, beam design, column design.

Module-5

Fire resistance:
Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance Ratings. Numerical Examples.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Design of Steel Structures	N. Subramanian	Oxford, IBH	
2	Design of Steel Structures	Duggal, S. K.	TataMcGraw-Hill,	
3	IS 800: 2007, IS 801-2010 , IS 811-1987			
4	BS5950 Part-8			
5	INSDAG Teaching Resource Chapter 11 to 20: www.steel-insdag.org			
6	SP 6 (5)			1980

(Group-3): 20CGT21	REINFORCED SOIL STRUCTURES
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Historical background: Introduction to reinforced soil structures, comparison with reinforced cement concrete structures.
Reinforced Earth: Principles, concepts and Mechanisms of reinforced earth

Module-2

Materials used, properties, laboratory testing and constructional details, metallic strips, metallic grids, geo textiles, geo grids, geo membranes and geo composites, their functions and design principles

Module-3

Geo textiles: Introduction, design methods, function and mechanism, geo textile properties and test methods – physical, mechanical and hydraulic properties, construction methods and techniques using geo textiles

Module-4

Design applications of reinforced soil structures in pavements, embankments, slopes, retaining walls and foundations, reinforced soil structures for soil erosion control problems, geo synthetic clay liners

Module-5

Design applications of reinforced soil structures : Slopes, Soil Nailing ,Case studies of reinforced soil structures, discussion on current literature and design problems

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Designing with Geo synthetics	Koerner R H	Prentice Hall Inc.	1994
2	Reinforcements and Soil Structures	Jones, CJEP	Butterworth Publications	1996
3	Membranes in ground engineering	Rankilor, P R	John Wiley & Sons	1985
4	Soil Reinforcement with Geo textiles	Jewel R A	CIRIA	1996
5	Geo textiles hand book	Ingold J S and Miller K S	Thomas Telford Ltd.	1988

(Group-3): 20CWM14	ENVIRONMENTAL POLLUTION AND CONTROL MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Environmental Pollution and Sources, types of pollution and their Global, regional and local environmental effects.

Air Pollution: Classifications and sources of air pollutants. Secondary pollutants and formation of Photo-chemical Smog, PAN, PBN, Acid rain; Atmospheric Diffusion and Plume Behaviour, Effects of air pollutants on plants.

Module-2

Water Pollution: Sources of water and their contamination, Types of pollutants, Industrial effluents- pulp and paper mills, Sugar, Distillery, Domestic wastes, Effluents from water treatment plants. Eutrophication – causes, effects and control measures.

Soil pollution: Plants as soil pollution indicators, Formation of salts in soils,Causes of soil pollution, Effects of Fungicides and weedicides on soil components and pollution. Different kinds of synthetic fertilizers (N, P, K), their toxicity and Environmental effects, control of soil pollution.

Module-3

Radioactive Pollution: Types of radiations (Alpha, Beta, Gamma), Units of radioactivity, Sources of radioactive material in environment, Biological impact and health hazards associated with radiation, control of Radioactive pollution. Fate and movement of radioactive material in environment.

Heavy Metal Pollution: Sources of heavy metals, Accumulation of heavy metals in abiotic environment and biotic components, Bioaccumulation, Bio-magnification, Toxic effects (Lead, Mercury, Arsenic).

Module-4

Noise Pollution: Basic properties of sound, Units, Sources of Noise Pollution, Effects of noise pollution, Measurement of sound. Measures to control noise pollution in industries-automotive type silencers, vibration isolation, damping, lagging. Protection of personnel–ear plugs, ear muffs, helmets, isolation.

Thermal pollution: Definition and Sources, effects of thermal pollution–physical, chemical, biological, control of thermal pollution.

Module-5

Oil pollution: introduction, major oil spills in the world, fate and movement of oil after spillage - spreading, evaporation, emulsification, dispersion, dissolution, sedimentation, biodegradation. Effects and control of oil pollution, Remote sensing in water quality monitoring.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Environmental Chemistry and Pollution Control	S. S. Dara	S. Chand and Co Ltd., New Delhi	
2	Environmental Protection and Pollution Control Manual	Jones, CJEP	Karnataka State Pollution Central Board	
3	Environmental Chemistry	B.K. Sharma and H. Kaur		
4	Handbook of Environmental Health and Safety – principle and Practices, Vol. II	Jewel R A	CIRIA	1996

(Group-3): 20CEE241	ENVIRONMENTAL GEO-TECHNOLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Soil- Pollutant Interaction:

Introduction to geo environmental engineering–environmental cycle–sources, production and classification of waste–causes of soil pollution–factors governing soil-pollutant interaction-Physicochemical behavior and modelling -failures of foundations due to pollutants stations, collection route optimization and economics, regional concepts. System dynamics

Module-2

Characterization, Stabilization and Disposal Safe disposal of waste–site selection for landfills–characterization of land fill sites–waste characterization–stability of landfills–current practice of waste disposal- passive contaminant system-Hazardous waste control and storage system–mechanism of stabilization - solidification of wastes–micro and macro encapsulation–absorption, adsorption, precipitation- detoxification–organic and inorganic stabilization. Biological and chemical techniques for energy and other resource recovery: composting, vermin composting, vermin gradation, fermentation. Incineration of solid wastes. control measures.

Soil pollution: Plants as soil pollution indicators, Formation of salts in soils, Causes of soil pollution, Effects of Fungicides and weedicides on soil components and pollution. Different kinds of synthetic fertilizers (N, P, K), their toxicity and Environmental effects, control of soil pollution.

Module-3

Transport of Contaminants:

Contaminant transport in sub surface–advection–diffusion–dispersion–governing equations–contaminant transformation–sorption–biodegradation–ion exchange –precipitation–hydrological consideration in land fill design–ground water pollution – bearing capacity of compacted fills – pollution of aquifers by mixing of liquid waste –protecting aquifers.

Module-4

Detection and Testing Methods
Methodology-review of current soil testing concepts–Proposed approach for characterization and identification of contaminated ground soil for engineering purposes

Module-5

Remediation of Contaminated Soils:

Rational approach to evaluate and remediate contaminated sites – monitored natural attenuation–exsitu and insitu remediation–solidification, bio–remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting – Ground water remediation – pump and treat, air sparging, reactive well- application of geo synthetics in solid waste management – rigid or flexible liners.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Geotechnical practice for waste disposal	Daniel, B.E.	Chapman and Hall, London	1993
2	Introduction to Environmental Geo technology	Fang, H.Y.	CRC press New York	1997
3	Hazardous Waste Management	Wentz, C.A.	McGraw Hill, Singapore	1989
4	Hazardous Waste Management	Lagrega M.d., Bukingham P.L. and Evans J.C.	McGraw Hill, Inc. Singapore	1994

(Group-3): 20WRM23	WATERSHED CONSERVATION AND MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Watershed – Definition and Classification – Components- Basic factors influencing watershed development – Codification - Watershed delineation – Characteristics of watershed: size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology – Socio - economic characteristics.

Module-2

Soil conservation measures: Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Control– Estimation of Soil Erosion- Soil Loss Models- Sedimentation - Soil Conservation Practices: Vegetative and Mechanical.

Module-3

Water harvesting and conservation: Types of storage Structures-Water yield from Catchments-Losses of stored water- Water Conservations Methods-Water harvesting methods and Techniques-Rainwater Harvesting-Catchment, Harvesting structures, Roof water harvesting- Soil Moisture Conservation-Check Dams-Artificial Recharge-Farm Ponds- Percolation tanks.

Module-4

Watershed management: Project Proposal Formulation-Watershed Development Plan Entry Point Activities– Estimation–Watershed Economics-Agro forestry–Grassland Management–Wasteland Management–Watershed Approach in Government Programmes–Developing Collaborative know how–People's Participation–Evaluation of Watershed Management

Module-5

Watershed management plan: Methodology of planning a watershed management, identification of watershed problems, socio-economic issues - application of Remote Sensing and GIS in watershed management.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Watershed Management	Dhuruva Narayana.V. V, Sastry. G and Patnaik. U. S	Publications and information division, Indian Council of Agriculture Research, New Delhi	1990
2	Soil and Water Conservation Engineering	Gelnn O. Schwab	John Wiley and sons, New York	1981
3	Hydrology and Soil Conservation engineering	Ghanashyam Das	Prentice Hall of India Private Limited, New Delhi	2000
4	Watershed Management in India	Murthy J.V.S	Wiley Eastern Limited, New Delhi	1995
5	Soil and Water Conservation Engineering	Suresh R	Standard Publishers	
6	Watershed Management	Tideman E.M.	Omega Scientific Publishers, New Delhi	1996

Visvesvaraya Technological University, Belagavi.

Ph.D. Coursework Courses – 2020 in Civil Engineering.

(Group-3): 20CCT15	MECHANIZATION IN CONSTRUCTION
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario.
Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Dozers, scrapers, excavators, Finishing equipment, Trucks and Hauling equipment, Hoisting equipment, Draglines and Clamshells.

Module-2

Mechanization in aggregate manufacturing: Flow chart of process of manufacturing of coarse aggregates, Different types of crushers used, process of screening and washing. Recycled aggregates: Types of recycled aggregates. Artificial aggregates: Types of artificial aggregates. Mechanization in concrete production (RMC plant):Flow chart of the process of concrete production. Methods of placing and compaction of concrete.

Module-3

Mechanization in rebar fabrication Mechanization through construction: formwork and scaffolding types, materials and design principles.

Module-4

Mechanization through construction methods/technologies: segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology. Pile Driving Equipments. Underground & under water construction (problems encountered, under water drilling, Blasting & grouting)

Module-5

Mechanization through construction methods of Drilling, Blasting and Tunneling Equipment : Definition of terms, bits, Jack hammers, Drifters, wagon drills, chisel drills, piston drills, blast hole drills, shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment; selecting drilling pattern. Safety and Environmental issues in mechanization

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Construction Equipment and its Planning and Applications	Mahesh Varma	Metropolitan Book Co. (P) Ltd., New Delhi. India	
2	Construction Equipment and Management	Sharma S. C.	Khanna Publishers, Delhi	1988
3	Construction Review	Ghanashyam Das	Published by Civil Engineering and Construction Review, New Delhi	1991

(Group-3): 20CEM244	URBAN HYDROLOGY, STORM DRAINAGE AND MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Urban Hydrologic Process: Process of urbanization–Water in Urban ecosystem–Urban water subsystems–Urban hydrologic cycle. Impact of urbanization on urban runoff and stream flow quantity–Impact of urbanization on quality of runoff and stream flow – Erosion due to urban runoff.

Module-2

Storm water Modeling: Analysis of hydrologic changes due to urbanization- Approaches to study – Data collection and analysis–Probabilistic and statistical approaches. Modelling of urban water quantity–Types of models–Rainfall, Runoff modeling; urban watershed modeling (quantity)–Rational Method (or coefficient method), Runoff hydrograph, unit hydrographs–10 min synthetic unit hydrograph–Linear reservoir model (Viessman) – Chen and Shubinski model–QUURM Model–TVA model. Urban watershed modellingfor water quality of runoff and stream water quality.

Module-3

Urban Drainage Systems: Sanitary and combined sewer systems–components–Design considerations for fixing sewer capacity–Infiltration into and exfiltration from sewers-causes Infiltration inflow analysis–Field investigations–Control measures.
Design consideration of the components of the sewer systems–Performance of the sewer system both under dry weather flow condition and under storm water impact-Sewer sediment.

Module-4

Storm Water Management: Urban storm runoff quantity and quality management – Mitigation of damaging effects of urban storm runoff Structural and non-structural control measures – Storm water management models.

Module-5

Urban Drainage Systems Maintenance: Maintenance management of UDS and its subsystems–Drainage system–Storm drain conveyance system–Pump stations–Open channel–Illicit connections and discharges–Spill response–Other considerations (limitations and regulations).

Question paper pattern:
* The question paper will have ten questions.
* Each full question is for 20 marks.
* There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
* Each full question with sub questions will cover the contents under a module.
* Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Storm water Hydrology and Drainage	Stephenson D	Elsevier Publications, 2nd Edition	1981
2	Urban Hydrology	Hall J. M	Elsevier Applied Science Publishing Company, 1st Edition	1984
3	Storm water Modelling	Overtens D.E. and Medows M. E.	Academic Press, 2nd Edition	1976
4	Urban Water Infrastructure Planning, Management, and Operations	Grigg, N.S	John Wiley & Sons, 2nd Edition	1986
5	Introduction to Hydrology	Viessman W.I., Knapp J.W., Lewis G.L. and Henbrough T.E.	Harper and Row Publishing Company, 2nd Edition	1977
6	Manual of Sewerage and Sewage Treatment		Ministry of works and Housing, Government of India	2006

(Group-3): 20CIM241 CONSTRUCTION EQUIPMENT AND SAFETY MANAGEMENT	
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Plants and Equipment for production of materials: Crushers, mixers, bituminous mixing plants, concrete mixing plants, advantages, choice,

Module-2

Construction Equipment: Operations, applications and performance of dozers, excavators, graders, compactors, pavers, haulers, crawler, wheel tractors, power shovels, Cranes, hauling equipment's.

Module-3

Selection of Construction Equipment: Task considerations, cost considerations, engineering considerations, equipment acquisition options, Maintenance of Equipment: Repairs, log maintenance, safety during operation, economical life of equipment

Module-4

Safety in Use of Construction equipment's: Human Factors in Construction Safety management Motivation: Management, Supervisors, Workers, Motivational schemes

Module-5

Safety Management: Role of first line supervisors, Role of middle managers, Role of workers, top management practices, safety audit, Safety in site preparation, Design, safety culture, Top Management, Company Activities and Safety-Safety Personnel, Sub-contractual Obligation-Project Coordination and Safety Procedures

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Construction Planning, Equipment and Methods	Peurifoy, R.L., Ledbette. W.B.	McGraw Hill Co.,	
2	Civil Engineering Construction	Antil J.M.	McGraw Hill Book Co.	
3	Construction equipment and its Management	S C Sharma	Khanna Publications	
4	Hand Book on Construction Safety Practices		SP 70, BIS	2001
5	Construction Safety	Jimmy W. Hinze	Prentice Hall Inc.	1997
6	Construction Safety and Health	Richard J. Coble, Jimmie Hinze and Theo C. Haupt		

(Group-3): 20CTE21	PAVEMENT DESIGN AND ANALYSIS

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Road Pavements and pavement layers- types, functions, choice Factors affecting design and performance of flexible and rigid pavements–Pavement design factors, loads–axle load distribution, ESWL, EWL, VDF due to varying load sand CSA.

Module-2

Sub grade support-CBR and plate bearing tests, Resilient Modulus, fatigue tests, permanent deformation Pavement material Characteristics, climatic, drainage and environmental factors, their effects and evaluation. Factors affecting design and performance of airport pavements.

Module-3

Stresses and Deflection/strain in flexible pavements: Application of elastic theory, stresses, deflections/train sin single, two and three layer system, Application sin pavement design problems

Module-4

Flexible pavement design: Emperical, semi- empirical and theoretical design approaches, principle, advantages and application. Design steps by CBR method as per IRC, outline of other common design methods such as AASHTO and Asphalt Institute methods, Problems.

Module-5

Rigid pavement design: Determination of ESWL, EWL for dual and dual tandem wheel load sin Rigid pavements, General design principle, Stresses in rigid pavements, stresses due to wheel load sand temperature variations, design of cement concrete Pavements (joint sand slab thickness) as per I R C guidelines. Design features of CRCP, SFRC and ICBP, Problems.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Principles of Pavement Design	Yoder and Witczak	John Wiley and sons Inc (second edition)	1975
2	Design of functional pavements	Yang	McGraw Hill Book Co.	
3	Pavement Analysis	Huang	Elsevier Publications	
4	Design & Performance of Road Pavements	David Croney, Paul Croney	McGraw Hill Book Co.	
5	Modern Pavement Management	W. Ronald Hudson, Ralph Haasand Zeniswki	McGraw Hill and Co. IRC37-2001, IRC81-1997, IRC58–2002, IRC59–1976, IRC101-1988, Indian Roads Congress	
6	Highway Engineering	Khanna and Justo	Nem chand & Bros, Roorkee	

(Group-3): 20CHT242	DESIGN OF BRIDGE AND GRADE SEPARATED STRUCTURES
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction to Bridges: Basic Elements of a Bridge.
Types of bridges and grade separated structures for highways, standard Specifications for road bridges and grade separated structures to fulfill traffic and Structural and Hydraulic design requirements.

Module-2

Bridge bearings- joints, approaches, construction and maintenance aspects.

Module-3

Basic design approaches of RCC, PSC and steel bridges superstructure. Types of bridges for IRC loading conditions

Module-4

General Design Considerations for grade separated structures and their choices, IRC Class AA Tracked and Wheeled Loading Analysis, Problems.

Module-5

Introduction to Construction Specification and quality control:
for foundations and substructures of bridges and Grade separated Interchanges–Types, warrants and Design standards. Concept of evaluation of existing bridge structures. Methods of rehabilitation and widening.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Essentials of bridge Engineering	D.Johnson Victor	Oxford, IBH publishing company	
2	Bridge Engineering	Ponnuswamy	McGraw Hill Publication	1989
3	Relevant IRC codes			
4	Design of Concrete Bridges	Vazirani Ratwani & M.G.Aswani	Khanna Publishers, New Delhi	
5	Design of Bridges	Dr. Krishna Raju	Oxford & IBH Publishing Company Limited	
6	Analysis and design of Bridges	M.A.Jayaram	Sapna Publishers, Bangalore	

(Group-3): 20CTM241	TRANSPORTATION INFRASTRUCTURE DESIGN
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Functional Classification of Highway System; Design Controls–Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design, Cross Section Elements: Design specifications; Pavement Surface characteristics–Skid Resistance, Road Roughness; Camber, Objectives, design standards. Specifications for hill roads.

Module-2

Horizontal Alignment of Roads: Sight Distances–Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance; Objectives of horizontal curves; Super elevation; Extra- widening on Curves; Transition Curves–Objectives and Design. Transition Curve setting methods, Introduction to MX Roads software.

Module-3

Vertical Alignment of Roads: Gradients–Types of Gradients, Design Standards; Vertical Curves–Summit Curves, Valley Curves and Design criteria for Vertical Curves; Importance of Sight Distances for Horizontal and Vertical Curves; Combination of Vertical and Horizontal Curves–Grade Compensation.

Module-4

Geometric Design of Intersections: Types of Intersections; Design Principles for Intersections; Design of At-grade Intersections–Channelization, Objectives; Traffic Islands and Design standards; Rotary Intersection–Concept, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

Module-5

Miscellaneous Elements: Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks – Guidelines and Design standards; Bus bays–Types and Guide lines; Design of On-street and Off street Parking facilities–Guidelines for lay out Design, Traffic Signs and Markings.
Note: Computer Lab. using highway geometric design software for design of intersections, interchanges and parking lots to be carried out.

Question paper pattern:
* The question paper will have ten questions.
* Each full question is for 20 marks.
* There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
* Each full question with sub questions will cover the contents under a module.
* Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Principles and Practice of Highway Engineering	L. R. Kadiyali and N.B.Lal	Khanna	2007
2	A Policy on Geometric Design of Highways and Streets		AASHO, American Association of State Highway and Transportation Officials, Washington D.C.	
3	Highway Engineering	Khanna S.K. and Justo, C. E.G.	Nem Chand and Bros.	2000
4	Roads in Urban Areas	DSIR	HMSO, London	
5	Planning and Design Guide: At-Grade Intersections	Jack E Leishand Associates	Illinios	
6	Relevant IRC Codes & Publications			

(Group-3): 20CSE242	DESIGN OF PRECAST & COMPOSITE STRUCTURES
Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Concepts , components, Structural Systems andDesign of precast concrete floors
Need and types of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections.
Design of precast Concrete Floors:
Theoretical and Design Examples of Hollow core slabs,. Precast Concrete Planks, floor with composite toppings with and without props.

Module-2

Design of precast reinforced and pre-stressed Concrete beams
Theoretical and Design Examples of ITB – Full section precast, Semi Precast, propped and unpropped conditions. Design of RC Nibs

Module-3

Design of precast concrete columns and walls
Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints.

Module-4

Design of Precast Connections and Structural Integrity Beam bearing, Beam half Joint, Steel Inserts, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties.

Module-5

Design of Steel Concrete Composite Floors and Beams Composite Floors:
Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example
Composite Beams:
Elastic Behaviour, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Precast Concrete – Design and applications	Hass A.M.	Applied Science	1983
2	Plant cast, Precast and Pre-stressed concrete	David Sheppard	McGraw Hill	1989
3	IS 15916-2011, IS 11447, IS6061–I and III	NBC – 2005 (Part I to Part VII)	BIS Publications, New Delhi	2005
4	Composite Structure of Steel and Concrete (Volume 1)	R.P. Johnson	Blackwell Scientific Publication (Second Edition), U.K.	1994
5	Code of Practice for Composite Construction in Structural Steel and Concrete	IS: 11384		1985
6	INSDAG Teaching Resource	Chapter 21 to 27: www.steel-insdag.org		

(Group-3): 20CCS253	COMPOSITE AND SMART MATERIALS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction to Composite materials: Classifications and applications. of fibers, volume fraction and load distribution among constituents, minimum & critical volume fraction, compliance & stiffness matrices, coupling.

Module-2

Anisotropic elasticity: Unidirectional and anisotropic lamina, thermo-mechanical properties, micro- mechanical analysis, classical composite lamination theory, Cross and angle–play laminates, symmetric, anti-symmetric and general asymmetric laminates, mechanical coupling, laminate stacking,

Module-3

Analysis of simple laminated structural elements: Ply-stress and strain, lamina failure theories - first fly failure, environmental effects, manufacturing of composites.

Module-4

Smart materials: Introduction, Types of smart structures, actuators & sensors, embedded & surface mounted, piezoelectric coefficients, phase transition, piezoelectric constitutive relation.

Module-5

Beam modeling with strain actuator, bending extension relation.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Mechanic of Composite Materials	Robart M Jones	McGraw Hill Publishing Co.	2015
2	Analysis and Performance of Fiber Composites	Bhagwan D Agarawal, and Lawrence J Brutman	John Willy and Sons	2006
3	Mechanics of composite materials and structures	Madujit Mukhopadyay	University Press	2004
4	Piezoelectric actuator modeling using MSC/NASTRAN and MATLAB	Mercedes C. Reaves and Lucas G. Horta	NASA/TM-2003-212651, Langley Research Center, Hampton, Virginia	2003
5	Lecture notes on Smart Structures	Inderjit h Chopra	Department of Aerospace Engg., University of Maryland	
6	Use of piezoelectric actuators elements of intelligent structures	Crawley E F. and deLuis J	A journal Vol 25, No 10, Pp 1373-1385	Oct 1987
7	Detailed models of piezo-ceramics actuation of beams	Ceawley E. and Anderson E	Ceawley E. and Anderson E	April 1989

(Group-3): 20CSE31	DESIGN OF BRIDGES	
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**	

Module-1

Introduction & Design of Slab Culvert
Bridge Engineering and its development in past, Ideal site selection for Bridges, Bridge classifications, Forces acting on Bridge. Analysis for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles. Structural design of slab culvert using limit state method with reinforcement details.

Module-2

Box Culvert
Introduction to box culvert, advantage of structural continuity, Analysis for maximum BM and SF at critical sections using moment distribution method for various load combinations such as Dead, Surcharge, Soil, Water and Live load as per IRC class A, B, AA tracked and wheeled vehicles. Structural design of box culvert using limit state method with reinforcement details.

Module-3

T Beam Bridge
Components of T Beam Bridge, Load transfer mechanism, Proportioning the of Components, Analysis of **Slab** using **Pigeauds Method** for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of **Slab** using limit state method with reinforcement details. Analysis of **Cross Girder** for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of slab using limit state method with reinforcement details. Analysis of **Main Girder** using **Courbon's Method** for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of **Main Girder** using limit state method with reinforcement details.

Module-4

PSC Bridge
Introduction to Pre & Post Tensioning, Proportioning of Components, Analysis & Structural Design of Slab, Analysis of Main Girder Using **Courbon's Method** for IRC Class AA, Tracked vehicle, Calculations of Prestressing Force, Calculations of Stresses, Cable profile, Design of End Block, Detailing of Main Girder.

Module-5

Balanced Cantilever Bridge
Introduction & Proportioning of Components, Analysis of Main Girder Using **Courbon's Method** for IRC Class AA, Tracked vehicle Design of Simply Supported Portion, Cantilever Portion, Articulation, using limit state method with reinforcement details

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Essentials of Bridge Engineering	Dr D Johnson Victor	& IBH Publishing Co New Delhi	
2	Design of Bridges	Dr N Krishna Raju	Oxford & IBH Publishing Co New Delhi	
3	Principles and Practice of Bridge Engineering	S P Bindra	Dhanpat Rai & Sons New Delhi	
4	IRC 6-1966 Standard Specifications And Course Code Of Practice For Road Bridges Section II Loads and Stresses		The Indian Road Congress New Delhi	
5	IRC 21-1966 Standard Specifications And Course Code Of Practice For Road Bridges Section III Cement Concrete (Plain and reinforced)		The Indian Road Congress New Delhi	

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
6	IS 456-2000 Indian Standard Plain and Reinforced Concrete Course Code of Practice (Fourth Revision)		BIS New Delhi	
7	IS 1343 - Indian Standard Pre-stressed Concrete Course Code of Practice		BIS New Delhi	

(Group-3): 20WLM22	GROUND WATER HYDROLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

General Water Balance, Regional Ground Water Balance, Distribution of Subsurface Water, Different Types of Aquifers, Heterogeneity and Anisotropy, Occurrence of Ground Water in Hydro Geological Formations, Structure and Types of Wells. –Problems on estimation of basic parameters.

Module-2

Governing Equation of Groundwater Flow in Aquifers. Derivation of General Differential Equations for Ground Water Flow, Regional Ground Water Problems, Governing Equations for Transient Flow Conditions.

Module-3

Models for Ground Water Analysis: Introduction, Major Applications of Groundwater Models, Numerical Modelling of Groundwater Systems, Groundwater Modelling by the Finite Difference (FD). –Problems.
Pollution of Groundwater: Hydrodynamic Dispersion of Pollutants in Groundwater Environment (Advection dispersion, Molecular diffusion) Optimization models for management of groundwater quantity and quality.

Module-4

Well Hydraulics: Analysis of Steady Radial Flow Towards a Well in a confined Aquifer, Dupuit Forcheimmer (DF) Theory of free Surface Flow For Steady Flow in Unconfined Aquifers, Analysis of Steady Radial Flow in Laterlly Stratified Phreatic Aquifers. Problems on well Hydraulics.

Module-5

Artificial Recharge: Spreading methods, Induced-recharge method, Recharge- well method, Subsurface dams, Wastewater discharge, Recharge by urban storm runoff, Case history.

Geophysical Methods in Groundwater Exploration, Introduction, Electrical Resistivity Method, Analytical Derivation for Resistivity in Vertical Electrical Sounding, Seismic Retraction Method, Determination of Aquifer Thickness, Geologic and Hydrologic methods, Hydrogeologic well logging, Tracer techniques.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Numerical Groundwater Hydrology	A. K. Rastogi	Penram International Publishing (India) Pvt.Ltd.	2007
2	Ground Water Hydrology	Todd D.K. & Mays, L.W.	3 Ed, Wiley	
3	Ground Water	Raghunath H.M.	New Age Publishers	2007

(Group-4): 20CSE23	EARTHQUAKE RESISTANT STRUCTURES
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification–Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems.

Module-2

The Response history and strong motion characteristics.
Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS- 1893.

Module-3

Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.

Module-4

Design of Reinforced concrete buildings for earthquake resistance-Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893. Structural behavior, design and ductile detailing of shear walls.

Module-5

Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Dynamics of Structures – Theory and Application to Earthquake Engineering- 2nd ed.	Anil K. Chopra	Pearson Education	
2	Earthquake Resistant Design of Building Structures	Vinod Hosur	WILEY (india)	
3	Earthquake Resistant Design of Structures	Duggal	Oxford University Press	
4	Earthquake resistant design of structures	Pankaj Agarwal, Manish Shrikande	PHI India	
5	IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993			
6	Design of Earthquake Resistant Buildings	Minoru Wakabayashi	McGraw Hill Pub.	
7	Seismic Design of Reinforced Concrete and Masonry Buildings	T Paulay and M J N Priestley	John Wiley and Sons	

(GROUP-4): 20CGT22	SOIL DYNAMICS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Theory of vibration–single degree, two degree and multi degree of freedom system. Free and forced vibration, transient response, resonance and its effects.

Module-2

Wave Propagation–theory and application to dynamic problems, dynamic soil properties- general, laboratory and field methods, factors affecting. Different properties, vibration inducing and measuring instruments.

Module-3

Shear strength and liquefaction of soils- stress, strain, strength characteristics of soils under dynamic loads. Factors affecting, resonance column test, triaxial test under dynamic loads. Liquefaction of soils and factors influencing liquefaction, dynamic earth pressure, retaining wall problems under dynamic loads.

Module-4

General principles of machine foundation design- introduction, design criteria, types and requirements of machine foundations, foundations for reciprocating machines, foundations for forge hammers, foundations for turbo generators.

Module-5

Vibration isolation–Introduction, mechanical isolators, isolation by artificial barriers, active and passive isolation, case histories of foundation of isolation.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Soil Dynamics and Machine Foundation (4010)	Swami Saran	Galgotia Publications Pvt. Ltd.	
2	Soil Dynamics	Prakash, S.	McGraw Hill Book Company	1981
3	Foundation for Machines Analysis and Design	Prakash S. and Puri V. K	John Wiley & Sons	1998
4	Vibration Analysis and Foundation Dynamics	Kameswara Rao, N. S. V.	Wheeler Publication Ltd.	1998
5	Vibrations of Soils and Foundations	Richart, F. E. Hall J. R and Woods R. D.	PrenticeHall Inc.	1970
6	Principles of Soil Dynamics (4002)	Das B. M.	PWS KENT publishing Company, Boston	

(GROUP-4): 20CWM22	INDUSTRIAL EFFLUENT TREATMENT AND ENGINEERING
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Industrial Effluent Significance of industrial effluent treatment, Effects of Industrial Wastes on sewerage system and sewage treatment plants and receiving water bodies. Effects of waste additions on physical and chemical properties of soil.
Disposal Standards Effluent standards and receiving water quality standards – differences, steps for implementation. Disposal alternatives–methods, operating procedures, recommended standards.

Module-2

Industrial Waste Survey - Process flow charts for manufacturing of Sugar, Distillery, Paper & Pulp, Dairy industries, condition of waste stream, Material balance–procedure & significance, Sampling–Grab, Composite and integrated samples. Continuous monitoring–pH, Conductivity, Bio-monitoring.

Module-3

Pre-treatment of Industrial Wastewater–Volume reduction–methods and its significance, Strength reduction–methods and its significance, Neutralization, Equalization and Proportion, Removal of Organic and inorganic dissolved solids.

Module-4

Effluent Treatment for industries: Distillery, Sugar Industry, Pulp and paper, Cement Industry, Textile, Dairy Industry, Fertilizer, Pesticides and Pharmaceutical industries – flowchart with significance of each treatment unit.

Module-5

Design of complete treatment system & disposal of Effluents: Distillery, Diary, Sugar Paper and Pulp mill to meet PCB standards.
Treatment of Radio Active Wastes - Low activity and high activity radiation, application of radioactive techniques for wastewater treatment. **Bio-Remediation**.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Liquid Waste of industry theories, Practices and Treatment	Nemerow N.N.	Addison Willey New York	1971
2	Wastewater Engineering - Treatment and Reuse	Metcalf and Eddy Inc.	4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi	2003

(GROUP-4): 20CEE31	ENVIRONMENTAL IMPACT ASSESSMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Environmental Legislation: Introduction & need, Constitution of India, Environmental Jurisprudence, National Environmental Policy, Environmental Tribunal (Green Tribunal) Legal framework Legislative act, rules, regulations notification and amendments

Module-2

Indian Environmental Acts: Environment (Protection) Act, 1986, Air & Water Acts. Biomedical Waste (Managing and Handling) Rules, 2011, Recycle Plastics (Manufacturing and Usage) Rules, 1999, Water Act, 1974, Air Act, 1981, Forest Act, 1927, Environmental Tribunal Authority, 1995. Wild Life Protection Act, 1972, Biodiversity Rules, 2004

Module-3

Environmental Impact Assessment: Definition, Objectives, Types – Rapid and Comprehensive EIA, EIS, FONSI. Step-by step procedure for conducting EIA and Limitations of EIA, Prevention of Significant Deterioration (PSD) Programme. Carrying capacity concept

Module-4

Attributes, Standards and Value functions: Public participation in EIA.
Environmental Management Plan (EMP) and Disaster Management Plan (DMP).

Module-5

EIA Case Studies–Thermal Power Plant, Mining, Fertilizer, Construction Projects, Air port, Water and Wastewater Treatment Plants

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Environmental Impact Assessment Methodologies	Anjaneyulu and Valli Manickam	BS Publications, Hyderabad	2010
2	Environmental Impact Assessment	Canter L.	McGraw Hill.	
3	Environmental Impact Analysis-A New Dimension in Decision Making	Jain R.K., Urban L.V., Stacey G.S.	Van Nostrand Reinhold	1977

(GROUP-4): 20WRM252	CLIMATE CHANGE AND ADAPTATION

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Earth's Climate System**:** Introduction–Climate in the spotlight - The Earth's Climate Machine–Climate Classification–Global wind systems–Trade Wind Systems–Trade Winds and the Hadley Cell–The Weserlies–Cloud formation and Monsoon Rains–Storms and Hurricanes–The Hydrological Cycle–Global Ocean Circulation–EI Nino and its Effect–Solar Radiation–The Earth's Natural Green House Effect–Green House Gases and Global Warming–Carbon Cycle.

Module-2

Observed Changes and Its Causes: Observation of Climate Change–Changes in pattern of temperature, precipitation and sea level rise–Observed effects of Climate Changes–Patterns of Large Scale Variability–Drivers of Climate Change–Climate Sensitivity and Feedbacks–The Montreal Protocol–UNFCCC–IPCC–Evidences of Changes in Climate and Environment–on a Global Scale and in India – Climate Change modeling.

Module-3

Impacts Of Climate Change: Impacts of Climate Change on various sectors – Agriculture, Forestry and ECO system – Water resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for different regions Uncertainties in the Projected Impacts of Climate Change – Risk of irreversible changes.

Module-4

Climate Change Adaptation and Mitigation Measures: Adaptation Strategy/options in various sectors – Water – Agriculture – Infrastructure and Settlement including coastal zones. Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and practices – Energy supply – Transport – Buildings – Industry – Agriculture – Forestry– Carbon sequestration – Carbon Capture and Storage (CCS) – Waste (MSW & Biowaste, Biomedical, Industrial waste – International and Regional co-operation.

Module-5

Clean Technology and Energy: Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco-friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind –Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Al core Inconvenient Truth		video form	
2	Climate Change – An Indian Perspective	Dash Sushil Kumar	Cambridge University Press India Pvt. Ltd.	2007
3	IPCC Fifth Assessment Report		www.ipcc.ch	
4	Impacts of "Climate Change and Climate Variability on Hydrological Regimes	Jan C. van Dam	Cambridge University Press	2003

(GROUP-4): 20CCT21	CONSTRUCTION ECONOMICS AND FINANCE
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Economics; Definition and importance and scope Finance: Definition and scope, Sources of finance, Financial Management; Meaning and Scope, Supply and Demand Mechanism, Time value of money, discounted cash flow, NPV, ROR, Problems

Module-2

Pricing; objectives, determinants, absorption, marginal costing. Financial analysis, Process of Decision making: Capital Budgeting, budgetary control, standard costing and variance, investment appraisal. Practical problems

Module-3

Quantifying alternatives for decision making; Bases of comparison, Incremental analysis, Benefit-Cost analysis, Capital budgeting; Profit, loss and Breakeven analysis, Practical Problems

Module-4

Working capital cycle, Working capital management, Financial statements; Balance sheet and its components, profit & loss account, fund flow statement. Financial ratios and their importance. Project appraisal, project yield, taxation and inflation

Module-5

Risk and uncertainty-SWOT analysis, Turnkey activities; cost control, performance budgeting. Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis, depreciation and amortization.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Managerial Economics	Peterson, H.C., Lewis, W.C.	Prentice Hall of India Pvt. Ltd.	2001
2	Modern Macroeconomics	Parkin, M. & Bade R.	4th Edition, Prentice Hall	1996
3	Human Resources & Personnel Management	Werther & Davis	McGraw Hill	1996
4	Manpower planning	Edwards, John et.al.	John Wiley, New York	1983
5	Management control systems	Anthony, R.N. Govindrajan, V., Irwin	McGraw Hill Publications, 10th Edition	2000

(GROUP-4): 20CTM324	RAILWAY INFRASTRUCTURE PLANNING AND DESIGNING
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Planning of railway network: Operational system, historical background, plans and developments, policy and standards, traffic forecasts and surveys, railway alignment, project appraisal and organization setups

Module-2

Component of railway track and rolling stock: Permanent way, forces acting on rails, function of rails, rail fixtures and fastenings, sleepers and ballast, rail joints, elements of junctions and layouts, types of traction, locomotives and other rolling stock, tractive effort and hauling power of locomotives.

Module-3

Geometric design of railway track, construction and maintenance:
Field investigation, right of way and formation, geometric design elements and standards, speeds computation, string lining of curves, grade compensation, railway cant and cant deficiency, traction, practice with examples. Special considerations and practices, track laying, inspection and maintenance, maintenance tools, maintenance of rail surface, track drainage, track circuited lengths, track tolerances, ballast confinement and track maintenance, renewal works.

Module-4

Signalling and interlocking: Objectives, classifications, signaling systems, mechanical and electrical signaling systems, systems for controlling train movement, interlocking, and modern signaling.
Railway accidents and safety: Cause of train accidents, types of collision and derailment, restoration of traffic, safety measures, disaster management, level crossing and related accidents, remedial measures.

Module-5

Railway Station and Yards: Site selection, facilities, classification, platforms, building areas, types of yards, sidings, foot over bridges and subways, loading gauge, end loading ramps, locomotive sheds, triangles, buffer stop, scotch block, derailing switch, sand hump, fouling mark.
High Speed Railways: Modernization of railways, effect of high speed track, vehicle performance on track, high speed ground transportation system, ballastless track, elevated railways, underground, and tube railways.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Indian Railway Track	Agarwal, M.M	Prabha & Co., New Delhi, India	1988
2	Railway Engineering	Chandra S. and M. Agrawal	Second Edition, Oxford University Press	2013
3	Practical Railway Engineering	Clifford F. Bonnett	2nd edition, imperial college press, London	2005
4	Text Book of Railway Engineering	Gupta, B.L.	Standard Publishers, New Delhi, India	1982
5	Railway Track Engineering	Mundrey, J. S.	Fourth Edition, TATA McGraw- Hill, New Delhi	2009
6	Principles of Railway Engineering	Rangwala, S. C.	Charotar Publishing House, Anand, India	2009
7	A text book of Railway Engineering	Saxena S.C. and S.P. Arora	Dhanpat Rai	2010
8	https://nptel.ac.in/courses/105107123/			
9	https://www.edx.org/course/railway-engineering-an-integral-approach-2			

(GROUP-4): 20CIM243	GROUND IMPROVEMENT TECHNIQUES
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction - Need and objectives of ground improvement, classification of ground modification techniques, trends in ground improvement, Engineering properties of soft, weak and compressible deposits; Principles of treatment; Methods of compaction: Blasting, dynamic consolidation, pre-compression and compaction piles.

Module-2

Methods of dewatering: Open sumps and ditches, well point system, electro- osmosis, Vacuum dewatering wells; pre-loading without and with sand drains, strip drains and rope drains.
Stabilization: With admixtures like cement, lime, calcium chloride, fly ash and bitumen. Methods of soil improvement-lime stabilization and injection; thermal, electrical and chemical methods.

Module-3

Soil reinforcement: Reinforcing materials, concept of confinement, Gabbion walls; Dynamic consolidation, Vibro flotation, Pre-consolidation with vertical drains, Granular piles, Soil nailing, Anchors & Thermal methods.

Module-4

Improvement of Foundation Soils:
(a) Improvement of granular soils: Terms used to describe degree of compactness – relative density, density ratio and degree of compaction; Methods-Vibration at ground surface, factors influencing roller compaction; deep dynamic compaction, vibro-compaction impact at depth.
(b) Improvement of cohesive soils: Preloading, or dewatering, methods of installing: sand drains, drain wicks, electrical and thermal methods.

Module-5

Grouting: Materials of grouting, grouting techniques and control; purpose, functions, types of grouts; soil bentonite - cement mix; Emulsions & solutions; grout injection methods; Geo-synthetics: types, functions & Classification of geo-textiles. Specific Applications: Bearing capacity improvement, reinforcement, Retaining walls, embankment etc.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Engineering principles of ground modification	Manfred R. Hansmann ISBN: 978-0070272798	McGraw Hill pub. Co., New York	1991
2	Construction and Geotechnical methods in Foundation Engineering	Robert M. Koerner ISBN: 978-0070352452	McGraw- Hill Pub. Co., New York	1984
3	Foundation Engineering Hand Book	Winterkornand Fang	Van Nostrand Rein hold Co., New York	1975
4	Soil Improvement by Preloading	Aris C. Stamatopoulos & Panaghiotis, C.Kotzios ISBN: 978-0471815938	John Wiley & Sons Inc. Canada	1985
5	Ground Improvement Techniques	P. Purushothama Rao ISBN: 978-8131805947	2e, Laxmi Publications	2016

(GROUP-4): 20CTE31	PAVEMENT CONSTRUCTION TECHNOLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Importance of surveys and investigations, Guidelines for alignment and route location, Use of aerial photographs and remote sensing technology, Conventional ground survey techniques, Types of drawings, Estimates, Project reports, Project Cost Forecasting, Cost Optimization and Resources Planning, Tendering and Contracting, Laws of Contracts, Subcontracts, Potential Problems, Post Contract Problems, Documents, Conditions, Arbitration, Special Features of International Contracts. Human Resource Management, Resource Management and Inventory: Basic concepts, labor requirements and productivity.

Module-2

Road construction equipment–different types of excavators, graders, soil compactors/ rollers, pavers and other equipment for construction of different pavement layers– their uses and choice. Problem on equipment usage charges; Pre-construction survey sand marking on ground-Specifications and steps for the construction of road formation in embankment and cut, construction steps for granular sub-base, quality control tests.

Module-3

Different types of granular base course–WMM, CRM, WBM; specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses; their specifications (as per IRC and MORTH); construction method and quality control tests.

Module-4

Different types of sub-base and base course for cement concrete (CC) pavement and construction method. Construction of cement concrete (PQC) pavements joints quality control during construction. Construction details of inter locking concrete block pavements

Module-5

Principle of construction planning, application of CPM and PERT, Problems, Road maintenance works–day to day and periodic maintenance works of various components of road works and road furniture

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Construction Planning, Equipment and Methods	Peurifoy R. L.	McGraw Hill Publishers, New York	2000
2	Construction Equipment and its Management	S. C. Sharma	Khanna Publishers, New Delhi	1988
3	Asphalt Technology and Construction Practices		The Asphalt Institute, Maryland, USA	1997
4	Relevant IS, IRC, AASHTO and MoRTH Publications			

(GROUP-4): 20CHT254	LOW VOLUME ROADS ENGINEERING

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction to Low-Volume Roads (LVR). Significance of LVR, Definition, Design Environments. Planning of rural road, planning data base, concept of network planning Rural roads plan, guidelines laid down in recent 20 year plans and in PMGSY Road alignment and surveys, governing factors for route selection Factors controlling alignment; obligatory points, traffic, geometric designs, economy, special considerations in hilly areas.

Module-2

Geometric design standards: classification of rural roads, terrain classification, design speed, basic principles of geometric design cross sectional elements, camber, sight distances. Horizontal alignment: general guidelines, super elevation, transition curve, widening and set back distances, vertical alignment: gradient, grade compensation at curves, valley curves, alignment compatibility, lateral and vertical clearances.

Module-3

Soil and material surveys, soil investigations for low embankment, high embankment, cut sections, subgrade, Survey for marginal materials and aggregates/ low grade materials Artificial aggregates, waste materials, new materials and stabilizers Design parameters, pavement components Design of flexible pavement: pavement thickness, pavement surfacing Design of semi rigid pavement: dry lean concrete / lime flyash concrete bases Design of rigid pavement: cement concrete pavement Design of special pavements: concrete block pavement , interlocking concrete block pavement Choice of pavement type and materials, maximize use of Locally available materials, Use of Geo-synthetics in LVR

Module-4

Types of road drainage, requirements of surface drain; road side drains, shoulder drains, catch water drains. Requirements subsurface drain Cross drains; types, requirements, choice of different types of cross drains Standard designs of culverts Standard design of small bridges.

Module-5

Selection of materials and methodology, construction techniques, machinery and tools.
Construction of Embankment/subgrade; materials, requirements and construction operations. Choice and requirements of coarse sand sub base, gravel roads.
Pavement Maintenance and Rehabilitation Management System (RMS) for LVR

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Highway Engineering	S.K. Khanna, C.E.G Justo and A. Veeraragavan	Nem Chand andBros., Roorkee. Revised 10th Edition	
2	Low-Volume Road Engineering, Design, Construction, and Maintenance	Robert A. Douglas	I edition, CRC Press	
3	Guidelines for the design of Flexible Pavements for Low Volume Roads		IRC: SP:72-2015, First Revision	
4	Guidelines for Design & Construction of CC pavements for low volume roads		IRC:SP:62-2014	
5	IRC SP 20 Rural Roads Manual			
6	Relevant IRC Publications			

(GROUP-4): 20CTM31 ROAD ASSET MANAGEMENT	
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Highway Asset Management: Principles, types of asset management definition, structure, historical background, elements of highway asset management, asset Inventory, activity and cost model development, public assets versus private assets, motivation for asset management, benefits of road asset, management system, financial management systems, roads billing, roads payment and cost accounting and tools for asset management.

Module-2

Highway Asset Valuation and Frame Work:
Asset Valuation approaches, guidelines, overview of highway asset valuation procedure, valuation principles, basis and rules, depreciation, highway lighting and high mast lighting, land associated with the highways

Module-3

Construction Management Systems: Preconstruction scheduling, utility management, ROW management, user occupancy permits, project control, agreement monitoring and contractor management.

Module-4

Roadway Operations Management Systems
Joint operations center, district operations center, traveler information systems.

Module-5

Road Asset Management Modules: Bridge inventory and rating, bridge management, Workforce Management Systems, Payroll detail, personal information and employee accident. Safety Management Systems Accident records, hazardous location and highway safety information Equipment Management Systems Equipment management information, fleet management

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	AASHTO Transportation Asset Management Guide: A Focus on Implementation		AASHTO	2011
2	Transportation: Asset Management	Hamilton, W.E.	House Fiscal Agency	2001
3	Performance Measures and Targets for Transportation Asset Management	NCHRP Report 551	TRB	2006
4	An Asset-Management Framework for the Inter State Highways	NCHRP Report 632	TRB	2009
5	Use of Transportation Asset Management Principles in State Highway Agencies	NCHRP Synthesis 439	TRB	2013
6	Transportation Asset Management, Federal Highway Administration, National Highway Institute	NHS	USA	2003
7	Asset Management for the Roads Sector, Organization for Economic Co- operation and Development	OECD	France	2001
8	AASHTO Transportation Asset Management Guide: A Focus on Implementation	Thompson, P.D.	USA	2011
9	Pavement Asset Design and Management Guide		Transportation Association of Canada	December, 2013
10	https://www.youtube.com/watch?v=ep3j7f_LuM			

(GROUP-4): 20CSE251	DESIGN OF INDUSTRIAL STRUCTURES

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames

Module-2

Analysis and design of gantry column (stepped column / column with bracket), purlins, girts, bracings including all connections.

Module-3

Analysis of transmission line towers for wind load and design of towers including all connections.

Module-4

Forms of light gauge sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light gauge sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength.

Module-5

Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light gauge sections, Design of flexural members (Laterally restrained / laterally unrestrained).

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Bureau of Indian Standards, IS800-2007, IS875-1987, IS-801-1975. Steel Tables		SP 6 (1)	1984
2	Design of Steel Structure	N Subramanian	oxford University Press	
3	Design of Steel Structures	B.C. Punmia, A.K. Jain	Laxmi Publications, New Delhi	
4	Design of Steel Structures Vol. 1 and Vol.2	Ramchandra and Virendra Gehlot	Scientific Publishers, Jodhpur	
5	Limit State Design of Steel Structures	Duggal	TMH	

(GROUP-4): 20CCS321	STRUCTURAL OPTIMIZATION - THEORY & COMPUTATIONS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems. Optimization Techniques: Classical optimization techniques, single variable optimization, multivariable optimization with no constraints, unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques.

Module-2

Linear Programming: Linear programming, standard form of linear programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, revised simpler methods, duality in linear programming.

Module-3

Non-linear programming: Non-linear programming, one dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, descent methods.

Module-4

Constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different technique.

Module-5

Geometric programming: Geometric programming, conversion of NLP as a sequence of LP / geometric programming. Dynamic programming: Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Optimum Structural Design	Spunt, L	Prentice Hall	1971
2	Optimization – Theory and Practice	Rao S. S.	Wiley Eastern Ltd.	1978
3	Optimum Structural Design	Uri Kirsch	McGraw Hill, New York	1981
4	Operation Research	Bronson R. and Govindsami N.	Schaum's Outline Series	2017
5	Structural optimization using sequential linear programming	Bhavikatti S. S.	Vikas publishing	2003
6	Optimization Methods for Engineering Design	Fox. R. L	Addison Wesley	1971
7	System simulation with digital computer	Narsingk Deo	Prentice Hall of India, New Delhi	1989
8	Mathematical Foundations for Design	Stark. R.M. Nicholls. R .L	McGraw Hill New York	1972

(GROUP-4): 20CCT251	BUILDING COST AND QUALITY MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Estimation of quantities for R.C.C. multi storeyed complex viz. earthwork, concrete in foundation, D.P.C., R.C.C. work, flooring and roofing, plastering and pointing etc., wood work, white washing.

Module-2

Analysis of rates for multi storeyed building works – Brick work in foundations and Superstructure, cement concrete, R.C. C., Plastering, Flooring, Timber work etc. Checking of construction quality– various tests for bricks, cement, concrete, aggregates, and steel as per IS codes.

Module-3

Preparation of bills for payment, measurement book, mode of payment, running account bill. Ledger and Cash book details, Arbitration.

Module-4

Estimation of building services viz. water supply works, electrification, sanitary fitting etc, and their cost analysis.

Module-5

Elements of Valuation: methods, techniques and examples Completion report of the project; Checking of Plan, Details of various works, and issue of completion report of the project.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Estimating and Costing	B.N. Dutta	UBS Publishers' Distributors Pvt. Ltd, 28th Revised Edition	2016
2	Estimating and Costing	G.S. Birdie	Dhanpat Rai Publishing Company	
3	Professional Practice	Roshan N Namavati	Lakahni Book Depot, Mumbai	

(GROUP-4): 20WLM251	IRRIGATION TECHNOLOGY AND IRRIGATION WATER MANAGEMENT

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction: Types & Techniques of Irrigation including advanced techniques, Present situation of irrigation in India Soil-Moisture Irrigation Relationship, Estimating depth and frequency of irrigation.

Module-2

Soil and Land Management in Agriculture: classification and surveys-land capability farm development, grading-equipment, land management techniques.

Module-3

Crop requirements and irrigation scheduling : Major Indian crops times of sowing and harvesting –critical periods of growth moisture stress, Duty & delta of crops, Irrigation scheduling, Consumptive use of Crop- Blanney-Criddle, Thornth wait penman, Christiansen methods, Water-use efficiency, scope of computerization in irrigation.

Module-4

Water conveyance Computing the capacity of canals, Losses in water canals, Distribution of water into the fields through water courses, Lined canals

Module-5

Reclaimation of Water Logged and Saline Soils: Glances of water logging- design of surface and subsurface drains, Saline and alkaline lands reclamation and management of Salt affected lands.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Irrigation, Water Resources & Water Power Engineering	Modi. P. N.	Standard Publishers, New Delhi	
2	Irrigation and water power engineering	B. C. Punmia, Pande, Ashok kumar and Arunkumar Jain	Laxmi Publications (P) LTD.	
3	Water Resources Systems Planning and Management	Chaturvedi. M.C	Tata McGraw Hill. NY	
4	Water Resources Engineering	Linsley, R. K. and Frazinini, J. B.	2nd Ed. McGraw Hill, NY	
5	Economics of Water Resources Systems Planning	James L.D and Lee R.R.	McGraw Hill. NY	

(GROUP-5): 20CSE243	ADVANCED CONCRETE TECHNOLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Fibre reinforced concrete:
History, mechanism, different types of fibres, Aspect ratio, Volume of fibres, orientation of fibres, balling effect, properties of fibre reinforced concrete, applications of fibre reinforced concrete. Types of Fibre reinforced concrete.

Ferro cement:
Definition, different materials used, casting techniques, properties of Ferro cement, applications.

Module-2

Light Weight Concrete:
Introduction, classification, properties, strength and durability, mix proportioning and problems

High Density Concrete:
Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.

Module-3

Ready mix concrete:
Concept, ready mix concrete plants, difficulties faced and their solution , use of admixtures in ready mix concrete, economics and quality control aspects of ready mix concrete.

High Performance Concrete:
Constituents, mix proportioning, properties in fresh and hardened states, applications & limitations

Module-4

Polymer concrete:
Polymers, resins, polymerization, different types of polymer concrete like polymer impregnated concrete, polymer concrete (Resin concrete) and polymer modified concrete, their properties and applications.

Self-compacting concrete:
Development of SCC, basic principles and requirements , workability tests for SCC, mix design of SCC, acceptance criteria for SCC, adoption of SCC in the precast industry, present status of SCC

Module-5

Concrete from Industrial wastes:
a. Blast furnace slag cement concrete
b. Fly-ash concrete
c. Silica fume concrete
d. Recycled aggregate Concrete

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	High performance concrete	Aitcin P.C.	E and FN, Spon London	1998
2	CONCRETE, Microstructure, Properties and Materials	Kumar Mehta.P, Paul J.N.Monterio	Tata McGraw Hill	
3	Chemical admixtures in concrete	Rixom R and Mailvaganam N.	E and FN, Spon London	1999
4	Light Weight concrete	Rudnai.G.	Akademiaikiado, Budapest	1963
5	Short A and Kinniburgh.W	Light Weight Concrete	Asia Publishing House	1963
6	High Performance Concrete	Aitcin P C	E and FN, London	

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Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
7	light weight Concrete	Andrew short and William Kinnibargh	applied science publishers ltd London	
8	Light weight concretes	GyulaRudani	house of the Hungarian academy of sciences, Budapest (Hungary)	
9	Hand book of structural concrete	Kong, Evans, Cohen and Roll	Pitman pub. Inc., 1020, Plain street, Marsh field, Massachusetts	
10	Concrete	Sidney Mindness and Francis young	Printice Hall inc. Englewood cliffs. New Jersey	
11	Design of concrete mixes	Krishnaraju.N	CBS Publication and distributors, Delhi	
12	Concrete	Mehta P K & P J M Monteiro	Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute Chennai)	
13	Properties of Concrete	Neville. A. M	ELBS Edition, Longman Ltd., London	
14	Special Structural Concretes	Rafat Siddique	Galgotia publications, New Delhi	
15	Concrete Technology	Santhakumar A R	Oxford University Press	
16	Concrete Technology	Shetty M S	S. Chand publishing House Ltd., New Delhi	

(GROUP-5): 20CGT23	DESIGN OF DEEP FOUNDATIONS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Single pile - Static capacity and lateral loads: Introduction, Timber, Concrete, Steel piles, Corrosion of steel piles, Soil properties for static pile capacity, Ultimate static pile point capacity, Skin resistance, Static load capacity using load transfer, load test data, Tension piles, Piles for resisting uplift, Laterally loaded piles, Numerical problems.

Module-2

Single pile – Dynamic analysis and load tests: Dynamic analysis, Pile driving, Rational pile formulae, other dynamic pile driving formulae and general considerations, Reliability of dynamic pile driving formulae. The wave equation, pile load tests, pile driving stresses, general comments on pile driving, Numerical problems.

Module-3

Pile foundations – Group, Single pile v/s Pile group, Pile group considerations, efficiency of pile groups, stresses on underlying strata from piles, settlements of pile groups, pile caps, Batter piles, Negative skin friction, Numerical problems.

Module-4

Well Foundation: Design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts, Numerical problems.
Drilled Shaft: Construction procedures, Design Considerations, Load Carrying Capacity and settlement analysis, Numerical problems.

Module-5

Special Topics of Foundation Engineering Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing, Preventive and Remedial measures.
Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures, Numerical Problems.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Analysis and design of Substructures	Swami Saran	Oxford & IBH Publications Pvt. Ltd.	2009
2	Foundation design in practices	Kaurna Moy Ghosh	PHI	2010
3	Foundation engineering	J E Bowles	McGraw Hill	2012
4	Pile Foundation Analysis and Design	H.G. Poulos, and E.H.Davis	John Wiley and Sons, New York	
5	Design of Foundation Systems, Principles & Practices	N.P. Kurien	Narosa, New Delhi	1992
6	Foundation Engineering Hand Book	H. F. Winterkorn and H Y Fang	Galgotia Book source	1990

(GROUP-5): 20CWM241	OCCUPATIONAL SAFETY AND HEALTH MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Sector Specific Occupational Health and Safety Issues – Health and safety risks in mining, Health hazards in electronics industry, food processing industry, textile industry, construction industry, wastewater treatment plants, solid waste landfills.

Module-2

Health hazards and risk assessment - Hazard and risk, biological, chemical, physical and psychological health hazards, health risk assessment and management.
Soico-Economic Aspects of Occupational Health and Safety – women and Occupational Health and Safety, child labour. Occupational Health, health problems in unorganized sectors.

Module-3

Occupational Diseases, Health problems and Preventions: - Asbestosis, Silicosis, Farmer's lung, Pneumoconiosis, Anthracosis, Bagassosis, Byssinosis, Tobacossis.
Health Screening Measures – Stages of medical examination, occupational history,Pulmonary Function Test (PFT), Noise Induced Hearing Losses (NIHL). Audiometry.

Module-4

Basics of Preventive Techniques – Accident analysis, monitoring of hazards, reporting and investigation of accidents, prevention and control of accidents, ensuring safety measures, PPE.

Module-5

Occupational health and safety legislations in India – overview of existing OHS legislations in India, Factories act, Mining act, Workmen's compensation act, Employee's state insurance act, Present state of OHS legislation in India. Inadequacy of OHS Legislation in India.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Occupational Safety and Health for Technologists	Goetsch D.L.	Engineers and Managers, Prentice Hall	1999
2	Industrial Accident Prevention	Heinrich H.W.	McGraw Hill Publication , New york	
3	Industrial Safety Management and Technology	Colling D.A.	Prentice Hall, New Delhi	
4	Industrial Safety and Pollution Control Handbook	H.G. Poulos, and E.H.Davis	National Safety Council and Associate (Data) Publishers Pvt. Ltd.	1991

(GROUP-5): 20CEE242	RISK ASSESMENT AND HAZARDOUS WASTES MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Risk factor calculation, impact identification – Risk Area, impact, Likelihood, consequences, Controls, Severity, risk score calculation; Toxicology and Risk Assessment: Toxic effects, Dose response assessment, Risk exposure assessment, Carcinogenesis, eco toxicology, risk characterization.

Module-2

Hazard identification and Risk Assessment – HAZOP, HAZID, Risk Ranking Matrix, Process and Instrumentation Diagram, and importance of Standard operating procedures, Material safety and Data Sheets, Guidelines, case study
Emergency Preparedness, Incident Investigation, Non Conformity, action and Preventive and Corrective Actions, Auditing.

Module-3

Hazard identification and Risk Assessment – HAZOP, HAZID, Risk Ranking Matrix, Process and Instrumentation Diagram, and importance of Standard operating procedures, Material safety and Data Sheets, Guidelines, case study
Emergency Preparedness, Incident Investigation, Non Conformity, action and Preventive and Corrective Actions, Auditing.

Module-4

Hazardous Waste Management
Sources, Classification, Impacts of Mismanagement, Problems in Developing Counties and Regulations for Hazardous Waste Management **Hazardous Waste Characterization**, Designated Hazardous Wastes, Waste Minimization and Resource Recovery – Approaches, Development of a Waste Tracking System, Selection of waste Minimization Process, Case Studies.

Module-5

Biomedical Waste management: Biomedical (Handling and Management) Rules 2008 ,sources, treatment and disposal
Transportation of Hazardous Waste – requirements, regulations, containers and Labelling, bulk and non-bulk transport, Emergency Response, personal protective equipment.

Treatment & Disposal: Physico-chemical, Chemical and Biological Treatment of hazardous waste, Thermal treatment-Incineration and pyrolysis.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Hazardous waste Management	Lagrega M.D., Buckingham P.L. and Evans J.C.	McGraw Hill International Edition	
2	Hazardous Waste Management	Wentz C.A.	McGraw Hill International Edition	1995
3	Hazardous waste (management and handling) Rules			2001
4	Biomedical (Handling and Management) Rules			2008
5	Hazardous Waste Management	Charles A. Wentz	McGraw Hill Publication	1995

(GROUP-5): 20WRM31	SEDIMENT TRANSPORT

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Properties of sediment. Initiation of motion of sediment. Analysis of non-cohesive sediment movement. Shield's diagram. Critical shear stress, critical velocity, lift on particles, Hydraulic relations for alluvial streams.

Module-2

Sediment Sources & sediment yield: Gross erosion, sediment yield, delivery ratio, estimation of sheet erosion, Universal soil loss equation (USLE), different factors affecting erosion process.

Module-3

Sediment delivery ratio from watershed, flow duration curve and sediment rating curve, reservoir sedimentation: empirical equations, trap efficiency, sediment control method.

Module-4

Fundamentals of sediment transport: general relationships. Bed forms. Wash load, suspended load and Bed load, Rouse equation for suspended sediment load. Sediment discharge formulas by DuBoys, Mayer-Peter & Muller, Schoklitsch, Einstein-Brown and Engelund- Hansen. Sediment sampling.

Module-5

Introduction to Meandering of rivers and river engineering. Scour: local scour at a bridge & abutment, Indian Codal provision for design scour depth.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Sedimentation Engineering	Vito A. Vanoni	Manuals and Reports on Engineering Practice No. 54	
2	Sediment Transport (Theory and Practice)	C.T. Yang		
3	Sediment and Ecohydaulics	T. Kusuda, H. Yamanishi, J. Spearman, and J.Z. Gailani	INTERCOH	2005
4	Mechanics of Sediment Transportation and Alluvial Stream Problems	R.J. Garde, K. G. RangaRaju		
5	Sediment Transport (in 3 parts)	L. van Rijn	ASCE	
6	Hydraulics of Sediment Transport	W.H. Graf		
7	Fundamentals of Fluvial Geomorphology	Ro Charlton		

(GROUP-5): 20CCT22	PRE-ENGINEERED CONSTRUCTION TECHNOLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

General Principles of Pre Fabrication

Comparison with monolithic construction, Types of prefabrication, site and plant prefabrication, Economy of prefabrication, Modular coordination, Standardization, Planning for Components of prefabricated structures, Disuniting of structures, Handling and erection stresses, Elimination of erection stresses (Beams, columns) Symmetrical frames.

Module-2

Prefabricated Elements

Roof and floor panels, ribbed floor panels, wall panels, footings, Joints for different structural Connections, Effective sealing of joints for water proofing, Provisions for non-structural fastenings, Expansion joints in pre-cast construction.
Construction of precast structural components (Purlins, Principal rafters, roof trusses, lattice girders, gable frames, Single span single storeyed frames, Single storeyed buildings – slabs, beams and columns.)

Module-3

Production and Hoisting Technology

Choice of production setup, Manufacturing methods, Stationary and mobile production, Planning of production setup, Storage of precast elements, Dimensional tolerances, Acceleration of concrete hardening. Equipments for hoisting and erection, Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns, Vacuum lifting pads.

Module-4

Precast sandwich Panels ,Pre-stressed concrete solid flat slabs, Hollow core slab/panels, Pre-stressed concrete Double "T", Bridge, Precast segmental Box Girders, Specifications and design considerations.

Module-5

Pre-Engineered Buildings

Introduction, Advantages, Pre Engineered Buildings Vs. Conventional Steel Buildings, Design Consideration of Pre Engineered Buildings (PEB) – Applications

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Prefabricated Concrete for Industrial and Public Structures	L. Mokk	Publishing House of the Hungarian Academy of Sciences, Budapest	2007
2	Manual of Precast Concrete Construction Vol. I, II, III & IV	T. Koncz	Berlin	1971
3	Building with Large Prefabricates	B. Lewicki	Elsevier Publishing Company, Amsterdam, London, New York	1998
4	Structural Design Manual, Precast Concrete Connection Details		Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag	2009
5	Precast concrete design and Applications	Hass, A.M.	Applied Science Publishers	1983

(GROUP-5): 20CEM31	CONSTRUCTION QUALITY AND SAFETY MANAGEMENT

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Quality and concept of QM-Necessity for improving quality, concept of quality control, quality assurance, quality management and total quality management, Total quality management concepts; ISO9000 documentation; QA/QC systems and organizations, Quality Audits; Problem solving techniques; Statistical Quality Control; Quality Function Deployment; Material Quality Assurance; Specifications and Tolerances.

Quality Planning-Quality policy, objectives and methods in construction industry-consumers satisfaction, time of completion-statistical tolerance.

Module-2

Codes and standards quality manuals-documents-contract and construction programming- inspection procedures - processes and products-total QA/QC programme and cost implication.

Managing Quality in various projects stages from concept to completion by building quality into design of structures, Inspection of incoming material and machinery In process quality inspections and tests.

Reliability & Probability testing, reliability coefficient and reliability prediction-selection of new materials-influence of drawings, detailing, specification, standardization-bid preparation-construction activity, environmental safety and social factors-natural causes and speed of construction-life cycle costing-value engineering and value analysis.

Module-3

Quality Assurance Department -and quality control responsibilities of the line organization, developing quality culture in the organization, training of people,

Construction accidents-importance, causes of accident, safety measures, construction industry related laws. Human factors in safety–legal and financial aspects of accidents in construction–occupational and safety hazard assessment.

Module-4

Safety Programmes-elements of safety programmes, job-site assessment, safety meetings, safety incentives, contractual obligations, safety in construction contracts

Safety in Design-safety culture-Safe Workers-Safety and First Line Supervisors-Safety and Middle Managers-Top Management Practices, Company Activities and Safety-Safety Personnel-Sub-contractual Obligation-Project Coordination and Safety Procedures-Workers Compensation, Safety issues; Injury accidents and their causes; Safety program components; Role of workers, Supervisors, Managers and Owners; Safety Procedures for various construction operations; Safety audits; Safety laws.

Module-5

Safety Management-safety and first line supervisors, safety and middle managers, top management practices, safety audit, safety equipment planning and site preparation, safety system of storing construction materials Excavation-blasting- timbering-scaffolding- safe use of ladders-safety in welding. First- aid- Fire hazards and preventing methods

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Construction Inspection Handbook-Quality Assurance and Quality Control	James, J.O Brian	Van Nostrand, New York	1989
2	Fundamentals of Construction Management and Organization	Kwaku, A., Tenah, Jose, M. Guevara	Reston Publishing Co., Inc., Virginia	1985
3	Quality Planning and Analysis	Juran Frank, J.M. and Gryna, F.M	Tata McGraw Hill	1982
4	ISO 9000	Hutchins.G	Viva Books, New Delhi	1993

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Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
5	Productivity Improvement in Construction	Clarkson H. Ogiesby	McGraw-Hill	1989
6	IS, IRC, Other codes			
7	Construction Safety	Jimmy W. Hinze	Prentice Hall Inc.	1997
8	Construction Safety and Health Management	Richard J. Coble, Jimmie Hinze and Theo C. Haupt	Prentice Hall Inc.	2001
9	Hand Book on Construction Safety Practices		SP 70, BIS	2001

(GROUP-5): 20CIM332	BUILDING SERVICES & MAINTENANCE
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Standard fire, fire resistance, classification of buildings, means of escape, alarms, etc., provisions of NBC. Engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems

Module-2

Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions

Module-3

Quality policy in construction industry: Consumer satisfaction, Ergonomics-Time of Completion-Statistical Tolerance-Taguchi's concept of quality.

Module-4

Contract and construction programming-Inspectional procedures. Total QA/QC Program and cost implication.

Module-5

Different aspects of quality - Appraisals - failure mode analysis, Stability methods and tools, Influence of drawings, detailing, specification, Standardization - Bid preparation. Construction activity, Environmental safety, Social and environmental factors

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Productivity Improvement in Construction	Clarkson H. Oglesby	McGraw Hill	
2	Construction Inspection Handbook - Quality Assurance and Quality Control	James, J.O Brian	Van No strand, New York	1989
3	F.M. Quality Planning and Analysis	Juran Frank, J.M. and Gryna	Tata McGraw Hill	1982
4	Relevant Parts	NBC	BIS New Delhi	
5	Services in Building Complex and High Rise Buildings	Jain V K	Khanna Pub.	
6	Fire Resistance of Buildings	Pchelinstev V. A.	McGraw-Hill	1989

(GROUP-5): 20CTE322 INTELLIGENT TRANSPORTATION SYSTEMS	
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects.
Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle
Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

Module-2

Advanced traveler information systems; transportation network operations; commercial vehicle operations and intermodal freight;

Module-3

Public transportation   applications, ITS and regional strategic transportation planning, including regional architectures

Module-4

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS and sustainable mobility.

Module-5

Travel demand management, electronic toll collection, and ITS and road-pricing.
Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS implementations in developed countries, ITS in developing countries.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Fundamentals of Intelligent Transportation Systems Planning	Choudury M A and Sadek A	Artech House	
2	Recommendations for World Road Association (PIARC)	Kan Paul Chen, John Miles	ITS Hand Book	2000
3	Perspective on ITS	Sussman, J. M.	Artech House Publishers	2005
4	National ITS Architecture Documentation	CDROM	US Department of Transportation	2007
5	Decision Support Systems and Intelligent Systems	Turban. E and Aronson. J. E	Prentice Hall	

(GROUP-5): 20CHT31	CONSTRUCTION PLANNING AND ECONOMICS

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Various types of highway development projects in progress in India and their scope. Factors to be considered in planning of new highway /expressway / bypass and up-gradation of existing roads.

Planning of Road Projects –project management framework, scope, project objectives, project environment, causes of project failure, project development process.

Resource planning – human resources, project man power grouping, structuring site organization, construction materials-classification of construction materials, materials usage, materials inventory, cost and budget.

Module-2

Time planning – project work breakdown, determining activities involved, assessment of duration, CPM / PERT network analysis, work scheduling, methods of work scheduling, factors affecting work scheduling, Problems.

Planning Control System – resource production, project cost, project time, codification and project management, information system, use of software

Use of softwares: Primavera V8i, MSP (Microsoft project), PPM (Project Portfolio Management)

Module-3

Highway Engineering Economics, principle, supply and demand models, equilibrium, sensitivity of travel demand, Elasticities – types, models (Kraft demand model) consumer surplus cost – cost elasticity pricing and subsidy policies, rates of interest, Vehicle operation cost, direct and indirect benefits due to road improvement, Total transportation cost, fixed and variable costs. Road user cost studies in India.

Module-4

Economic analysis, different methods, determination of annual cost, benefit cost ratio, IRR, FIRR, NPV. Sensitivity of economic analysis, Examples of economic analysis for different types of road improvement measures, pavement options, construction of bypasses and upgrading of intersections. Project priorities, methods of dealing with uncertainties.

Module-5

Highway financing, various options for road and bridge projects, special cess, tolling, BOT, BOOT and other options. Economic and financial analysis of highway projects and use of computer software packages. Road investment decision packages.

Use of software: HDM-4 software, Primavera V8i, MSP (Microsoft project), PPM (Project Portfolio Management)

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Traffic Engineering and Transport Planning	L.R. Kadiyali	Khanna Publishers, New Delhi	
2	Construction Project Management Planning, Scheduling and Controlling	K.K. Chitkara	Tata McGraw Hill publications	
3	Economic analysis for Highways	Winfrey	International Textbook Company, Pennslyvania	1969
4	Theory and Applications of Economics in Highway & Transport Planning	Dr. Vinay Maitri and Dr. P.K. Sarkar	Standard Publishers Distributors, Delhi	
5	Financial Management	Prasanna Chandra	Tata McGraw, New Delhi	
6	Highway Engineering	Hewes C.I. and Oglesby, C.H.	Asia Publishing House	
7	Transportation Engineering Economics	Ian G. Heggie	McGraw Hill Book Co.	

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Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
8	Road User Cost Study in India		Final Report, Central Road Research Institute, New Delhi,	1982
9	Value of Travel Time Savings	L.R. Kadiyali, et al	Traffic Engineering, HRB	
10	Road Development Plan for India- 2001-2021	Ministry of Road Transport and Highways	Indian Roads Congress, New Delhi	2002
11	Manual for the Application of Critical Path Method to Highway Projects in India		IRC	
Nhai.org, pmgsy.nic.in websites				
Standard Data Book on Highway Technology issued by the University may be referred in the PG Examination of VTU.				

(GROUP-5): 20CTM321	ROAD SAFETY AND MANAGEMENT
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Road accidents, Causes, Scientific Investigations and Data Collection: Analysis of Individual accidents to arrive at Real Causes, Statistical Methods of Analysis of Accident Data, Application of Computer Analysis of Accident Data.

Module-2

Ensuring Traffic Safety in Designing New Roads: Meteorological Conditions, Structure of Traffic Streams, Orientation of a Driver on the Direction of a Road beyond the Limits of Actual Visibility and Roadway Cross Section & Objects on the Right-of-Way.

Module-3

Ensuring Traffic Safety in Road Reconstruction: Road Reconstruction and Traffic Safety, Reconstruction Principles, Plotting of Speed Diagram for Working out Reconstruction Projects, Use of Accident Data in Planning Reconstruction of Roads, Examples of Reconstruction of Selected Road Sections for Improving Traffic Safety, Improving Traffic Conditions on Grades, Sharp Curves, Redesign of Intersections, Channelized At-Grade Intersections, Bus Stops, Parking & Rest Areas and Effectiveness of Minor Road Improvements.

Module-4

Ensuring Traffic Safety in Road Operation: Ensuring Traffic Safety during Repair and Maintenance, Prevention of Slipperiness and Influence of Pavement Smoothness, Restriction speeds on Roads, Safety of Pedestrians, Cycle Paths, Informing Drivers on Road Conditions with Aid of Signs, Traffic Control Lines & Guide Posts, Guard rails & Barrier sand Road Lighting.

Module-5

Road Safety Audit and Traffic Management Techniques: Principles-Procedures and Practice, Code of Good Practice and Checklists. Road safety issues and engineering, education, enforcement measures for improving road safety. Local area management, Various types of long term traffic management measures and their uses. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Traffic Engineering and Transport Planning	Kadiyali, L.R.	Khanna Publications, New Delhi	2009
2	Transportation Engineering-An Introduction	C. Jotin Kishty & B. Kent Lall	Third Edition, Prentice Hall of India Private Limited, New Delhi	2006
3	Design of Roads and Road Safety		Latest Editions of Relevant Indian Roads Congress (IRC)	
4	Text book of Highway Engineering	Khanna and Justo	Nemchand Brothers, Roorkee	2001

(GROUP-5): 20CSE252	ADVANCES IN ARTIFICIAL INTELLIGENCE
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: What is AI? Foundations of AI, History of AI, Agents and environments, The nature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies

Module-2

Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, First-order logic, Using First-order logic, Inference in First- order logic, forward and Backward Chaining

Module-3

Learning: Learning from observations, Forms of Learning, Inductive Learning, Learning decision trees, why learning works, Learning in Neural and Belief networks

Module-4

Practical Natural Language Processing: Practical applications, Efficient parsing, Scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception, Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis

Module-5

Robotics: Introduction, Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Introduction to AI based programming Tools

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	2nd Edition, Pearson Education	2007
2	Artificial Neural Networks	B. Yagna Narayana	PHI	
3	Artificial Intelligence	E. Rich and K. Knight	2nd Edition TMH	
4	Artificial Intelligence and Expert Systems	Patterson	PHI	
5	Expert Systems: Principles and Programming	Giarrantana/ Riley	Fourth Edn, Thomson	
6	PROLOG Programming for Artificial Intelligence	Ivan Bratka	Third Edition – Pearson Education	
7	Neural Networks	Simon Haykin	PHI	

(GROUP-5): 20CCS331	DESIGN OF STACK, TOWER AND WATER STORAGE STRUCTURAL SYSTEMS

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Steel Chimneys: Lining for chimneys–breach opening–Forces acting on steel chimneys including seismic forces. Analysis Design and Detailing of RC chimneys for different load combinations. Design of thickness of steel plate–Design of base plate–Design of anchor bolts–Design of foundation.

Module-2

Transmission line towers of various shapes and member types: Loads on towers Analysis and Design of Steel transmission line towers. Design of Foundations.

Module-3

Trestles: Analysis and design of Steel Trestles for vertical and horizontal loads.

Module-4

Water Storage structures: Properties of un-cracked section – Calculation of thickness and reinforcement for Liquid retaining structure, Design and Detailing of underground, Ground Level reservoirs.

Module-5

Overhead water tanks: Circular, Rectangular on framed and Shaft type of Staging systems as per IS 3370 Parts 1 to 4.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Design of Steel structures Vol. 1 and Vol. 2	Ramachandra	Standard Publications	2016 and 2018
2	Design of Steel structures	S.K. Duggal	Tata McGraw Hill	2000
3	Design and Analysis of Steel structures	Vazirani V. N. & Ratwani M. M	Khanna Publishers	2015
4	Code of Practice for Design and Construction of steel chimneys		IS: 6533	
5	Use Of Structural Steel In Overhead Transmission Line		IS 802	
6	Code of practice for design and construction of foundations for transmission line Towers and poles		IS :4091	
7	IS 3370 Part 1 to 4			

(GROUP-5): 20CCT331	ENERGY AND BUILDINGS

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Conservation & energy efficiency concepts-overview of significance of energy use- Renewable and Non- Renewable, energy and their significance, Global energy and environmental resources, Impact of temperature change, Energy crises Energy processes in buildings

Module-2

Solar energy fundamentals & practices in building design- solar astronomical relations and radiation physics and measurements, design decision for optimal orientation of building, shadow analysis.

Module-3

Heating and ventilation design- Human thermal comfort, climatological factors, material specifications and heat transfer principles, thermal performance evaluation, Heat loss from buildings, design of artificial ventilation system, design of insulators

Module-4

Design audits & economic optimization-Concept of cost/benefit of energy conservation & carbon footprint estimation. Energy efficient lighting system design: Basic terminologies and standards, day lighting and artificial lighting design, auditing.

Module-5

Computerenergysimulationprograms-Needforenergysimulationprogramsand its working, Energy simulation tools, Implementation of computer simulation programs.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Energy Efficient Buildings In India	Mili Majumdar	The Energy Research Institute	
2	Energy-EfficientBuildingSystems	Lal Jayamaha	McGraw Hill Publication	
3	Solar Energy and thermal processes	J A Duffie & W A Beckman	John Wiley	
4	Energy Conservation Building		Code, 2007	
5	Handbook of functional requirement of buildings		SP: 41:1987	

(GROUP-5): 20WLM333	GLOBAL WARMING AND CLIMATE CHANGE
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction: Introduction and history of meteorology and climatology: The atmosphere, Solar energy, Global circulation, Climatology, Mid-latitude disturbances , The polar regions, Tropical weather, Paleoclimates, The global climate system
Atmospheric composition, mass and structure Composition of the atmosphere: Primary gases, Greenhouse gases, Reactive gas species, Aerosols, Variations with height, Variations with latitude and season, Variations with time
Mass of the atmosphere: Total pressure, Vapor pressure

Module-2

Atmospheric composition, mass and structure The layering of the atmosphere: Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere and magnetosphere
Solar radiation and the global energy budget: Solar radiation: Solar output, Terrestrial infrared radiation and the greenhouse effect, Heat budget of the earth
Atmospheric moisture budget: The global hydrological cycle, Humidity, Evaporation, Condensation, Precipitation characteristics and measurement

Module-3

Numerical models of the general circulation, climate and weather prediction
Fundamentals of the GCM, Model simulations: GCMs, Simpler models, Regional models, Data sources for forecasting, Numerical weather prediction: Short- and medium- range forecasting, Now casting, Long-range outlooks.

Module-4

Boundary layer climates
Surface energy budgets, Non-vegetated natural surfaces : Rock and sand, Water, Snow and ice Vegetated surfaces: Short green crops, Forests
Urban surfaces: Modification of atmospheric composition, Modification of the heat budget, Modification of surface characteristics, Tropical urban climates.

Module-5

Climate change: General considerations, Climate forcing, feedback and response: Climate forcing, Climate feedbacks, Climate response, The importance of framework
The climatic record : The geological record, The last glacial cycle and post- glacial conditions, The past 1000 years
Understanding recent climatic change : Circulation changes, Solar variability,   Volcanic activity, Anthropogenic factors
Projections of temperature change through the twenty-first century : Applications of General Circulation Models, The IPCC simulations **Projected change in other system components :** Hydrologic cycle and atmospheric circulation, Global sea level, Snow and ice, Vegetation, Post scrip

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Atmosphere, Weather and Climate	Barry R.G., and Chorley R.L.	4th Edition, ELBS Publication	
2	Carbon Cycle Modelling	Bolin B., (Ed.)	John Wiley and Sons Publications	
3	Global Warming	Srivatsava A.K.	APH Publications	
4	Global Climate Change and Life on Earth	Wyman R.L., (Ed.),	Chapman and Hall Publications	
5	Global Warming: India's Response and Strategy	Yadav, Chander and Bhan	RPH Publications	

(GROUP-6): 20CSE332	DESIGN OF MASONRY STRUCTURES

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction, Masonry units, materials and types:
History of masonry, Masonry units–Brick-Types of bricks, Tests conducted on bricks. Other masonry units - stone, clay block, concrete block, laterite block, stabilized mud block masonry units Masonry materials–Classification and properties of mortars, selection of mortars. Cracks - Cracks in masonry structures, Type of crack, causes and prevention of crack.

Module-2

Strength of Masonry in Compression:
Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar Characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, Failure theories of masonry under Compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

Masonry Bond Strength and Masonry in Shear and Flexure
Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength

Module-3

Design of load bearing masonry wall
Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses. Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings. Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.

Module-5

Earthquake resistant masonry buildings:
Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions. In-filled frames: Types–modes of failures

Reinforced brick masonry
Methods of reinforcing Masonry, Analysis of reinforced Masonry under axial, flexural and shear loading

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Structural Masonry	Henry, A.W.	Macmillan Education Ltd.	1990
2	Structural masonry	K.S. Jagadish	I. K. International Publishing House Pvt. Ltd	
3	Brick and Reinforced Brick Structures	Dayaratnam P	Oxford & IBH	1987
4	Building and Construction Materials	M. L. Gambhir	Mc Graw Hill education Pvt. Ltd.	

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(GROUP-6): 20CGT254	SOIL STRUCTURE INTERACTION
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Soil-Foundation Interaction: Introduction to soil-foundation interaction problems, Soil behavior, Foundation behavior, Interface behavior, Scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behavior, Time dependent behavior.

Module-2

Beam on Elastic Foundation- Soil Models: Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness. Plate on Elastic Medium: Thin and thick plates, Analysis of finite plates, Numerical analysis of finite plates, simple solutions.

Module-3

Plates on Elastic Continuum: Thin and thick rafts, Analysis of finite plates, Numerical analysis of finite plates.

Module-4

Elastic Analysis of Pile: Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

Module-5

Laterally Loaded Pile: Load deflection prediction for laterally loaded piles, Subgrade reaction and elastic analysis, Interaction analysis, Pile-raft system, Solutions through influence charts. An introduction to soil-foundation interaction under dynamic loads.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Foundation analysis and design	J E Bowles	McGraw Hill, NY	
2	Soil Mechanics in Engineering Practice	Karl Terzaghi and R B Peck	John Wiley and Sons, NY	1967
3	Analysis and Design of Foundations and Retaining Structures	S Prakash	Sarita Prakashana, Meerut	1979
4	Soil Mechanics and Foundation Engineering	S K Garg	Khanna Publications	
5	Geotechnical Engineering	C Venkataramaiah	New Age International Publishers	

(GROUP-6): 20CWM243	AQUATIC CHEMISTRY AND MICROBIOLOGY
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Microbiology - Importance of Microorganisms in air, water and soil environment. Difference between Prokaryotic and Eukaryotic cells. Principles and applications of microscopy – Bright field, Dark field, Fluoresce, TEM, SEM. Metabolism and metabolic pathways (Meaning and Importance).

Module-2

Bacteria – Morphology, typical growth curve and generation time, classification and their importance.
Algae - Morphology, classification and their importance.
Fungi - Morphology, classification and their importance.
Protozoa - Morphology, classification and their importance.
Enzymes- classification, factors influencing enzyme reaction, Derivation of Michaelis – Menten equation.

Module-3

Control & Measurement of Microorganisms–Physical agents, chemicals agents (Types and Importance in brief). Measurement Techniques - APC, MPN, MFT.
Microbiology of Domestic water and wastewater. Eutrophication of lakes. Bio concentration, Bio magnification and Bioaccumulation.

Module-4

Introduction to Fundamental Chemistry-Importance of environmental Chemistry. Toxic chemicals, Heavy metals and effects, Electrochemistry and its applications.
pH–Principle, Measurement, Numerical Examples, Buffers and Buffer index. **Colourimetry–Principles and applications.**
Dissolved Oxygen–Environmental Significance, methods of determining DO, DO membrane probes, problems.

Module-5

Water Softening–Methods, Causes and Sources of hardness, types of hardness, methods of determination, public health significance, problems.
Instrumental methods of analysis of pollutants–Working principles using Infrared Spectroscopy, Atomic Emission Spectroscopy, Atomic Absorption Spectroscopy, Fluorimetry, Gas Chromatography, HPLC.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	**Chemistry for Environmental Engineering and Science**	Sawyer C.N. and McCarty, P. L.	5th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi	2003
2	**Textbook of Microbiology**	Pelczar M. J , Chan ECS, Krieg, NR	5th edition Tata McGraw Hill Publishing Co.	1998
3	**Microbiology for Sanitary Engineers**	McKinney R.E.	New York McGraw Hill	1962
4	**Standard Methods for Examination of Water and Wastewater**	APHA	21st Edition	2002
5	**Microbiology for Environmental Scientists and Engineers**	Gaudy and Gaudy	McGraw Hill	1980
6	**Microbiology**	L.M. Prescott, Harley, Klein	5th edition, McGraw-Hill Higher Education	2002

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(GROUP-6): 20CEE251	WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Hydrology: Water resources of the world, India and Karnataka, National Water Policy, Hydrologic cycle, estimation of missing precipitation and rain gauge density.

Module-2

Hydrograph theory: Unit hydrograph-derivation, flow routing, low flow analysis. Urban Hydrology - Run-off estimation – Design of Storm water Drains.

Module-3

Unsteady Flow through Conduits: Water hammer analysis, Water hammer protection methods-surge tanks.
Flow Measurements: Area–Velocity method, Weir method, flumes, end-depth method & chemical and radioactive tracers method

Module-4

Groundwater: Basic equations of flow, confined and unconfined aquifers, sea water intrusion, artificial recharge, groundwater pollution, borewells - types & design principles, open wells – types, yield tests

Module-5

Basics and applications of Remote Sensing and GIS: Characteristics of Recently launched Indian Remote sensing satellites with Advantages and Disadvantages various applications related to agriculture, water resource and urban planning etc. Different types of sensors used in remote sensing, Spectral properties of soil, water and vegetation. Contrast enhancement techniques/Image enhancement techniques, Different types data input techniques used in GIS,
Theoretical framework for GIS

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Engineering Hydrology	K. Subramanya	Tata McGraw Hill Publishers, New Delhi.	
2	Ground Water Hydrology	K. Todd	Wiley and Sons, New Delhi	
3	Advanced Hydrology	Raghunath H.M.	Wiley Eastern Ltd New Delhi.	
4	Hand Book of Applied Hydrology	Ven T. Chow	1st Edition McGraw Hill Publications	
5	Remote Sensing and Image Interpretation	Lillesand, Kiefer, Chipman	Wiley	2011

(GROUP-6): 20WRM322	WATER POWER AND DAM ENGINEERING
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Introduction, sources of energy, role of hydropower in a power system, development of water power potential in India and the world, Features and characteristics of water power generation. Data requirement for assessment of water power potential-flow duration and mass curves, energy flow diagram, demand and prediction, Types of Hydropower generation plants-site selection and Planning – Environmental Considerations and its layouts,

Module-2

Components of a hydropower structure-regulatory structures-intake structures –types, location, losses, air entrainment, anti-vortex device, air vent, fore bay, trash racks, power canals, tunnels, surge tanks, settling basins, anchor blanks, penstocks-classification, resonance in penstocks, design criteria, losses, anchor blocks, valves, bends and manifolds,

Module-3

Tunnels- geometric and hydraulic design, water hammer and surges, surge tank- functions, type, design of surge tank, methods of surge analysis, channel surges Types of water power house- structural and geotechnical aspects of power house design, location, site and general arrangements, draft tubes, tail trace and their hydraulic design, draught and cooling towers, turbines - characteristics, hydraulics of turbines,

Module-4

cavitations, transients caused by turbine and foundations, pumps-efficiency and characteristics, generators, exciters, switchboard, transformers and other accessories Water retaining structures-Dams-Classifications, types, planning and investigation of reservoir and dam sites, reservoir capacity and regulation, reservoir silting, dam optimization, analysis and design of earthen and rockfill dams, internal seepage, stability and stress, settlement and deformation, foundation treatment, analysis for failure and safety criteria.

Module-5

Gravity dam - forces acting and criteria, elementary and practical profile, stability analysis, modes of failures, joints, seals, keys and galleries in gravity dams, spillways-types, location and design, energy dissipaters, dam break analysis, dam safety and hazard mitigation

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Water Power Engineering	Barrows, H. K	Tata McGraw Hill Publishing Company Ltd, New Delhi	2000
2	Engineering for dams	Creager, W.P, Justin, J. D and Hinds J	Nem Chand and Brothers, Roorkee	1995
3	Water Power Engineering	Dandekar, M.M., and Sharma, K.N	Vikas Publishing House, New Delhi	1994
4	Irrigation Engineering and Hydraulic Structures	Garg S. K	Khanna Publishers, New Delhi	1998
5	Hydraulics of spillways and energy dissipaters	Khatsuria, R. M	CRC Press, New Delhi	2005
6	Water Power Engineering	Sharma, R.K and Sharma,T.K	S. Chand and company Ltd, New Delhi	2003
7	Fluid Transients	Streeter, V.L and Wylie B	McGraw-Hill Book Company. New Delhi	1967

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
8	Hydro Power Structures	Varshney, R .S	Nem Chand & Bros, Roorkee	2001
9	Hydraulic Structures	Novak, P, Moffat, A.I.B, Nalluri, C and Narayanan, R	CRC press, Fourth Edition	2006

(GROUP-6): 20CCT31	CONSTRUCTION CONTRACTS, SPECIFICATIONS AND ESTIMATION
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Estimation: Estimate, Data required to prepare estimate, Types of estimate, Report for estimate, Factors affecting estimation of major construction project.

Analysis of Rates: Purpose of rate analysis, Procedure for rate analysis, Factors affecting rate analysis. Rate analysis for Lime concreting in foundation or floor, Cement concreting in foundation or floor, RCC work in beams, slabs & column, Reinforced brick work in slabs, First class brick work in foundation & superstructure, Coursed Rubble stone masonry in superstructure, Ashlar stone masonry in superstructure, Cement plastering & Pointing, Cement Concrete Floor, Mosaic or terrazzo Tile floor, white washing & distempering, Damp proof course, Painting, Varnishing , Earth work in excavation, Centering, Shuttering, formwork for RCCbeam, slab, Galvanizedcorrugatedironsheet roofing.

Module-2

General/brief specifications of a first class building, Second class building, Third class building, fourth class building.

Detailed specifications for Earth work in excavation in foundation, Lime concrete in foundation, Cement concrete, Reinforced cement concrete, Damp proof course, Brick work first class, Reinforced brick work, Plastering, pointing, Cement concrete floor, Mosaic or terrazzo floor, White washing, Colour washing, Distempering, Painting, Varnishing, Wood work (carpenter ̈s work), Doors and windows, Glazing, Centering and shuttering, Ashlar stone masonry, Coursed Rubble masonry, Galvanized corrugated iron sheet roofing.

Module-3

Introduction to Contracts:

Agreement, Contract, Essentials conditions of a Valid Contract, Terminologies of Contract, Distinction between Agreement and Contract, Types of Contracts, Indian Contract Act 1872.

Tendering, Bidding & Contracting:

Tender and Tender Documents, Tendering procedure, Tender Notice, Methods of Bidding/Tendering, Conditions of Contract, Securities/Guarantees in contract.

Module-4

Construction Claims: Reasons for Claims in Construction Contracts, Types of Claims, Causes of claims, effects of claims Preparation And Presentation of Claims, Deviations/ Variations: Extraitem, Excess quantity, Deficit quantity, Price Escalation.

Dispute Resolution: Dispute Resolution Mechanism, Types of Dispute Resolution: Arbitration, Mediation, Conciliation, Litigation, Dispute Resolution Board [DRB].

Module-5

BOT Contract: Types of contract, PPP framework, types of risk, concession agreement.

Relational Contracts: Partnering, Alliancing.

Laws affecting Engineers: Labour Law, Sales Tax, VAT, Service Tax, Excise Duty.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Estimation and Costing in Civil Engineering	B.N.Dutta	28th revised edition, UBS Publishers Distributors Pvt. Ltd.	2016
2	*Managing Construction Contracts*	Collier, K.	Reston Publishing Company	
3	Contract Management and Dispute Resolutions	S. Ranaga Rao	Engineering staff College of India	January 2008

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Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
4	General Conditions of Contract		Central Public Works Department, New Delhi	2010
5	Professionalconstruction management including C.M. Design construct and general contracting	D.S. Berrie and B.c. Paulson	McGraw Hill InternationaL, Third Edition	1992
6	Construction & Contract Management Practices	V. K. Raina	SPD, New Delhi	

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(GROUP-6): 20CEM241	INFRASTRUCTURE FOR SMART CITY PLANNING
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

INTRODUCTION
Understanding – Dimensions – Global experience, Global standards and performance bench marks, Practice codes. India 100 smart cities policy and mission, Smart city planning and development, Financing smart cities development, Governance of smart cities.

Module-2

GREEN BUILDING CONCEPTS AND SUSTAINABLE DEVELOPMENT
Green projects in smart cities, sustainability–green building–Rating system–Energy efficient building–energy saving systems

Module-3

WATER SUPPLY AND DRAINAGE
Water–sources of water, treatment and storage, transportation and distribution, quality, networks, distribution losses, water harvesting, recycling and reuse, norms and standards of provision, institutional arrangements, planning provisions and management issues. Sanitation–points of generation, collection, treatment, disposal, norms and standards, grey water disposal, DEWATS, institutional arrangements, planning provisions and management issues. Municipal and other wastes–generation, typology, quantity, collection, storage, transportation, treatment, disposal, recycling and reuse, wealth from waste, norms and standards, institutional arrangements, planning provisions and management issues. Power–Sources of power procurement, distribution networks, demand assessment, norms and standards, planning provisions and management

Module-4

SMART URBAN TRANSPORT SYSTEMS
Elements of Infrastructure (Physical, Social, Utilities and services), Basic definitions, concepts, significance and importance; Data required for provision and planning of urban networks and services; Resource analysis, Provision of infrastructure. Role of transport, types of transport systems, evolution of transport modes, transport problems and mobility issues. Urban form and Transport patterns, land use–transport cycle, concept of accessibility. Hierarchy, capacity and geometric design elements of roads and intersections. Basic principles of Transport infrastructure design. Urban transport planning process–Transport, environment and safety issues. Principles and approaches of Traffic Management, Transport System Management

Module-5

E- GOVERNANCE AND IOT
The concept of management, concept of e-management & e-business, e-Government Principles, Form e-Government to e-governance, e-governance and developing countries, Designing and Implementing e-Government Strategy, E governance: Issues in implementation. IOT fundamentals, protocols, design and development, data analytics and supporting services, case studies.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Regional Development and Planning for the 21st Century: New Priorities and New Philosophies	Allen G.Noble, (Eds)	Aldershot, USA	1988
2	Handbook of Local and Regional Development	Andy Pike, Andres Rodriguez-Pose, John Tomaney	Taylor & Francis	2010

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Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
3	Fifty years of Dutch National Physical Planning	Andreas Faludi and Sheryl Goldberg	Alexandrine Press, Oxford	1991
4	Form Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers	Daniel G. Parolek, AIA, Karen Parolek, Paul C. Crawford, FAICP	John Wiley & Sons	2008

(GROUP-6): 20CIM334	CONSTRUCTION DEMOLITION AND WASTE MANAGEMENT

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Environmental Impact of Building Materials Embodied energy of materials; impact on the local environment; toxicity of the material; life cycle assessment. Nature and Source Direct and indirect waste; site types and origins; composition; quantity; current recycling/reuse potential of building materials.

Module-2

Construction and Demolition Waste Management Plans International good practice; planning requirements; DoEHLG guidance document; company policy; demolition plans; site implementation; supplier agreements; sub−contractor management; role of waste management contractor; training; auditing; skip management; current markets; current disposal options; health and

Module-3

Designing for Waste Prevention and Minimisation Waste prevention and minimization; client, contractor and designer attitudes; proper maintenance of existing buildings; reuse of existing building structure; design flexibility; design for reuse and recycling; dimensional co−ordination and standardization; modular design; material selection and control.

Module-4

Waste Forecasting Tools Application of WRAP's designing out waste tool for buildings and civil engineering; WRAP net waste tool; BRE SMART Waste; WRAP Site Waste Management Plan Tracker

Module-5

Future developments Potential future markets; 'smart' materials; use of eco−materials.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Recycling and Resource Recovery Engineering	Springer – Verlag, Berlin Heidelberg	Springer	1996
2	Recycling Construction and Demolition waste: A LEED - Based Toolkit (Green Source)	Greg Winkler ISBN: 978-0071713382	1e, McGraw Hill Professional	2010
3	Reuse of Construction and Demolition Waste in Housing Development	V M Tam, Chi Ming Tam	Nova Science Publishers ISBN: 9781604563627	2008
4	Sustainable Materials in Building Construction	JMPQ Delgado	Volume 11, Building Pathology and Rehabilitation, Springer, ISBN 978-3-030-46799-9 ISBN 978-3-030-46800-2 (eBook)	2020
5	Current Literature			

(GROUP-6): 20CTE333	PAVEMENT EVALUATION AND MANEGMENT

Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction to pavement evaluation:
Structural and functional requirements of flexible and rigid pavements. Distress and different types of failures in pavements. Functional and structural deterioration of flexible and rigid pavements, Deterioration models.

Module-2

Structural and functional evaluation of pavements-Structural deterioration of pavements, causes, effects, methods of treatment. Structural evaluation of flexible pavements by Rebound deflection method, Analysis of data, interpretation and applications, design of overlay. "Use of FWD and other methods for evaluation of flexible and rigid pavements and their application. Problems. Rating methods. Use of modern equipment for pavement surface condition measurements.

Module-3

Functional deterioration of pavements, causes, effects, methods of treatment. **Pavement surface condition**-Causes, effects, methods of measurement. Functional evaluation and treatment of: a) Pavement slipperiness b) Riding quality and unevenness c) Rutting d) Cracking e) Potholes f) Edge breaking etc. Rating methods. Use of modern equipment for pavement surface condition measurements. Analysis of data, interpretation and application.

Module-4

Evaluation of Pavement Structural Condition & Overlay Design: Evaluation by non- destructive tests such as FWD, Benkelman Beam rebound deflection, Plate load test, wave propagation and other methods; evaluation by destructive test methods, and specimen testing.
Overlay Design: Design of Flexible overlay over flexible pavement, choice of overlays on existing flexible& rigid pavement.

Module-5

Model Pavements & Instrumentation in Pavement Testing: Testing of new pavement materials and model pavements under controlled conditions, test set up and instrumentation.
Instrumentation in Pavement Testing: Details, applications and limitations of various equipment/ instrument/accessories, for, in-situ measurement of strain, pressure, moisture and pavement temperature.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Modern Pavement Management	Hass R., Hudson W. R., Zaniewisti. J.	Krieger Publishing Company, Florida	1994
2	Design and performance of road pavements	David and Paul Croney	Third edition, McGraw hill	1998
3	Pavement Analysis	Per Ulitz	Elsevier Amsterdam	
4	Highway Hand Book	FAW	Publication from NUS, Singapore	
5	Traffic and Highway Engineering	Nicholas J. Garber, Lester A. Hoel	Third Edition Thompson Learning	
6	GUIDELINES FOR STRENGTHENING OF FLEXIBLE ROAD PAVEMENTS USING BENKELMAN BEAM DEFLECTION TECHNIQUE		IRC 81, 1997	
7	Guidelines for Surface Evenness of Highway Pavements		IRC SP 16, 2004	
8	Recommendation about Overlays on Cement concrete Pavements		IRC SP 17	

(GROUP-6): 20CHT323	SPECIAL PROBLEMS IN ROAD CONSTRUCTION
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Problems of construction of roads in marshy areas and weak / expansive soils and water- logged - areas. Various effective measures for solving the problems, machinery required and method of construction.
Control of water table, capillary rise and seepage flow in road construction. Design and construction of filter drains and capillary cut-off. Construction of subgrade in marshy areas and weak / expansive soils and water- logged - areas.

Module-2

Methods of strengthening weak foundation soil, acceleration of consolidation and settlement of compressible embankment foundation, vertical sand drains -Application, design and construction method.

Module-3

Problems in construction of high embankments, stability of foundation and embankment slopes. Stability of hill slopes, control of erosion.

Module-4

Use of special materials such as geo-synthetics for drainage and in pavement layers. Use of reinforced earth retaining walls, Nailing Technique, Techniques of pavement construction using recycled materials – cold and hot mix recycling of bituminous materials.

Module-5

Special construction techniques - construction techniques of cell filled concrete Pavements – design, economics and construction method, and its application. Road construction on desert region and coastal areas, alternative methods, **Special problems** in construction & maintenance of hill roads, land slide, causes, investigation, and preventive and remedial measures, protection of embankment and cut slopes.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Designing with Geosynthetics	R.M. Koerner	4th Edition Prentice Hall, New Jerssey	1997
2	Geotechnical Aspects of Pavements	Reference Manual / Participant Workbook U.S. Department of Transportation	Publication No. FHWA NHI-05-037 Federal Highway Administration	May 2006
	https://www.fhwa.dot.gov/engineering/geotech/pubs/05037/05037.pdf			
3	Pavement Drainage- Theory and Practice	G.L. Shivakumar Babu, Prithvi S Kandhal, Nivedya Mandankara Kottayi, Rajib Mallick	A. Veeraragavan, CRC Press	
4	Guidelines for the design of High embankments	IRC-75	IRC	2015
5	Foundation engineering	Leonards G.A	McGraw Hill Book Company, New York	1962
6	Drainage of highway and airfield pavement	Cedgreen H.R.	John Willey and Sons. Inc., New York	1974
7	Pavements on Expansive clays	G. Kassiff M. Livnet. G. Wisemen	Jerusalem Academy Press, Jerusalem. Israel	1969
8	Highway Materials	R.D. Krebs & R.D.Walker	McGraw Hill Book House, New York	1971

(GROUP-6): 20CTM333	REMOTE SENSING AND GIS IN TRANSPORT PLANNING
Exam Hours: 3 hours	Exam Marks (Maximum): 100

Module-1

Introduction to remote sensing: Definition–Components of Remote Sensing Energy, Sensor, Interacting Body –Active and Passive Remote Sensing–Platforms– Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites Electromagnetic Radiation– EMR Spectrum.

Module-2

Introduction to GIS : Basic Concept and Components – Hardware, Software –Data Spatial and non- spatial – Geo-referencing – Map Projection – Types of Projection – Simple Analysis – Data retrieval and querying.

Module-3

Data structures and analysis: Database–Raster and Vector data structures–Data storage–Run length, Chain and Block coding– Vector data storage–Topology–GIS Modeling-Raster and Vector data analysis–Buffering and overlaying techniques–Network Analysis–Spatial Analysis

Module-4

Basic applications in transportation: Highway and Railway Alignment, location of transport terminals and roadside facilities, bus stops–Route optimization–Bus route rationalization–Accident analysis–Applications of Aerial Photography and Satellite Imageries

Module-5

Advanced applications: GIS as an integration technology–Integration of GIS, GPS and Remote Sensing Techniques–Advanced Traveller Information System (ATIS) – Automatic Vehicle Location System (AVLS)

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Remote Sensing and Image Interpretation	Anji Reddy	John Wiley and Sons Inc. New York	1987
2	Remote Sensing Applications	M.G.Srinivas	Narosa Publishing House	2001
3	Principles of GIS for Land Resources Assessment	Burrough P. A	Oxford Publication	1994
4	Geographical Information System–An Introduction	Jeffrey Star and John Ester	Prentice Hall Inc., Englewood Cliffe	1990
5	Basic Readings in GIS	Marble, D.F, Calkins, H.W and Penquest	Speed System Ltd., New York	1984

Visvesvaraya Technological University, Belagavi.

Ph.D. Coursework Courses – 2020 in Civil Engineering.

(GROUP-6): 20CSE254	DESIGN OF TALL STRUCTURE
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads

Module-2

Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.

Module-3

Behavior of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Futigger – braced and hybrid mega system.

Module-4

Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses.

Module-5

Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Structural Analysis and Design of Tall Buildings	Taranath B.S	McGraw Hill	
2	High rise building structures	Wilf gang Schuller	John Wiley	
3	Tall building structures Analysis and Design	Bryan Stafford Smith & Alexcoull	John Wiley	
4	Structural concepts and system for Architects and Engineers	T.Y Lin & D.Stotes Burry	John Wiley	
5	Advances in Tall Buildings	Lynn S.Beedle	CBS Publishers and Distributors	
6	Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities	Dr. Y.P. Gupta– Editor	New Age International Limited	

(GROUP-6): 20CCS12	COMPUTATIONAL STRUCTURAL MECHANICS - CLASSICAL AND FE APPROACH
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Direct Stiffness Method – Trusses Degrees of Static and Kinematic indeterminacies, Concepts of Stiffness and Flexibility, Local and Global Coordinate System, Analysis of indeterminate Trusses, with and without initial strains for different types of boundary conditions such as Fixed, Hinged, Roller, Slider, Elastic (Spring) supports, support settlement. Numerical examples.

Module-2

Direct Stiffness Method-Continuous Beam, and Frames. Analysis of Continuous beams, for different types of boundary conditions such as Fixed, Hinged, Roller, Slider, Elastic (Spring) supports, support settlement. Numerical examples. Element stiffness matrix formulation for 2D, Grids and 3D frames (Local and Global).

Module-3

FE Analysis using Bar Elements:
Element Stiffness matrix of two and three noded elements. Examples with constant and varying cross sectional area subjected to concentrated loads, distributed body force and surface traction and Initial strains due to temperature.

Module-4

Isoparametric formulation of Bar Elements. Element stiffness matrix of two noded element with constant area, linear variation in area, Consistent Load due to body force, Surface traction. Element stiffness matrix of three noded bar Element, Consistent load due to UDL, Linearly Varying Load, Quadratic Varying Load.

Module-5

FE Analysis using Beam Element. Element Stiffness matrix, Consistent Nodal loads, Concept of Reduced or Lumped Loads, Examples. Cantilever and Simply Supported beams.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Computational Structural Mechanics	Rajasekaran, S. and Shankarsubramanian, G.	PHI New Delhi	2001
2	Matrix analysis of framed structures	Weaver, W. and Gere, J. M.	CBS Publishers and Distributors Pvt. Ltd.	2004
3	Basic Structural Analysis	Reddy. C. S.	TMH, New Delhi	2001
4	Concepts and Applications of Finite Element Analysis	Robert D Cook, Malkas, D. S. and Plesha., M. E.	3rd Edition, John Wiley and Sons, New York	2007
5	Finite element procedures in Engineering Analysis	Bathe. K. J.	PHI. New Delhi	2007
6	Matrix Computer Analysis of structures	Rubinstein M.F	Prentice-Hall, Eaglewood Cliffs, New Jersey	1966
7	Fundamental finite element analysis and applications	M. Asghar Bhatti	John Wiley & Sons	2005

(GROUP-6): 20CTM22	ADVANCED TRAFFIC ENGINEERING
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Traffic Forecast: General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection

Module-2

Design Hourly Volume For Varying Demand Conditions: Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, demand functions. Determination of design hourly volume; critical hour concept

Module-3

HighwayCapacity: Factorsaffectingcapacity,levelofservice;Capacitystudies- Capacity of different highway facilities including un signalized and signalized intersections. Problems in Mixed Traffic flow; Case studies

Module-4

Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to road way and traffic conditions.

Module-5

Traffic Flow Theory: Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications. Probabilistic Aspects Of Traffic Flow: Vehicle arrivals, distribution models, gaps and Head way distribution models; gap acceptance merging parameters, applications.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Traffic Engineering and Transport Planning	Kadiyali, L.R	Khanna Publications	
2	Traffic Flow Theory and Control	Drew, D.R.	McGraw Hill Book Co.	
3	Road conditions and Traffic Safety	BABKOV, V. F.	MIR publications	1975
4	Traffic Engineering –Theory and Practice'	Pignataro, Louis	John Wiley	
5	Research on Road Safety	RRL, DSIR	HMSO, London	
6	IRC Third Highway Safety Workshop	Lecture Notes 1978 and other IRC publications		
7	Traffic Flow Theory	Barenbag	Monograph	
8	Traffic Flow Theory	Gerlan, D. L. and Hember, M. J.	A Monograph, Special report 165 TRRB	
9	Manual of Transportation Engineering Studies	Institute of Transportation Engineers	Prentice Hall	

(GROUP-6): 20WLM331 GROUND WATER ASSESSMENT, DEVELOPMENT AND MANAGEMENT	
Exam Hours: 3 hours	**Exam Marks (Maximum): 100**

Module-1

Zones of Aeration and Saturation: Zone of aeration, Zone of saturation, Storage efficient of aquifers, Fluctuations of the water table, Fluctuations of the piezometric surface, Recharge and discharge areas.
Ground Water Flow: Properties of water in relation to flow, Head distribution, Laminar and turbulent flow, Darcy's law. Formation constants, Flow through aquifers.

Module-2

Evaluation of Aquifer Properties: Aquifer tests, Confined aquifers, Semi confined aquifers, Unconfined and semi unconfined aquifers, Transition for artesian to water table conditions, Bounded aquifers, Partially penetrated aquifers, Sloping piezometric and phreatic surfaces, Areal methods. Sea Water Intrusion: Sea Water Intrusion in Coastal Aquifers, Modelling of Pollutant Transport in the Unsaturated Zone. Prevention and Control of Seawater Intrusion.

Module-3

Ground Water Recharge, Discharge and Balance: Parameters of Ground- Water Balance, Estimation of Recharge Components, Nuclear Methods, Estimation of Ground Water Discharge, Ground Water Resources Evaluation In India, Case History.

Module-4

Ground Water Development and Management: Ground-Water Development, Water logging, Conjunctive use, Desalination, Modelling Techniques in Ground-Water Management, Ground Water Legislation.
Management of Groundwater: Pollution in Relation to water use, Municipal sources and causes, Industrial sources and causes, Agricultural sources and causes, Miscellaneous sources And causes, Attenuation of Pollution, Monitoring Groundwater Quality

Module-5

Groundwater Basin Management and Conjunctive Use: Groundwater Basin Management, Conjunctive Use, Mathematical modelling of a dual aquifer system.

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbook/Reference Books

Sl. No.	Title of the book	Author Name	Publisher's Name	Publication year
1	Ground Water Assessment Development and Management	K. R. Karanth	Tata McGraw- Hill Publishing Company Limited, New Delhi.1	
2	Groundwater Hydrology	David Keith Todd	Gopsons Paper Ltd., Noida, Second Edition	
3	Ground Water	H. M. Raghunath	New Age International (P) Ltd., New Delhi, Third Edition.	

B.E Civil Engineering
Program Outcomes (POs)

At the end of the B.E program, students are expected to have developed the following outcomes.

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.

8. **Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary

settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B.E Civil Engineering program, the students are expected to have developed the following program specific outcomes.

PSO1

The graduates will have the ability to plan, analyse, design, execute and maintain cost effective civil engineering structures without overexploitation of natural resources.

PSO2

The graduates of civil engineering program will have the ability to take up employment, entrepreneurship, research and development for sustainable civil society.

PSO3

The graduates will be able to persue opportunities for personal and professional growth, higher studies, demonstrate leadership skills and engage in lifelong learning by active participation in the civil engineering profession.

PSO4

The graduates will be able to demonstrate professional integrity and an appreciation of ethical, environmental, regulatory and issues related to civil engineering projects.

General Notes:

1. Question Paper Pattern for Theory Courses (2017 Scheme):

- The question paper will have TEN questions.

- Each full question carries 20 marks.

- There will be two full questions (with a maximum of four sub questions) from each module.

- Each full question will have sub questions covering all the topics under a module.

- Students will have to answer 5 full questions, selecting one full question from each module.

2. The teaching learning process should be as per the Choice Based Credit System

3. All Civil Engineering Departments should have a "CIVIL ENGINEERING MUSEUM" with collections related to civil engineering like models, charts, material samples, fixtures and fittings etc. which assist effective teaching learning process.

4. The teaching learning process may be planned to develop capabilities, competencies and skills required for career development based on course beginning and course end surveys.

5. Course objectives, course outcomes and RBT levels given under each course in the syllabus are broad and indicative/suggestive. The faculty can set them appropriately according to their lesson/ course plan.

6. The course coordinators/teachers/instructors are informed to deliberate in the faculty meeting with module coordinator, program coordinator along with the stake holders to develop the respective lesson/ course plans.

7. The department advisory board may make suitable changes to the course objectives, course outcomes and program objectives according to their finalized course plans.

8. The faculty should complement the teaching with case studies and field visits wherever required.

9. One faculty development program to be conducted to compliment teaching learning process by the department in a year

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

III SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week Theory	Teaching Hours /Week Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	Credits
1	17MAT31	Engineering Mathematics –III*	Maths	04		03	60	40	100	4
2	17CV32	Strength of Materials	Civil Engg.	04		03	60	40	100	4
3	17CV33	Fluid Mechanics	Civil Engg.	04		03	60	40	100	4
4	17CV34	Basic Surveying	Civil Engg.	04		03	60	40	100	4
5	17CV35	Engineering Geology	Civil Engg.	04		03	60	40	100	3
6	17CV36	Building Materials and Construction	Civil Engg.	03		03	60	40	100	4
7	17CVL37	Building Materials Testing Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVL38	Basic Surveying Practice	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
		TOTAL		**Theory: 24hours Practical: 06 hours**		25	510	340	850	28

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:
(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – I, which is 03 contact hours per week.

1	17MATDIP31	Additional Mathematics –I	Maths	03		03	60	--	60	--

(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

IV SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics –IV*	Maths	04		03	60	40	100	4
2	17CV42	Analysis of Determinate Structures	Civil Engg.	04		03	60	40	100	3
3	17CV43	Applied Hydraulics	Civil Engg.	04		03	60	40	100	4
4	17CV44	Concrete Technology	Civil Engg.	04		03	60	40	100	4
5	17CV45	Basic Geotechnical Engineering	Civil Engg.	04		03	60	40	100	4
6	17CV46	Advanced Surveying	Civil Engg.	03		03	60	40	100	4
7	17CVL47	Fluid Mechanics Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVL48	Engineering Geology Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
			TOTAL	**Theory: 24hours Practical: 06 hours**		25	510	340	850	28

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2.Audit Course:
(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – II, which is 03 contact hours per week.

| 1 | 17MATDIP41 | Additional Mathematics –II | Maths | 03 | | 03 | 60 | -- | 60 | -- |

(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

V SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination					Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks		
1	17CV51	Design of RC Structural Elements	Civil Engg.	04		03	60	40	100		4
2	17CV52	Analysis of Indeterminate Structures	Civil Engg.	04		03	60	40	100		4
3	17CV53	Applied Geotechnical Engineering	Civil Engg.	04		03	60	40	100		4
4	17CV54	Computer Aided Building Planning and Drawing	Civil Engg.	04		03	60	40	100		4
5	17CV55X	Professional Elective-1	Civil Engg.	03		03	60	40	100		3
6	17CV56X	Open Elective-1	Civil Engg.	03		03	60	40	100		3
7	17CVL57	Geotechnical Engineering Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100		2
8	17CVL58	Concrete and Highway Materials Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100		2
			TOTAL	**Theory: 22hours Practical: 06 hours**		24	480	320	800		26

Professional Elective-1		Open Elective – 1*** (List offered by Civil Engg Board only)	
17CV551	Air pollution and Control	17CV561	Traffic Engineering
17CV552	Railways, Harbours, tunneling and Airports	17CV562	Sustainability Concepts in Engineering
17CV553	Masonry Structures	17CV563	Remote Sensing and GIS
17CV554	Theory of Elasticity	17CV563	Occupational Health and Safety
		17CV563	NCC

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).
Selection of an open elective is not allowed, if:
· The candidate has no pre – requisite knowledge.
· The candidate has studied similar content course during previous semesters.
· The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s).
Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

VI SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CV61	Construction Management and Entrepreneurship	Civil Engg.	04		03	60	40	100	4
2	17CV62	Design of Steel Structural Elements	Civil Engg.	04		03	60	40	100	4
3	17CV63	Highway Engineering	Civil Engg.	04		03	60	40	100	4
4	17CV64	Water Supply and Treatment Engineering	Civil Engg.	04		03	60	40	100	4
5	17CV65X	Professional Elective-2	Civil Engg.	03		03	60	40	100	3
6	17CV66X	Open Elective-2	Civil Engg.	03		03	60	40	100	3
7	17CVL67	Software Application Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVL68	Extensive Survey Project /Camp	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
			TOTAL	**Theory:22hours Practical: 06 hours**		**24**	**480**	**320**	**800**	**26**

Professional Elective-2		Open Elective – 2*** (List offered by Civil Engg Board only)	
17CV651	Solid Waste Management	17CV661	Water Resource Management
17CV652	Matrix Method of Structural Analysis	17CV662	Environmental Protection and Management
17CV653	Alternative Building Materials	17CV663	Numerical Methods and Applications
17CV654	Ground Improvement Techniques	17CV664	Finite Element Analysis

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).

Selection of an open elective is not allowed, if:

· The candidate has no pre – requisite knowledge.

· The candidate has studied similar content course during previous semesters.

· The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s).

Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

VII SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week Theory	Teaching Hours /Week Practical/ Drawing	Examination Duration in hours	Examination SEE Marks	Examination CIE Marks	Examination Total Marks	Credits
1	17CV71	Municipal and Industrial Waste Water Engineering	Civil Engg.	04		03	60	40	100	4
2	17CV72	Design of RCC and Steel Structures	Civil Engg.	04		03	60	40	100	4
3	17CV73	Hydrology and Irrigation Engineering	Civil Engg.	04		03	60	40	100	4
4	17CV74X	Professional Elective-3	Civil Engg.	03		03	60	40	100	3
5	17CV75X	Professional Elective-4	Civil Engg.	03		03	60	40	100	3
6	17CVL76	Environmental Engineering Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
7	17CVL77	Computer Aided Detailing of Structures	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVP78	Project Work Phase–I + Project work Seminar	Civil Engg.		03	--	--	100	100	2
	TOTAL			**Theory:18 hours Practical and Project: 09 hours**		**21**	**420**	**380**	**800**	**24**

Professional Elective-3		Professional Elective-4	
17CV741	Design of Bridges	17CV751	Urban Transportation and Planning
17CV742	Ground Water & Hydraulics	17CV752	Prefabricated Structures
17CV743	Design Concept of Building Services	17CV753	Rehabilitation and Retrofitting of Structures
17CV744	Structural Dynamics	17CV754	Reinforced Earth Structures

1. **Project Phase – I and Project Seminar:** Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and Seminar presentation skill.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

VIII SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CV81	Quantity Surveying and Contracts Management	Civil Engg.	4	-	3	60	40	100	4
2	17CV82	Design of Pre Stressed Concrete Elements	Civil Engg.	4	-	3	60	40	100	4
3	17CV83X	Professional Elective-5	Civil Engg.	3	-	3	60	40	100	3
4	17CV84	Internship/ Professional Practice	Civil Engg.	Industry Oriented		3	50	50	100	2
5	17CVP85	Project Work-II	Civil Engg.	-	6	3	100	100	200	6
6	17CVS86	Seminar on current trends in Engineering and Technology	Civil Engg.	-	4	-	-	100	100	1
		TOTAL		Theory: 11 hours Project and Seminar: 10 hours		15	330	370	700	20

Professional Elective -5	
17CV831	Earthquake Engineering
17CV832	Hydraulic Structures
17CV833	Pavement Design
17CV834	Advanced Foundation Design

1. Internship/ Professional Practice: 4 Weeks internship to be completed between the (VI and VII semester vacation) and/or (VII and VIII semester vacation) period

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: STRENGTH OF MATERIALS B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV32	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives: This course will enable students;

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To analyse and understand principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials.

5. To evaluate the behavior of torsional members, columns and struts.

Module-1

Simple Stresses and Strain:

Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

L1, L2

Module-2

Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses

Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

L2,L4

Module-3
Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations. L2,L4
Module-4
Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion. **Theories of Failure:** Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory). L2 ,L4
Module-5
Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre(only concept) **Columns and Struts:** Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns. L1,L2,L4
Course outcomes: After studying this course, students will be able; 1. To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion. 2. To suggest suitable material from among the available in the field of construction and manufacturing. 3. To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts 4. To understand the basic concept of analysis and design of members subjected to torsion. 5. To understand the basic concept of analysis and design of structural elements such as columns and struts.
Text Books: 1. B.S. Basavarajaiah, P.Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010 2. Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

Reference Books:

1. D.H. Young, S.P. Timoshenko " Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
3. S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

TITLE OF THE COURSE: **FLUIDS MECHANICS**			
B.E., III Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	**17 CV33**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course Objectives: The objectives of this course is to make students to learn:
1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to practical problem solving
3. Principles of Kinematics and Hydro-Dynamics for practical applications
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements

Module-1

Fluids & Their Properties: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension& Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems).Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems

Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.

L2,L3

Module-2

Hydrostatic forces on Surfaces: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane

surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

Fundamentals of fluid flow (Kinematics): Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irroational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.

L2,L4

Module-3
Fluid Dynamics: Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses).   Vortex motion; forced vortex, free vortex, problems Momentum equation problems on pipe bends.   **Applications:** Introduction. Venturimeter, Orificemeter, Pitot tube. Numerical Problems   L2,L4

Module-4
Orifice and Mouthpiece: Introduction, classification, flow through orifice, hydraulic coefficients, Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).   **Notches and Weirs:** Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.   L1,L2,L4

Module-5
Flow through Pipes: Introduction. Major and minor losses in pipe flow. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Pipe Networks, Hardy Cross method, Numerical problems.   **Surge Analysis in Pipes:** Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems   L2 ,L4

Course outcomes: After successful completion of the course, the student will be able to: 1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum   2. Compute and solve problems on hydrostatics, including practical applications   3. Apply principles of mathematics to represent kinematic concepts related to fluid flow   4. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications   5. Compute the discharge through pipes and over notches and weirs
Text Books: 1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi   2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi   3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi
Reference Books:
1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics",

Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)

2. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.

3. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.

4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition

5. 5. Mohd.Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press

TITLE OF THE COURSE: **BASIC SURVEYING** **B.E., III Semester, Civil Engineering** **[As per Choice Based Credit System (CBCS) scheme]**			
Course Code	**17 CV34**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course Objectives: This course will enable students to;
1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Module-1

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.

Measurement of Horizontal Distances: Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems.

L1, L2

Module-2

Measurement of Directions and Angles: Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Theodolite Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite

L2,L3

Module-3

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems

Tacheometry: basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems

L1, L2

Module-4

Leveling: Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling, trigonometric leveling (heights and distances-single plane and double plane methods.)

L3,L4

Module-5

Areas and Volumes: Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- rapezoidal and prismoidal formula.

Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.

L2,L3

Course outcomes: After a successful completion of the course, the student will be able to:
1. Posses a sound knowledge of fundamental principles Geodetics
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
3. Capture geodetic data to process and perform analysis for survey problems]
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

Text Books:
1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi – 2009.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan, 1988

Reference Books:
1. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi.2009.
2. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. – 2010
3. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi
4. A. Bannister, S. Raymond , R. Baker, "Surveying", Pearson, 7th ed., New Delhi

TITLE OF THE COURSE: ENGINEERING GEOLOGY B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV35	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives: This course will enable students;

1. To understand the internal structure and composition of the earth.
2. To comprehend the properties, occurrence and uses of minerals in various industries.
3. To learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects.
4. To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways.
5. To learn the application of Topographic maps, remote sensing and GIS in Civil engineering practices and natural resource management.

Module-1

Introduction: Application of Earth Science in Civil Engineering Practices, Understanding the earth, internal structure and composition.

Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chromite (Alloy); Bauxite (aluminum); Chalcopyrite (copper)

L1,L2

Module-2

Petrology: Formation, Classification and Engineering Properties. Rock as construction material, concrete aggregate, railway ballast, roofing, flooring, cladding and foundation. Deformation of rocks, Development of Joints, Folds, Faults and Unconformities. Their impact in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges, Rock Quality Determination (RQD), Rock Structure Rating (RSR),: Igneous Rocks - Granite, Gabbro, Dolerite, Basalt; Sedimentary rocks - Sandstone, Shale, Limestone, Laterite; Metamorphic rocks - Gneiss, Quartzite,Slate, Charnockite: Decorative stones - Porphyries, Marble and Quartzite

L2,L3.

Module-3

Geomorphology and Seismology: Landforms – Classification, Rock weathering, types and its effects on Civil Engineering Projects. Study of Geo-morphological

aspects in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges. Watershed management, Floods and their control,River valley, Drainage pattern – parameters and development; Coastlines and their engineering considerations.

Earthquake - Causes and Effects,, Seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, Richter Scale, Seismograph, Seismic zones-World and India, Tsunami – causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides – causes and their control

L2, L3, L5.

Module-4

Hydrogeology: Hydrological cycle, Occurrence of Groundwater in different terrains -Weathered, Hard and Stratified rocks; Determination of Quality aspects - SAR, RSC and TH of Groundwater. Groundwater Pollution, Groundwater Exploration-Electrical Resistivity and Seismic methods, Resistivity curves, Water Bearing Formations, Aquifer types and parameters - Porosity, Specific yield and retention, Permeability, Transmissibility and Storage Coefficient. Springs and Artesian Wells, Artificial Recharging of Groundwater, Sea water intrusion and remedies.

L4,L5

Module-5

Geodesy: Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) – Concept and their use resource mapping. LANDSAT Imagery–Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation.

L2,L3, L5

Course outcomes: After a successful completion of the course, the student will be able to:

1. Students will able to apply the knowledge of geology and its role in Civil Engineering
2. Students will effectively utilize earth's materials such as mineral, rocks and water in civil engineering practices.
3. Analyze the natural disasters and their mitigation.
4. Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems.

5. Apply and asses use of building materials in construction and asses their properties

Text Books:

1. P.K. Mukerjee, "A Text Book of Geology", World Press Pvt., Ltd. Kolkatta.
2. Parbin Singh, "Text Book of Engineering and General Geology", Published by S.K.Kataria and Sons, New Dehli

Reference Books:

1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
2. Dimitri P Krynine and William R Judd, "Principles of Engineering Geology and

Geotechnics", CBS Publishers and Distributors, New Delhi.

3. K V G K Gokhale, "Principles of Engineering Geology", BS Publications,Hyderabad.
4. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.
5. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills
6. K. Todd, "Groundwater Hydrology", Tata Mac Grow Hill, New Delhi.
7.   D. Venkata Reddy, "Engineering Geology", New Age International Publications, New Delhi.
8. S.K Duggal, H.K Pandey and N Rawal, "Engineering Geology", McGraw Hill Education (India) Pvt, Ltd. New Delhi.
9. M.P Billings, "Structural Geology", CBS Publishers and Distributors, New Delhi.
10. K. S. Valdiya, " Environmental Geology",, Tata Mc Grew Hills.
11. M. B. Ramachandra Rao, "Outlines of Geophysical Prospecting- A Manual for Geologists", Prasaranga, University of Mysore, Mysore

TITLE OF THE COURSE: Building Materials and Construction B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**17 CV36**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

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Credits – 04

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Course Objectives: This course will develop a student;

1. In recognizing the good materials to be used for the construction work
2. In investigation of soil condition, Deciding and design of suitable foundation for different structures
3. In supervision of different types of masonry
4. In selection of materials, design and supervision of suitable type of floor and roof.
5. To gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning and to take suitable engineering measures.

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Module-1

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Building Materials: Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.

Cement Concrete blocks, Stabilized Mud Blocks, Sizes, requirement of good blocks.

Mortar: types and requirements. Timber as construction material

Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

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L1 L2

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Module-2

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Foundation: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation

Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls

<div align="right">

L1,L2

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Module-3

Lintels and Arches: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.

Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material, Laying of Concrete, Mosaic, Marble, Granite, Tile flooring, Cladding of tiles. Roof;-Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

L3

Module-4

Doors, Windows and Ventilators: Location of doors and windows, technical terms, Materials for doors and windows, Paneled door, Flush door, Collapsible door, Rolling shutter, PVC Door, Paneled and glazed Window, Bay Window, French window. Ventilators. Sizes as per IS recommendations

Stairs: Definitions, technical terms and types of stairs, Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.

Formwork: Introduction to form work, scaffolding, shoring, under pinning.

L2 L3 L5

Module-5

Plastering and Pointing : purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering **Damp proofing**-causes, effects and methods.

Paints- Purpose, types, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

L4 L5

Course outcomes: After a successful completion of the course, the student will be able to:
1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Adopt suitable repair and maintenance work to enhance durability of buildings.

Text Books:

1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015,Standard Publishers
2. Dr. B.C.Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.

Reference Books:

1. S.K.Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. P C Vergese, "Buliding Materials", PHI Learning Pvt. Ltd
3. Building Materials and Components, CBRI, 1990, India
4. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
5. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

TITLE OF THE COURSE: BUILDING MATERIALS T ESTING LABORATORY B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]				
Course Code	**17CVL37**	**CIE Marks**		**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**		**60**
RBT Levels	**L1, L2, L3**	**Exam Hours**		**03**
Credits – 02				

Course Objectives: The objectives of this course is to make students to learn:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Experiments:

1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections
4. Bending Test on Wood Under two point loading
5. Shear Test on Mild steel- single and double shear
6. Impact test on Mild Steel (Charpy & Izod)
7. Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's
8. Tests on Bricks and Tiles
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
11. Demonstration of Strain gauges and Strain indicators

NOTE: All tests to be carried out as per relevant latest BIS Codes

Course outcomes: After successful completion of the course, the students will be able to:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

Question paper pattern:

- Group experiments - Tension test, compression test, torsion test and

bending test.

- Individual Experiments - Remaining tests.

- Two questions are to be set - One from group experiments and the other as individual experiment.

- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.

- All exercises are to be included for practical examination.

Reference Books:

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education(India)Pvt. Ltd., 2014
3. Fenner, " Mechanical Testing of Materials", George Newnes Ltd. London.
4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.
5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd.New Delhi.
6. Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual",Standard Publishers & Distributors 1996.
7. Relevant **latest IS Codes**

TITLE OF THE COURSE: BASIC SURVEYING PRACTICE B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CVL38	CIE Marks	40
Number of Lecture Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Number of Hours	40	Exam Hours	03
RBT Levels	L1, L2, L3, L4		

Credits – 02

Course Objectives: The objectives of this course is to make students to:

1. Apply the basic principles of engineering surveying and measurements
2. Follow effectively field procedures required for a professional surveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Experiments:

1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.
   b) Setting out perpendiculars. Use of cross staff, optical square

2. Obstacles in chaining and ranging – Chaining but not ranging, ranging but not chaining, both ranging and chaining.

3. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.

4. Measurement of bearings of sides of a closed traverse and adjustment of closing error by Bowditch method.

5. Determination of distance between two inaccessible points using compass and accessories

6. Determination of reduced levels of points using dumpy level/auto level (simple leveling)

7. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling)

8. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error

9. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale

10. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.

11. Determination of horizontal distance and vertical height to a base inaccessible object using theodolite by single plane and double plane method.

12. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.

13. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule.

14. Demonstration of Minor instruments Clinometer, Ceylon Ghat tracer, Box sextant, Hand level, Planimeter, nautical sextant and Pentagraph

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying for linear and angular measurements.
2. Comprehend effectively field procedures required for a professional surveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Question paper pattern:

- All are individual experiments.

- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.

- All exercises are to be included for practical examination.

Reference Books:

1. B.C. Punmia, **"Surveying Vol.1"**, Laxmi Publications pvt. Ltd., New Delhi 2009.
2. Kanetkar T P and S V Kulkarni , **Surveying and Levelling Part I**, Pune VidyarthiGrihaPrakashan, 1988
3. S.K. Duggal, **"Surveying Vol.1"**, Tata McGraw Hill Publishing Co. Ltd. New Delhi.-2009.
4. K.R. Arora, **"Surveying Vol. 1"** Standard Book House, New Delhi. – 2010 & Distributors 1996.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: Analysis of Determinate Structures B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV42	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			

Course Objectives: This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope and deflections
2. Identify, formulate and solve engineering problems
3. Analyse structural systems and interpret data
4. Engage in lifelong learning with the advances in Structural Engineering

Module-1

Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

L2,L4,L5

Module-2

Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.

Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts.

Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections.

L2,L4,L5

Module-3

Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the

point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit

load method.

L2,L4,L5

Module-4
Arches and Cable Structures: Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.
L2, L4, L5

Module-5
Influence Lines and Moving Loads: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses-Reactions, BM and SF in determinate beams using rolling loads concepts.
L2, L4, L6

Course outcomes: After studying this course, students will be able to:
1. Evaluate the forces i n determinate trusses by method of joints and sections.
2. Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods
3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.
4. Determine the stress resultants in arches and cables.
5. Understand the concept of influence lines and construct the ILD diagram for the moving loads.

Text Books:

1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.

2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi,2015.

3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi, 2002.

Reference Books:

1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014

2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi, 2008.

3. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd, 2007.

TITLE OF THE COURSE: Applied Hydraulics B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV43	**CIE Marks**	40
Number of Lecture Hours/Week	04	**SEE Marks**	60
Total Number of Lecture Hours	50 (10 Hours per Module)	**Exam Hours**	03

Credits – 04

Course Objectives: The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Module-1

Dimensional analysis: Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ð theorem, dimensional analysis, choice of variables, examples on various applications.
Model analysis: Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model

Buoyancy and Flotation: Buoyancy, Force and Centre of Buoyancy, Metacentre and Metacentric height, Stability of submerged and floating bodies, Determination of Metacentric height, Experimental and theoretical method, Numerical problems

L1, L2, L3, L4

Module-2

Open Channel Flow Hydraulics:

Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems

L3,L4

Module-3

Non-Uniform Flow: Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems, Control sections

L2,L3,L4

Module-4

Hydraulic Machines:

Introduction, Impulse-Momentum equation. Direct impact of ajet on a stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems

Turbines – Impulse Turbines: Introduction to turbines, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems
L1, L2, L3,L4
Module-5
Reaction Turbines and Pumps: Radial flow reaction turbines: (i) Francis turbine-Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)   Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.
L1,L2, L3,L4

Course outcomes:

After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

Text Books:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechan ics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hy draulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechan ics and Fluid Machines", Tata McGraw Hill,New Delhi

1. K Subramanya, "Fluid Mechanics and Hydraulic Machin es", Tata McGraw Hill Publishing Co. Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, *"Fluid Mechanics and Machinery"*, Oxford University Publication – 2010
4. J.B. Evett, and C. Liu, *"Fluid Mechanics and Hydraulics "*, McGraw-Hill Book Company.-2009.

TITLE OF THE COURSE: Concrete Technology B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]				
Course Code	17 CV44		**CIE Marks**	40
Number of Lecture Hours/Week	04		**SEE Marks**	60
Total Number of Lecture Hours	50 (10 Hours per Module)		**Exam Hours**	03
Credits – 04				

Course objectives: This course will enable students to:

1. Recognize the importance of material characteristics and their contributions to strength development in Concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Module-1

Concrete Ingredients

Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.

L1, L2, L3

Module-2

Fresh Concrete

Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

L1, L2, L3

Module-3

Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per

IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

Module-4
Concrete Mix Proportioning
Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262 L1, L2, L3, L4
Module-5
Special Concretes
RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and aplications L1, L2, L3 L4

Course outcomes:

After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behaviour based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

Text Books:

1. Neville A.M. "Properties of Concrete"-4th Ed., Long man.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Mi crostructure, Property and Materials", 4th Edition, McGraw Hill Education, 201 4
4. A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (New Edition)

1. M L Gambir, "Concrete Technology", McGraw Hill Educ ation, 2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning , 2015
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete]Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House

TITLE OF THE COURSE: Basic Geotechnical Engineering B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV45	**CIE Marks**	40
Number of Lecture Hours/Week	04	**SEE Marks**	60
Total Number of Lecture Hours	50 (10 Hours per Module)	**Exam Hours**	03

Credits – 04

Course Objectives: This course will enable students

1. To appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also to become familiar broadly with geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering.
2. To know the basic engineering properties and the mechanical behaviour of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils.
3. To determine the improvement in mechanical behaviour by densification of soil deposits using compaction.
4. To know how the properties of soils that can be measured in the lab

Module-1

Introduction:

Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their inter relationships. Determination of Index properties-Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis) Atterberg's Limits, consistency indices, relative density, activity of clay, Plasticity chart, unified and BIS soil classification.

L1, L2

Module-2

Soil Structure and Clay Mineralogy

Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and ontmorillonite and their application in Engineering

Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control - compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

L1, L2

Module-3

Flow through Soils:

Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity,
superficial velocity and coefficient of percolation, Capillary Phenomena

Seepage Analysis: Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications. Flow nets for sheet piles a nd below the dam section.

Unconfined flow, phreatic line (Casagrande's method –with and without toe filter), flow through dams, design of dam filters.

Effective Stress Analysis: Geostatic stresses, Effective stress concept-total stress, effective

stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena

L1, L2, L3

Module-4

Consolidation of Soil:

Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumption and limitations. Derivation of Governing differential Equation Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under

consolidated and over consolidated soils. Consolidation characteristics of soil (Cc, av, mv and Cv. Laboratory one dimensional consolidation test, characteristics of e-log(σ) curve, Determination of consolidation characteristics of soils compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

L1, L2, L3,

L4Module-5

Shear Strength of Soil:

Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion

Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. Total and effective stress paths.

L2, L3

Course outcomes:

On the completion of this course students are expected to attain the following outcomes;

1. Will acquire an understanding of the procedures to determine index properties of any type of soil, classify the soil based on its index properties
2. Will be able to determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures
3. Will be able to determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress; Also acquire ability to estimate seepage losses across hydraulic structure
4. Will be able to estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.
5. Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.

Text Books:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2000), New Age International (P) Ltd., Newe Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering- (2012) , Laxmi Pulications.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; (2002), Fifth Edition, Thomson

Business Information India (P) Ltd., India

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons, 1969.
2. Donold P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. (2009), "Tata Mc Graw Hill.
4. Narasimha Rao A. V. & Venkatrahmaiah C, Numerical Problems, Examples and objective questions in Geotechnical Engineering-. (2000), Universities Press., Hyderabad.
5. Muni Budhu ,Soil Mechanics and Foundation Engg.- (2010), 3rd Edition, John Wiely & Sons

TITLE OF THE COURSE: Advanced Surveying B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV46	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

<div align="center">Credits – 04</div>

Course Objectives: This course will enable students to:

1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

<div align="center">Module-1</div>

Curve Surveying

Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics , numerical problems on Length of Transition curve, Vertical curves –Types – (theory).

<div align="right">L1,L3,L5</div>

<div align="center">Module-2</div>

Geodetic Surveying and Theory of Errors

Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and

stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.

<div align="right">L1,L2, L3</div>

<div align="center">Module-3</div>

Introduction to Field Astronomy: Earth, celestial sphere, earth and celestial coordinate

systems, spherical triangle, astronomical triangle, Napier's rule

<div align="right">L4,L5</div>

Module-4

Aerial Photogrammetry

Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple

problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax

L2,L3, L5

Module-5

Modern Surveying Instruments

Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station,

Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).

L2,L3, L5

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply the knowledge of geometric principles to arrive at surveying problems

2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.

3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;

4. Design and implement the different types of curves for deviating type of alignments.

Text Books:

1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd., New Delhi.

2. Kanetkar T P and S V Kulkarni , Surveying and Levelling Part 2, Pune Vidyarthi Griha Prakashan,

3. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi.

4. Sateesh Gopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi

Reference Books:

1. S.K. Duggal, "Surveying Vol.I & II", Tata McGraw Hi ll Publishing Co. Ltd. New Delhi.

2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.

3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers

4. B Bhatia, Remote Sensing and GIS , Oxford University Press, New Delhi.

5. T.M Lillesand,. R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India

6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication.

7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill Higher Education

TITLE OF THE COURSE: Fluid Mechanics and Hydraulic Machines Laboratory			
B.E., IV Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	**17CVL47**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3, L4**		
Credits – 02			

Course Objectives: This course will enable students to;
1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

Experiments:

1. Verification of Bernoulli's equation
2. Determination of Cd for Venturimeter and Orifice meter
3. Determination of hydraulic coefficients of small vertical orifice
4. Calibration of Rectangular and Triangular notch
5. Calibration of Ogee and Broad crested weir
6. Determination of Cd for Venturiflume
7. Experimental determination of force exerted by a jet on flat and curved plates (Hemispherical Vane).
8. Experimental determination of operating characteristics of Pelton turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major and Minor Losses in Pipes
13. Demonstration Experiments:
    a. Reynold's experiment to understand laminar and turbulent flow
    b. Flow Visualization
    c. Calibration of Sutro-weir

Course outcomes: During the course of study students will develop understanding of:
1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:
1. Sarbjit Singh , *Experiments in Fluid Mechanics* - PHI Pvt. Ltd.- New Delhi
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi & D r S.M. Seth, Standard Book House- New Delhi. 2009 Edition

Title of the Course: Engineering Geology Laboratory

BE–IV SEMESTER Civil Engineering [AsperChoiceBasedCreditSystem (CBCS) scheme]

Subject Code		17CVL48	CIE Marks	40
Number of Hours/Week	Lecture	03(1hrtutorial+2hr laboratory)	SEE Marks	60
Total Number of Hours	Lecture	40 hr	Exam Hours	03
RBT Levels	L1, L2, L3, L4			
CREDITS–02				

Course objectives: This course will enablestudents
1. Toidentifythemineralsandrocksbasedontheirinherentpropertiesandusesincivil engineering
2. Tointerpretthegeologicalmapsrelatedtocivilengineeringprojects.
3. Tolearnthedipandstrike,boreholeproblems,thicknessofgeologicalformationrelated tofoundation,tunnels,reservoirsandmining.
4. Tounderstand subsurfacegeologicalconditionsthroughageophysical techniquesandwatershedmanagement.
5. Tovisitthecivilengineeringprojectslikedams,reservoirs,tunnels,quarrysitesetc.

Modules	Teaching Hours	RevisedBloom's Taxonomy (RBT Level)
1. Identification of minerals as mentioned in theory, their properties, uses and manufacturing of construction materials.	6 Hours	L1, L2,L3
2. Identification of rocks as mentioned in theory, their engineering properties and uses in construction and decorative purposes	6 Hours	L1,L2, L3
3. Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, reservoirs) –graphical or any other method.	6 Hours	L3,L4
4. Bore hole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining. Triangular and Square	6 Hours	L3, L4
5. Calculation of Vertical, True thickness and width of the outcrops.	3 Hours	L3,L4
6. Interpretationof Electricalresistivitycurvestofind out subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone	4 Hours	L3, L4
7. Interpretation of Toposheets and geological maps related to Civil Engineering Projects	9 Hours	L2,L3, L4

Course outcomes:

Duringthiscourse,studentswilldevelopexpertisein;

1. Identifying the minerals and rocks and utilize them effectively in civil engineering practices

2. Understanding and interpreting the geological conditions of the area for the implementationofcivilengineeringprojects.

3. Interpreting subsurfaceinformationsuchasthickness ofsoil,weathered zone,depthof hardrockandsaturatedzone byusinggeophysicalmethods.

4. Thetechniquesofdrawingthecurvesofelectricalresistivitydataanditsinterpretationfor geotechnicalandaquiferboundaries

ProgramObjectives(asperNBA):

o EngineeringKnowledge.
o ProblemAnalysis.
o Design/developmentofsolutions(partly).
o Interpretationofdata.

Questionpaperpattern:**Questionpaper should be set for 100 marks**

Allareindividualexperiments

Instructions asprinted onthecoverpageofanswer scriptfor splitupofmarkstobe strictlyfollowed.

Allexercisesaretobeincludedfor practicalexamination.

Question PaperPattern		
Qn.No.	EXPERIMENT	MARKS(100)
1	IdentificationofMinerals bygivingtheirphysical propertiesandcivilengineeringapplications(5 minerals)	25(5 x5)
2	Identificationofrocksbygivingtheirphysical properties,classificationandtheircivil engineeringapplications(5rocks)	25(5 x5)
3	Dipandstrikeproblems	7
4	Boreholeproblems(3pointmethod)	12
5	Thicknessofstrataproblemsincludingcalculation ofvertical,truethicknessanditswidthofout crop.	5
6	Electricalresistivitycurvesdrawingandits interpretationforGeotechnicalandAquifer investigations.	7
7	InterpretationofToposheets	6
8	Geologicalmaps,theircrosssectionsand description	15
9	Vivavoce	5

Note:

1)Questionnos.1,2,4,5.7,8&9arecompulsory.

2)**Amongquestionno. 3&6anyone shallbegiven**.

3)InternalAssessmentMarks=**40**:Byconductingatleastonetestfor**20marks**remaining

a)**10 marksforrecord**andb)**10 marks forfield visit report submission**(Engineering projects)

ReferenceBooks:
1. MPBillings,StructuralGeology,CBSPublishersandDistributors,NewDelhi
2. B.S.SatyanarayanaSwamy, Engineering Geology Laboratory Manual , DhanpatRai
    Sons,NewDelhi.
3. LRANarayan,Remotesensinganditsapplications,UniversityPress.
4. P.K.MUKERJEE,TextbookofGeology,WorldPressPvt.Ltd.,Kolkatta
5. JohnIPlattandJohnChallinor,SimpleGeologicalStructures,ThomasMurthy&Co,London

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

5th Semester

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: DESIGN OF RC STRUCTURAL ELEMENTS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17CV51	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			

Course objectives: This course will enable students to
1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of RC elements for the success in competitive examinations.

Module-1

Introduction to Limit State Design and Serviceability: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

L1, L2

Module-2

Limit State Analysis of Beams:
Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear

L2, L4

Module-3

Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams for shear, design for combined bending and torsion as per IS-456

L2, L4

Module-4

Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

L2, L4

Module-5

Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design

concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment

L2, L4

Course outcomes: After studying this course, students will be able to:
1. understand the design philosophy and principles
2. solve engineering problems of RC elements subjected to flexure, shear and torsion
3. demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings
4. owns professional and ethical responsibility

- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper

Text Books:
1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

Reference Books:
1. P C Varghese, "Limit State design of reinforced concrete" , PHI, New Delhi
2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publisher s
3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

TITLE OF THE COURSE: ANALYSIS OF INDETERMINATE STRUCTURES B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CV52	**CIE Marks**	40
Number of Lecture Hours/Week	04	**SEE Marks**	60
Total Number of Lecture Hours	50 (10 Hours per Module)	**Exam Hours**	03
Credits – 04			

Course Objectives: This course will enable students to
1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. communicate effectively in design of structural elements

Module-1

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3

L2, L4,L5

Module-2

Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of 08 Hours orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3

L2, L4,L5

Module-3

Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway

L2, L4,L5

Module-4

Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3

L2, L4,L5

Module-5

Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3

L2, L4,L5

Course outcomes: After studying this course, students will be able to:
1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams and frames using flexibility

method
5. Analyze the beams and indeterminate frames by system stiffness method.

Text Books:
1. Hibbeler R C, **" Structural Analysis",** Pearson Publication
2. L S Negi and R S Jangid, **"Structural Analysis",** Tata *McGraw-Hill* Publishing Company Ltd.
3. D S Prakash Rao, **"Structural Analysis: A Unified Approach"** , Universities Press
4. K.U. Muthu, H.Narendra etal, **"Indeterminate Structural Analysis",** IK International Publishing Pvt. Ltd.

Reference Books:
1. Reddy C S, **"Basic Structural Analysis",** *Tata McGraw-Hill* Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, **"Theory of Structures"**, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M M Ratwani, **"Analysis Of Structures** ", Vol. 2, Khanna Publishers
4. Wang C K, **"Intermediate Structural Analysis",** McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, **"Computational Structural Mechanics",** PHI Learning Pvt. Ltd.,

TITLE OF THE COURSE: APPLIED GEOTECHNICAL ENGINEERING B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CV53	**CIE Marks**	40
Number of Lecture Hours/Week	04	**SEE Marks**	60
Total Number of Lecture Hours	50 (10 Hours per Module)	**Exam Hours**	03
Credits – 04			

Course objectives: This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geotechnology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

Module-1

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

L1,L2,L3

Module-2

Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart Foundation Settlement - Approximate method for stress distribution on a horizontal plane, Types of settlements and importance, Computation of immediate and consolidation settlement

L2,L3,L4

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.

Stability of Slopes : Assumptions, infinite and finite slopes, factor of safety, use of Taylor's stability charts, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle

L2,L4,L5

Module-4

Bearing Capacity of Shallow Foundation: Types of foundations, **10 Hours** determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Effect of water table and eccentricity, field methods - plate load test and SPT Proportioning of shallow foundations- isolated and combined footings (only two columns)

L2,L4,L5,L6

Module-5

Pile Foundations: Types and classification of piles, single loaded pile capacity in

cohesionless and cohesive soils by static formula, efficiency of file group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation)

L1, L2, L3 L4

Course outcomes: On the completion of this course students are expected to attain the following outcomes;
1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Text Books:
1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India

Reference Books:
1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications
4. Debashis Moitra, "Geotechnical Engineering", Universities Press.,
5. Malcolm D Bolton, "A Guide to soil mechanics", Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications

	TITLE OF THE COURSE: COMPUTER AIDED BUILDING PLANNING AND DRAWING B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]		
Course Code	17CV54	**CIE Marks**	40
Number of Lecture Hours/Week	04	**SEE Marks**	60
Total Number of Lecture Hours	50	**Exam Hours**	03

Credits – 04

Course Objectives: Provide students with a basic understanding
1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

Module-1

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962
Simple engineering drawings with CAD drawing tools : Lines, Circle,Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings

12 Hours L1,L2

Module-2

Drawings Related to Different Building Elements:
Following drawings are to be prepared for the data given using CAD
Software
a. Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
b. Different types of bonds in brick masonry
c. Different types of staircases – Dog legged, Open well
d. Lintel and chajja
e. RCC slabs and beams
f. Cross section of a pavement
g. Septic Tank and sedimentation Tank
h. Layout plan of Rainwater recharging and harvesting system
i. Cross sectional details of a road for a Residential area with provision for all services
j. Steel truss (connections Bolted)
Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing

12 Hours L2,L3,L4,L5,L6

Module-3

Building Drawings: Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services *using CAD software* for:

1. Single and Double story residential building
2. Hostel building
3. Hospital building
4. School building
5. Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:
- *Students should sketch to dimension the above in a sketch book before doing the computer drawing*
- *One compulsory field visit/exercise to be carried out.*
- *Single line diagrams to be given in the examination*

26 Hours L2,L3, L4, L5, L6

Course outcomes: After studying this course, students will be able to
1. Gain a broad understanding of planning and designing of buildings
2. Prepare, read and interpret the drawings in a professional set up.
3. Know the procedures of submission of drawings and Develop working and submission drawings for building
4. Plan and design a residential or public building as per the given requirements

Question paper pattern:
- There will be two full questions with sub divisions if necessary from Module 2 with each full question carrying ***thirty*** marks. Students have to answer one question.
- There will be two full questions from Module 3 with each full question carrying ***fifty*** marks. Students have to answer one question.
- The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. question papers should be given in batches

Text Books:
1. MG Shah, CM Kale, SY Patki, **"Building drawing with an integrated approach to Built Environment Drawing"**, Tata Mc Graw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, **"Building Construction",** Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, **"Civil Engineering Drawing"**, Asian Publishers/Computech Publications Pvt Ltd.

Reference Books:
1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
2. IS: 962-1989 (Code of practice for architectural and building drawing)
3. **National Building Code**, BIS, New Delhi.

<table>
<tr><td colspan="4" align="center">TITLE OF THE COURSE: AIR POLLUTION AND CONTROL
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]</td></tr>
</table>

Course Code	17CV551	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03

<table>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
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Course Objectives: This course will enable students to
1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

Module-1

Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

L1,L2

Module-2

Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model

L1,L2,L3

Module-3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)

L2,L3,L4

Module-4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP.

L3,L4

Module-5

Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards. Environmental issues, global episodes, laws, acts, protocols

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:
1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Text Books:
1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication.
2. H. C. Perkins, "Air pollution". Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell, "Introduction t o Environmental Engineering" McGraw-Hill Co.

Reference Books:
1. Noel De Nevers, "Air Pollution Control Engineering" , Waveland Pr Inc.
2. Anjaneyulu Y, "Text book of Air Pollution and Contr ol Technologies", Allied Publishers

TITLE OF THE COURSE: RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17 CV552	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to
1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.
2. Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction
3. Understand various aspects of geometric elements, points and crossings, significance of maintenance of tracks.
4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
5. Apply design features of tunnels, harbours, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

Module-1

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.

L1,L2

Module-2

Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

L1,L2,L3

Module-3

Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.
Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

L2,L3,L4

Module-4

Airport Planning: Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

Module-5

Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

Text Books:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi.
3. Khanna S K, Arora M G and Jain S S, "Airport Planni ng and Design", Nemchand and Brothers, Roorkee,
4. C Venkatramaiah, " Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi

Reference Books:

1. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co.,
2. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill
3. Srinivasan R. Harbour, "Dock and Tunnel Engineering ", 26th Edition 2013

TITLE OF THE COURSE: MASONRY STRUCTURES
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17 CV553	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to
1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Module-1

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties o f mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

L1,L2,L3

Module-2

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

L1,L2,L3

Module-3

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

L1,L2,L3

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

L2,L3,L4,L5

Module-5
Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs.   In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.   **L2,L3,L4,L5**
Course outcomes: After studying this course, students will be able to: 1. Explain engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.   2. Summarize various formulae's for finding compressive strength of masonry units.   3. Explain permissible stresses and design criteria as per IS: 1905 and SP-20.   4. Design different types of masonry walls for different load considerations.
Text Books: 1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd., 1990.   2. Dayaratnam P, "Brick and Reinforced Brick Structures", Oxford & IBH, 1987.   3. M. L. Gambhir, "Building and Construction Materials", Mc Graw Hill education Pvt. Ltd.   **Reference Books:**   1. IS 1905–1987 "Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi.   2. SP 20 (S&T) – 1991, "Hand book on masonry design and construction (1st revision) BIS, New Delhi.

	TITLE OF THE COURSE: THEORY OF ELASTICITY B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]		
Course Code	17CV554	**CIE Marks**	**40**
Number of Lecture Hours/Week	03	**SEE Marks**	**60**
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	**03**
	Credits-03		

Course Objectives: This course will enable students to

1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials into more general, two and three-dimensional problems.

2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.

3. Introduction to the stress – strain relationship, basic principles and mathematical expressions involved in continuum mechanics. also solution of problems in 2- dimensional linear elasticity

Module-1

Concepts of continuum, Stress at a point, Components of stress, Differential equations of equilibrium, Stress transformation, Principal stresses, Maximum shear stress, Stress invariants.

Strain at a point, Infinitesimal strain, Strain-displacement relations, Components of strain, Compatibility Equations, Strain transformation, Principal strains, Strain invariants, Measurement of surface strains, strain rosettes

L1,L2,L3

Module-2

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only).

L1,L2,L3

Module-3

Two-dimensional problems in rectangular coordinates, bending of a cantilever beam subjected to concentrated load at free end, effect of shear deformation in beams, Simply supported beam subjected to Uniformly distributed load.

Two-dimensional problems in polar coordinates, strain-displacement relations, equations of equilibrium, compatibility equation, stress function.
L3, L4

Module-4
Axisymmetric stress distribution - Rotating discs, Lame's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.
L3,L4

Module-5
Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections
L3,L4

Course outcomes: After studying this course, students will be able to:
1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum 2. Ability to formulate boundary value problems; and calculate stresses and strains 3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints; 4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

Text Books:

1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publish ers, 2012
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford & IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003.

Reference Books:

1. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York, 1953

2. G. W. Housner and T. Vreeland, Jr., "The Analysis o f Stress and Deformation", California Institute of Tech., CA, 2012. [Download as per user policy from http://resolver.caltech.edu/CaltechBOOK:1965.001]

3. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", Prentice Hall, 2003.

4. Abdel-Rahman Ragab and Salah EldininBayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press,1998

<table>
<tr><td colspan="4" align="center">TITLE OF THE COURSE: TAFFIC ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]</td></tr>
<tr><td>Course Code</td><td>17 CV561</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40 (8 Hours per Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
</table>

Course Objectives: This course will enable students to
1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analysing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

Module-1

Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

L1,L2,L3

Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.

L1,L2,L3,L4,L5

Module-3

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks

L1,L2,L3,L4

Module-4

Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

L1,L2,L3

Module-5

Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

L1,L2,L3,L4

Course outcomes: After studying this course, students will be able to:
1. Understand the human factors and vehicular factors in traffic engineering design.
2. Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Text Books:
1. Kadiyali.L.R. "Traffic Engineering and Transport Planning ", Khanna Publishers, Delhi, 2013
2. S K Khanna and CEG Justo and A Veeraragavan, "Highway Engineering", Nem Chand and Bros.
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

Reference Books:
1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996
5. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005

TITLE OF THE COURSE: SUSTAINABILITY CONCEPTS IN ENGINEERING			
B.E., V Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV562	**CIE Marks**	40
Number of Lecture Hours/Week	03	**SEE Marks**	60
Total Number of Lecture Hours	40 (8 Hours per Module)	**Exam Hours**	03
Credits – 03			

Course Objectives: This course will enable students to
1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frameworks and their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

Module-1

Introduction: Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act

L1,L2,L3

Module-2

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking

L1,L2,L3

Module-3

Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

L1,L2,L3,L4

Module-4

Clean Technology and Energy: Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

L1,L2,L3

Module-5

Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis

Course outcomes: After studying this course, students will be able to:
1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
5. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

Text Books:
1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning

Reference Books:
1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice
6. Daniel A. Vallero and Chris Brasier, " Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers

<table>
<tr><td colspan="4" align="center">TITLE OF THE COURSE: REMOTE SENSING AND GIS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]</td></tr>
</table>

Course Code	17CV563	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03

<table><tr><td colspan="4" align="center">Credits – 03</td></tr></table>

Course Objectives: This course will enable students to
1. Understand the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required units.
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic maps for various applications.

Module-1

Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

L1,L2,L3

Module-2

Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

L2,L3,L4

Module-3

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

L2,L3,L4

Module-4

Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.

L3,L4,L5

Module-5

Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based

Services And Its Applications.

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:
1. Collect data and delineate various elements from the satellite imagery using their spectral signature.
2. Analyze different features of ground information to create raster or vector data.
3. Perform digital classification and create different thematic maps for solving specific problems
4. Make decision based on the GIS analysis on thematic maps.

Text Books:
1. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press 2008.
2. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press 2011
3. Kang – Tsurg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited 2015.
   Lillesand, Kiefer, Chipman, "Remote Sensing and Image Interpretation", Wiley 2011.

Reference Books:
1. Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006
2. John R. Jensen, "Remote sensing of the environment", An earth resources perspective – 2nd edition – by Pearson Education 2007.
3. Anji Reddy M., "Remote sensing and Geograperhical information system", B.S. Publications 2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications 2004.
5. S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005.

TITLE OF THE COURSE: OCCUPATIONAL HEALTH AND SAFETY			
B.E., V Semester, Civil Engineering			
[As per Choice Based Credit System (CBCS) scheme]			

Course Code	**17CV564**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**
Credits – 03			

Course Objectives: This course will enable students to
1. Gain an historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

L1,L2,L3

Module-2

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations

L2,L3,L4,L5

Module-3

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.
Electrical Safety, Product Safety: Technical Requirements of Product safety.

L2,L3,L4,L5

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and
advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

L2,L3,L4,L5

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:
1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Text Books:
1. Goetsch D.L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
2. Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3. "Industrial Safety and Pollution Control Handbook

Reference Books:
1. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
2. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

TITLE OF THE COURSE: GEOTECHNICAL ENGINEERING LAB			
B.E., V Semester, Civil Engineering **[As per Choice Based Credit System (CBCS) scheme]**			
Course Code	**17CVL57**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT LEVEL L1,L2			
Credits – 02			

Course Objectives: This course will enable students to;
1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

Modules

1. Visual soil classification. Water content determination by oven drying method and infrared moisture method. Specific gravity test (pycnometer and density bottle method).

2. Grain size analysis
    i. Sieve analysis
    ii. Hydrometer analysis

3. In-situ density tests
    i. Core-cutter method
    ii. Sand replacement method

4. Consistency limits
    i. Liquid limit test (by Casagrande's and cone penetration method)
    ii. Plastic limit test
    iii. Shrinkage limit test

5. Standard compaction test (light and heavy compaction)

6. Co-efficient of permeability test
    i. Constant head test
    ii. Variable head test

7. Shear strength tests
    i. Unconfined compression test
    ii. Direct shear test
    iii. Triaxial test (undrained unconsolidated)

8. Consolidation test : Determination of compression index and co- efficient of consolidation

9. Laboratory vane shear test

10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

Course outcomes: Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine
1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shear strength and consolidation parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics (SPT- Demonstration)

Question paper pattern:

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:

1. Punmia B C, Soil Mechanics and Foundation Engineering- (2017), 16th Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4. Bowles J.E., "Engineering Properties of Soil and Their Measurements",- McGraw Hill Book Co. New York.
5. Relevant BIS Codes of Practice: 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)-1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 1 0) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1 966, IS 2720 (Part-60) 1965.

TITLE OF THE COURSE: CONCRETE AND HIGHWAY MATERIALS LABORATORY B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**17CVL58**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3,**		
Credits – 02			

Course objectives: This course will enable students
1. To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

Modules

Part A: Concrete Lab

1. Tests on Cement:
   a. Normal Consistency
   b. setting time
   c. compressive strength
   d. fineness by air permeability test
   e. specific gravity

2. Tests on Concrete:
   a. Design of concrete mix as per IS-10262
   b. Tests on fresh concrete:
      i. slump,
      ii. compaction factor and
      iii. Vee Bee test
   c. Tests on hardened concrete:
      i. compressive strength test,
      ii. split tensile strength test,
      iii. flexural strength test
   d. NDT tests by rebound hammer and pulse velocity test.

3. Tests on Self Compacting Concrete:
   a. Design of self compacting concrete,
   b. slump flow test,
   c. V-funnel test,
   d. J-Ring test,
   e. U Box test and
   f. L Box test

Part B: High way materials Lab

1. Tests on Aggregates
   a. Aggregate Crushing value
   b. Los Angeles abrasion test
   c. Aggregate impact test
   d. Aggregate shape tests (combined index and angularity number)

2. Tests on Bituminous Materials
   a. Penetration test
   b. Ductility test
   c. Softening point test
   d. Specific gravity test
   e. Viscosity test by tar viscometer
   f. Bituminous Mix Design by Marshall Method (Demonstration only)

3. Tests on Soil
    a. Wet sieve analysis
    b. CBR test

Course outcomes: During this course, students will develop expertise in;
1. 1. Conduct appropriate laboratory experiments and interpret the results
2. Determine the quality and suitability of cement
3. Design appropriate concrete mix
4. Determine strength and quality of concrete
5. Test the road aggregates and bitumen for their suitability as road material.
6. Test the soil for its suitability as sub grade soil for pavements.

Question paper pattern:
- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:
1. 1. M.L.Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand & Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual ", Nem Chand Bros, Roorkee
7. L R Kadiyali, "Highway Engineering ", Khanna Publishers, New Delhi

Course Title: CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV61	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks - 100	

Course Objectives: This course will enable students to
1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties.

Module -1

Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans

Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles

Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node.

L1,L2,L3

Module -2

Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

Construction Equipments: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance

Materials: material management functions, inventory management.

L1,L2,L3

Module -3

Construction Quality , safety and Human Values:

Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.

Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

L1,L2,L3

Module -4

Introduction to engineering economy :

Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

Interest and time value of money: concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.

Comparison of alternatives : Present worth, annual equivalent , capitalized and rate of return methods , Minimum Cost analysis and break even analysis
L1,L2,L3

Module -5
Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions. **Micro, Small & Medium Enterprises (MSME):** definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC **Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities , entry into international business , exporting , direct foreign investment , venture capital **L1,L2,L3**

Course Outcomes: After studying this course, students will be able to: 1. Understand the construction management process. 2. Understand and solve variety of issues that are encountered by every professional in discharging professional duties. 3. Fulfill the professional obligations effectively with global outlook

Program Objectives: • Engineering knowledge • Problem analysis • Interpretation of data

Text Books: 1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education 2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi. 3. Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education 4. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi. 5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works :

Reference Books: 1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education 2. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, New Delhi 3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell 4. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw-Hill Education 5. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pitsburgh 6. James L.Riggs , David D. Bedworth , Sabah U. Randhawa " Engineerng Economics" 4 ed tata Mc Graw hill. 7. S.C Sharma –"Construction Equipments and its management" – Khanna publishers

Course Title: DESIGN OF STEEL STRUCTURAL ELEMENTS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	17CV62	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course Objectives: This course will enable students to
1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Module -1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

L1,L2,L3

Module -2

Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip(HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member,
Advantages and Disadvantages of Bolted and Welded Connections.

L1,L2,L3

Module -3

Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

L1,L2,L3

Module -4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

L1,L2,L3

Module -5

Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behaviour of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.

Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel
2. Understand the Concept of Bolted and Welded connections.

3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:
- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:
1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi

Reference Books:
1. Dayarathnam P, "Design of Steel Structures", S Chand and Company Ltd., New Delhi.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

Course Title: HIGHWAY ENGINEERING
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VI

Subject Code	17CV63	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course objectives: This course will enable students to;
1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

Module -1

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute

Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.

L1,L2

Module -2

Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects

Highway Geometric Design: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves

L2,L3,L4

Module -3

Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates-Desirable properties and tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material

Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples

L3,L4,L5

Module -4

Pavement Construction: Design of soil aggregate mixes by Rothfuch's method.

Uses and properties of bituminous mixes and cement concrete in pavement construction.

Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads

	L2,L3,L4

Module -5

Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods-Examples, Highway financing-BOT-BOOT concepts

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. S K Khanna and C E G Justo, " Highway Engineering", Nem Chand Bros, Roorkee
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K.P.subramanium, "Transportation Engineering", SciTech Publications, Chennai.

Reference Books:
1. Relevant IRC Codes
2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

Course Title: WATER SUPPLY AND TREATMENT ENGINEERING As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV64	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course objectives: This course will enable students to
1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

Module -1

Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period.
Different methods of population forecasting -with merits and demerits. Numerical Problems.

L1,L2,L3

Module -2

Water Treatment: Objectives, Treatment flow chart – significance of each unit
Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques.
Water quality characteristics: Physical, Chemical and Microbiological.

L1,L2,L3

Module -3

Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers. Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarriflocculators . Filtration: mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system.
Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pre treatment.

L1,L2,L3

Module -4

Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration.
Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.

L1,L2,L3

Module -5

Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures.
Pumps: Types of pumps with working principles. Numerical Problems.
Pipes: Design of the economical diameter for the rising main; Numerical Problems.
Pipe appurtenances, Valves, Fire hydrants
Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material.
Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination.

Visit to Intake structure, Water treatment plant and report working of each unit
Design of water treatment plant units and distribution system with population forecasting for the given city

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010
2. Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York, 2008.

Reference Books:
1. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.
2. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000
3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

Course Title: SOLID WASTE MANAGEMENT			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	17CV651	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to
1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Module -1

Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.
Collection: Collection of solid waste- services and systems, equipments,
Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.

L1,L2,L3

Module -2

Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control,Mechanical   volume   reduction   (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

L1,L2,L3

Module -3

Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems.
Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill-   Gas and Leachate movement, Control of gas and leachate movement,   Design of sanitary landfill. Numerical Problems

L1,L2,L3

Module -4

 Sources, collection, treatment and disposal of :-
Biomedical waste ,E-waste ,Hazardous waste and construction waste

L1,L2,L3

Module -5

Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolsis ,design criteria for incineration
Energy recovery technique from solid waste management

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
   1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste

Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd.,

Reference Books:
1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solidwaste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

Course Title: MATRIX METHOD OF STRUCTURAL ANALYSIS As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV652	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to
1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses.
3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.
4. Gain knowledge of solving problems involving temperature changes and lack of fit.

Module -1

Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements

L2, L4,L5

Module -2

Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4,L5

Module -3

Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4,L5

Module -4

Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

L2, L4,L5

Module -5

Direct Stiffness Method: Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses

L2, L4,L5

Course Outcomes: After studying this course, students will be able to:
1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Weaver W and Gere J H, **"Matrix Analysis of Framed Structures"**, CBS publications, New Delhi.
2. Rajasekaran S, **"Computational Structural Mechanics"**, PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, **"Matrix and Finite Element Analysis of Structures"**, Ane Books Pvt. Ltd.

Reference Books:
1. Godbole P N et.al, "Matrix Method of Structural Analysis", PHI ltd, New Delhi.
2. Pundit and Gupta, "Theory of Structures Vol II", TMH publications, New Delhi
3. A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee.
4. Manikaselvam, "Elements of Matrix Analysis and Stability of Structures", Khanna Publishers, New Delhi.
5. H C Martin, "Introduction to Matrix Methods in Structural Analysis", International textbook company, McGraw Hill.

Course Title: ALTERNATIVE BUILDING MATERIALS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	17CV653	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
	CREDITS –03	**Total Marks-**	100

Course objectives: This Course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

Module -1

 Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions

L1,L2,L3

Module -2

Elements of Structural Masonry : Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as
per BIS, characteristics and requirements of mortar, selection of mortar.
Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties   of   masonry materials and masonry, Design of masonry compression elements subjected to axial load.

L1,L2,L3

Module -3

 Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes

L1,L2,L3

Module -4

 Alternative Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications.
Top down construction, Mivan Construction Technique.

Alternative Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes

L1,L2,L3

Module -5

Equipment for Production of Alternative Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. KS Jagadish, BV Venkatarama Reddy and KS Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers

Reference Books:

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

Course Title: GROUND IMPROVEMENT TECHNIQUES As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV654	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to
1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and Injection.

Module -1

Formation and Development of Ground : Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits;
Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.
Compaction: Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.

L1, L2 , L3

Module -2

Drainage Methods: Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.
Pre-compression and Vertical Drains: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading

L1, L2 , L3

Module -3

Chemical Modification-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.
Chemical Modification-Ii: Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

L2, L3 , L4

Module -4

Vibration Methods: Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibroflotation, sand compaction piles, stone columns, heavy tamping
GROUTING AND INJECTION: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting

L2 , L3, L5

Module -5

Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of
Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,
Miscellaneous Methods (Only Concepts & Uses): Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.

Course Outcomes: After studying this course, students will be able to:
1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
2. Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", Mc Graw Hill Pub. Co.

Reference Books:
1. Manfred Hausmann , "Engineering principles of ground modification", Mc Graw Hill Pub. Co.,
2. Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London.
3. Nelson J.D. and Miller D.J, "Expansive soils", John Wiley and Sons.
4. Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths

Course Title: WATER RESOURCES MANAGEMENT			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	17CV661	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS – 03	Total Marks-100	

Course objectives: This course will enable students to;
1. Judge surface and ground water resources.
2. Address the issues of water resources management.
3. Learn the principles of integrated water resources management.
4. Understand the legal framework of water policy.
5. Know the different methods of water harvesting.

Module -1

Surface and Ground water Resources: Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage Medium

L2, L3

Module -2

Water Resources Planning and Management: Necessity, System components, planning scales, Approaches, planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.

L2, L3

Module -3

Integrated Water Resources Management: Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and Forms of Private Sector Involvement.

L3, L4

Module -4

Water Governance and Water Policy: Legal Framework of Water – Substance of National Water Laws – Other key issues – Changing incentives through Regulation - National Water Policy – National-Level Commissions – Irrigation Management Transfer Policies and Activities – Legal Registration of WUAs – Legal Changes in Water Allocation, – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India.

L2, L3

Module -5

Water Harvesting and Conservation: Water Harvesting Techniques – Micro-catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment, Rain water Harvesting-various techniques related to Rural and Urban area.

L2, L3

Course outcomes: After studying this course, students will be able to:
1. Assess the potential of groundwater and surface water resources.
2. Address the issues related to planning and management of water resources.
3. Know how to implement IWRM in different regions.

4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
3. Daniel P. Loucks and Eelco van Beek, "Water Resources Systems. Planning and Management", UNESCO Publication.
4. Mollinga, P. et al, "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
5. Singh, Chhatrapati "Water Rights in India," Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi,1992.
6. 6) Dhruva Narayana, G. Sastry, V. S. Patnaik, "Watershed Management", CSWCTRI, Dehradun, ICAR Publications, 1997.

Reference Books:

1. Lal, Ruttan. " Integrated Watershed Management in the Global Ecosystem". CRC Press, New York.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.

Course Title: ENVIRONMENTAL PROTECTION AND MANAGEMENT As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV662	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to gain knowledge in Environmental protection and Management systems

Module -1   Environmental Management Standards

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

L1,L2,L3

Module -2 Environmental Management Objectives

Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies

L1,L2,L3

Module -3 Environmental Management System

EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

L1,L2,L3

Module -4 Environmental Audit

 Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit

L1,L2,L3

Module -5 Applications

Applications of EMS , Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, , Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards
2. Lead pollution prevention assessment team and implement waste minimization options
3. Develop, Implement, maintain and Audit Environmental Management systems for Organisations

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Reference Books:
1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice", McGraw- Hill International, Boston,2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

Course Title: NUMERICAL METHODS AND APPLICATIONS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	17CV663	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

Module -1

Solution of Equations and Eigen value Problems: Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method

L1,L2,L3

Module -2

Interpolation and Approximation: Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

L1,L2,L3

Module -3

Numerical Differentiation and Integration: Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

L1,L2,L3

Module -4

Initial Value Problems for Ordinary Differential Equations : Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

L1,L2,L3

Module -5

Boundary Value Problems in Ordinary and Partial Differential Equations:
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

L1,L2,L3

Course Outcomes: After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from
Industry, management and other engineering fields.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna
   Publishers, 9th Edition, New Delhi
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi

Reference Books:
1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill,

New Delhi

2. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi

3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi

Course Title: FINITE ELEMENT METHOD			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	17CV664	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to;
1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

Module -1

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions

L1,L2

Module -2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates , Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples

L1,L2

Module -3

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisymmetric Element

L1,L2,L3

Module -4

Isoparametric concepts; isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems

L1,L2,L3

Module -5

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.
Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

L1,L2,L3

Course outcomes: The student will have the knowledge on advanced methods of analysis of structures

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al., "Concepts and applications of Finite Element analysis ", John Wiley

Reference Books:
1. Daryl L Logan," A first course on Finite element Method " , Cengage Learning
2. Bathe K J - " Finite Element Procedures in Engineering analysis "- Prentice Hall

Course Title: SOFTWARE APPLICATION LAB				
As per Choice Based Credit System (CBCS) scheme]				
SEMESTER:VI				
Subject Code	17CVL67		IA Marks	40
Number of Lecture Hours/Week	1I+2P		Exam Marks	60
Total Number of Lecture Hours	40		Exam Hours	03
CREDITS –02			Total Marks- 100	

Course objectives: This course will enable students to
1. Use industry standard software in a professional set up.
2. understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design
3. Develop customized automation tools

Module -1

Use of civil engineering softwares:
Use of softwares for:
1. Analysis of plane trusses, continuous beams, portal frames
2. 3D analysis of multistoried frame structures

L1,L2,L3

Module -2

1. **Project Management- Exercise on Project planning and scheduling of a building project using any project management software:**
a. Understanding basic features of Project management software
b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.
c. Identification of Predecessor and Successor activities with constrain
d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non Critical paths, Project duration, Floats.
e. Study on various View options available
f. Basic understanding about Resource Creation and allocation
g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project
(9hrs)

1. **GIS applications using open source software:**
a. To create shape files for point, line and polygon features with a map as reference.
b. To create decision maps for specific purpose.   (3hrs)

L1,L2,L3

Module -3

Use of EXCEL spread sheets:
Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Program Objectives:
• Engineering knowledge
• Problem analysis
• Interpretation of data

Question paper pattern:
• The question paper will have 3 modules comprising of 6 questions.
• There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
• Each full question shall cover the topics as a module
• Module-1: 40 Marks, Module-2: 20 Marks, Module-3: 20 Marks

- The students shall answer three full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Reference Books: Training manuals and User manuals and Relevant course reference books

Course Title: EXTENSIVE SURVEY PROJECT /CAMP			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VI			
Subject Code	**17CVL68**	**IA Marks**	**40**
Number of Practice Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Practice Hours	**50**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to
1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

1. **NEW TANK PROJECTS:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design and preparation of drawing with report.

2. **WATER SUPPLY AND SANITARY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparation of village map by using total station.
   d. Survey work required for laying of water supply and UGD
   e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   f. Design of all elements and preparation of drawing with report.

3. **HIGHWAY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
   c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
   d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

4. **RESTORATION OF AN EXISTING TANK:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design of all elements and preparation of drawing with report.

5. **TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Detailed survey required for project execution like contour surveys
   c. Preparation of layout plans as per regulations
   e. Centerline marking-transfer of centre lines from plan to ground
   f. Design of all elements and preparation of drawing with report as per regulations

Course outcomes: After studying this course, students will be able to:
1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general
5. Establishing trust based relationships in teams & organizational environment
6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Reference Books:
Training manuals and User manuals
Relevant course reference books

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

7th Semester

Course Title: MUNICIPAL AND INDUSTRIAL WASTE WATER ENGINEERING			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	17CV71	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course objectives: This course will enable students to;

4. Understand sewerage network and influencing parameters.
5. Understand and design different unit operations involved in conventional and biological treatment process.
6. Apply the principles of Industrial effluent treatment process for different industrial wastes.
7. Evaluate self purification of streams depending on hydraulic and organic loading of sewage into receiving waters.

Module -1

Introduction, need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm flow, time of concentration flow, material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers. low-cost waste treatment; oxidation pond, septic tank, Sewer appurtenances, manholes, catch basins, basic principles of house drainage, typical layout plan showing house drainage connections,

L1,L2

Module -2

Design of sewers, hydraulic formula for velocity, effects of variation on velocity, regime velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions, disposal of effluents by dilution, self purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents, Streeter-Phelps equation

L2,L3

Module -3

Waste water characteristics, sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water treatment, unit operations; screens, grit chambers, skimming tanks, equalization tanks

Suspended growth and fixed film bio process, design of trickling filters, activated sludge process, sequential batch reactors, moving bed bio reactors, sludge digesters,

L1,L2,L3

Module -4

Difference between domestic and industrial waste water, effect of effluent discharge on streams, methods of industrial waste water treatment; volume reduction, strength reduction, neutralization, equalisation and proportioning. Removal of organic, inorganic and colloidal solids, combined treatment methods; merits, demerits and feasibility, principles of discharge of raw, partially treated and completely treated wastes in to streams

L1,L2

Module -5

Process flow chart, sources and characteristics of industrial waste water, treatment methods, reuse and recovery and disposal; cotton and textile industry, tanning industry, cane sugar and distilleries, dairy industry, steel and cement industry, paper and pulp industry, pharmaceutical and food processing industry.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

4. Acquires capability to design sewer and Sewerage treatment plant.
5. Evaluate degree of treatment and type of treatment for disposal, reuse and recycle.
6. Identify waste streams and design the industrial waste water treatment plant.
7. Manage sewage and industrial effluent issues.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Metcalf and Eddy, "Wastewater Engineering - Collection, Treatment, Disposal and Reuse", McGraw Hill Pub.Co., 2009.
2. Nelson Leonard Nemerow, "Industrial Waste Treatment", Butterworth-Heinemann, 2007.
3. Patwardhan A.D, "Industrial Waste Water Treatment", PHI Learning Private Limited-New Delhi
4. Hammer, M.J. and Hammer, M.J., "Water and Wastewater Technology", 7th Ed., Prentice Hall of India

Reference Books:
1. Manual on Waste Water Treatment: CPHEEO, Ministry of Urban Development, New Delhi.
2. Fair, Geyer and Okun , "Water and Wastewater Engineering" Vol-II, John Willey Publishers, New York.

Course Title: DESIGN OF RCC AND STEEL STRUCTURES			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	17CV72	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course objectives: This course will enable students to

6. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
7. Identify, formulate and solve engineering problems in RC and Steel Structures
8. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
9. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
10. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

Footings: Design of rectangular slab type combined footing.

Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.

Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV)**

Design of portal frames with fixed and hinged based supports.

L1,L2,L3

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.

Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks

Gantry Girder: Design of gantry girder with all necessary checks

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

6. Students will acquire the basic knowledge in design of RCC and Steel Structures.
7. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 40 marks.
3. Code books – IS 456, IS 800, IS 3370 (Part IV), SP (6) – Steel Tables, shall be referred for designing
4. The above charts shall be provided during examinations

Text Books:

4. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
5. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
6. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:
6. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behaviour"**, Pearson Publications
7. Nether Cot, et.al, **"Behaviour and Design of Steel Structures to EC -III"**, CRC Press
8. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
9. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

Course Title: HYDROLOGY AND IRRIGATION ENGINEERING			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	**17CV73**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
	CREDITS – 04	**Total Marks-100**	

Course Objectives: This course will enable students to;

1. Understand the concept of hydrology and components of hydrologic cycle such as pricipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

Module -1

Hydrology: Introduction, Importance of hydrology, Global and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

L2, L3

Module -2

Losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control

Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation,

Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

L2, L3

Module -3

Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations
L2, L4

Module -4

Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation. **Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.
L2, L4

Module -5

Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method. **Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.
L2, L4

Course outcomes: After studying this course, students will be able to:

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.
4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

Program Objectives:

- Engineering knowledge

- Problem analysis

- Interpretation of data

Text Books:

1) K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.

2) Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.

3) Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.

Reference Books:

1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"-. Standard book house, Delhi.
5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications,

Course Title: DESIGN OF BRIDGES				
As per Choice Based Credit System (CBCS) scheme]				
SEMESTER:VII				
Subject Code	17CV741	**IA Marks**		40
Number of Lecture Hours/Week	03	**Exam Marks**		60
Total Number of Lecture Hours	40	**Exam Hours**		03
	CREDITS –03	**Total Marks- 100**		

Course objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Module -1

Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth

Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

L1,L2

Module -2

Design of Slab Bridges: Straight and skew slab bridges

L2,L3

Module -3

Design of T beam bridges(up to three girder only)

Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

L2,L3,L4

Module -4

 Other Bridges:

Design of Box culvert (Single vent only)

Design of Pipe culverts

L2,L3,L4

Module -5
Substructures - Design of Piers and abutments,   Introduction to Bridge bearings, Hinges and Expansion joints.(No design)   **L2,L3,L4**
Course outcomes: After studying this course, students will be able to: • Understand the load distribution and IRC standards.   • Design the slab and T beam bridges.   • Design Box culvert, pipe culvert   • Use bearings, hinges and expansion joints and   • Design Piers and abutments.
Program Objectives: • Engineering knowledge   • Problem analysis   • Interpretation of data
Text Books: 1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.   2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company   3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India
Reference Books: 1. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2., Nem Chand Brothers.   2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.   **3.** "Concrete Bridges", The Concrete Association of India

Course Title: GROUND WATER & HYDRAULICS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	17CV742	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS – 03	Total Marks-100	

Course objectives: This course will enable students

- To characterize the properties of ground water and aquifers.
- To quantify the ground water flow.
- To locate occurrence of ground water and augment ground water resources.
- To synthesize ground water development methods.

Module -1

Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.

L1, L2

Module -2

Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, unisotropic layered soils, steady one dimensional flow: cases with recharge.

L2, L3

Module -3

Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers,

pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper

and Jacob method, Chow's method, solution of unsteady flow equations, leaky

aquifers (only introduction), interference of well, image well theory.

L2, L3, L4

Module -4

Ground Water Exploration: Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and

fluid logging.	
	L2, L3
Module -5	
Ground Water Development: Types of wells, methods of construction, tube well	
design, dug wells, pumps for lifting water, working principles, power requirement,	
Conjunctive use, necessity, techniques and economics.	
Ground Water Recharge: Artificial recharge, groundwater runoff	
	L2, L3

Course outcomes: After studying this course, students will be able to:

- Find the characteristics of aquifers.
- Estimate the quantity of ground water by various methods.
- Locate the zones of ground water resources.
- Select particular type of well and augment the ground water storage.

Program Objectives:

3. Engineering knowledge
4. Problem analysis
5. Interpretation of data

Text Books:

1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.

Reference Books:

1. Garg Satya Prakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

<table>
<tr><td colspan="4" align="center">**Course Title: DESIGN CONCEPT OF BUILDING SERVICES**

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII</td></tr>
<tr><td>**Subject Code**</td><td>**17CV743**</td><td>**IA Marks**</td><td>**40**</td></tr>
<tr><td>**Number of Lecture Hours/Week**</td><td>**03**</td><td>**Exam Marks**</td><td>**60**</td></tr>
<tr><td>**Total Number of Lecture Hours**</td><td>**40**</td><td>**Exam Hours**</td><td>**03**</td></tr>
<tr><td></td><td align="right">**CREDITS –03**</td><td>**Total Marks- 100**</td><td></td></tr>
</table>

Course Objectives: This course will enable students to

1. learn the importance of sanitation, domestic water supply, plumbing and fire services
2. Understand the concepts of heat, ventilation and air conditioning
3. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply, Drainage and Solid Waste Disposal:
Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps – quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit

Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers

Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods

L1,L2

Module -2

Heat Ventilation and Air Conditioning (HVAC):

Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

L1,L2

Module -3

Electrical and Fire Fighting Services:

Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires,

Wiring systems and their choice , planning electrical wiring for building, Main and

distribution boards, Principles of illumination,

Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc.

Provisions of NBC.

L1,L2,L3

Module -4

Plumbing and Fire Fighting Layout of Simple Buildings:

Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

L2,L3

Module -5

Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.
Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift

codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,

Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Reference Books:

- National Building Code
- Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
- Kamala & DL Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
- Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
- M.David Egan, Concepts in Building Fire Safety.
- O.H.Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom
- V.K.Jain, Fire Safety In Building 2edition, New Age International Publishers
- E.G.Butcher, Smoke control in Fire-safety Design.
- E.R.Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York
- Handbook for Building Engineers in Metric systems, NBC, New Delhi

Course Title: STRUCTURAL DYNAMICS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	**17CV744**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

1. Understand the behaviour of structure especially building to various dynamic loads: such as wind, earthquake, machine vibration and ambient vibration
2. Basic understanding of structural analysis and knowledge of engineering mathematics.
3. Understand response of a single degree of freedom system to dynamic excitation and Vibration Control Techniques.

Module -1

Introduction: Introduction to structural dynamics, brief history of vibration, Basic definitions, vibration of SDOF (Single Degree of Freedom) systems, undamped, Damped, Free vibrations, equivalent viscous damping, Logarithmic decrement

L1,L2

Module -2

Forced vibrations of SDOF system, Response of undamped and damped system subjected to harmonic loading, response to SDOF subject to harmonic base excitation, Duhamel's integral, response to general system of loading, dynamic load factor, response spectrum.

L1,L2,L3

Module -3

Free vibration of MDOF (Multi Degree Freedom System), Natural frequencies, Normal modes, Orthogonality of normal modes, Eigen Values Shear buildings modeled as MDOF systems. Free vibrations, Natural frequencies,

L1,L2,L3

Module -4

Forced vibrations, Motion of shear buildings, Model Superposition Method, Response to shear buildings, Base motion, Harmonic fixed excitation.

Damped motion of shear buildings, Equations for damped shear buildings, uncoupled damped equations, Conditions for damping uncoupled.

	L1,L2,L3

Module -5
Dynamic analysis of base stuffiness matrices, Lumped mass and consistent mass formulation, Equations of motion. **L1,L2,L3**

Course outcomes: After studying this course, students will be able to: 1. Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response. 2. Basic understanding of fundamental analysis methods for dynamic systems Interpret dynamic analysis results for design, analysis and research purposes 3. Apply structural dynamics theory to earthquake analysis, response, and design of structures
Program Objectives: 1. Engineering knowledge 2. Problem analysis 3. Interpretation of data
Text Books: • Anil K Chopra, **"Structural Dynamics"**, PHI Publications • Mukobadhyay, **"Vibrations, Structural Dynamics",** Oxford IBH Publications • Vinod Husur, **"Earth Quake resistant design of building structures"**, WILE EASTERN India Publications
Reference Books: • V K Mac Subramanian, "Elementary structural dynamics", Danpatra Publications • Mario Poz, "Structural Dynamics", CBS publications. • Manik A Selvam, "Structural Dynamics", Danpatra publications

Course Title: URBAN TRANSPORTATION AND PLANNING			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	17CV751	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course Objectives: This course will enable students to;

1. Understand and apply basic concepts and methods of urban transportation planning.
2. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
3. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
4. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

Module -1

Urban transport planning: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

L1,L2,L3

Module -2

Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

L1,L2,L3

Module -3

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above**

L3,L4

Module -4

Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above**

L2,L3,L4,L5

Module -5

Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Introduction to land use planning models, land use and transportation interaction.

L2,L3,L4,L5

Course outcomes: After studying this course, students will be able to:

1. Design, conduct and administer surveys to provide the data required for transportation planning.
2. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
3. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
4. Adopt the steps that are necessary to complete a long-term transportation plan.

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:

- Kadiyali.L.R., 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi.
- Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
- Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
- Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

Reference Books:
- Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
- Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
- Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

Course Title: PREFABRICATED STRUCTURES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	17CV752	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course objectives: This course will enable students to

1. Understand modular construction, industrialised construction
2. Design prefabricated elements
3. Understand construction methods.

Module -1

Introduction: Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.

L1,L2

Module -2

Prefabricated Components: Behaviour of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels

–Columns–Shear walls

L1,L2

Module -3

Design Principles: Disuniting of structures-Design of cross section based on efficiency

of material used–Problems in design because of joint flexibility

–Allowance for joint deformation.

L2,L3

Module -4

Joint In Structural Members: Joints for different structural connections–Dimensions and detailing–Design of expansion joints

L1,L2,L3

Module -5

Design For Abnormal Loads: Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

Course Outcomes: After studying this course, students will be able to:

1. Use modular construction, industrialised construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

- CBRI, Building materials and components, India, 1990
- Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

Reference Books:

- Koncz T.,"Manual of precast concrete construction", Vol.I, II and III, Bauverlag, GMBH,1976.
- "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

Course Title: REHABILITATION AND RETROFITTING OF STRUCTURES			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	17CV753	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course Objectives: This course will enable students to;

• Investigate the cause of deterioration of concrete structures.
• Strategise different repair and rehabilitation of structures.
• Evaluate the performance of the materials for repair

Module -1

General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

L1,L2

Module -2

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems

L1,L2

Module -3

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

L1,L2,L3

Module -4

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

L1,L2,L3

Module -5

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different type of structures
3. Summarize the principles of repair and rehabilitation of structures
4. Recognize ideal material for different repair and retrofitting technique

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.

Reference Books:
1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Course Title: REINFORCED EARTH STRUCTURES			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	17CV754	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	

Course Objectives: This course will enable students to;

1. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module -1

Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics

Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties

L1,L2,L3

Module -2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken

L1,L2,L3,L4

Module -3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

L2,L3,L4

Module -4

Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes   **L2,L3,L4**

Module -5

GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability (No Numerical Problems)   Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems)   **L2,L3,L4**

Course outcomes: After studying this course, students will be able to:

1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geosynthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geosynthetics in drainage requirements and landfill designs

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Koerner. R.M, "Design with Geosynthetics", Prince Hall Publications
2. Koerner. R.M. & Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York,.
3. SivakumarBabu G. L., "An introduction to Soil Reinforcement and Geosynthetics", Universities Press, Hyderabad
4. Swami Saran, "Reinforced Soil and its Engineering Applications", I. K. International Pvt. Ltd, New Delhi
5. Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, "Engineering with Geosynthetics", Tata McGraw Hill publishing Company Limited., New Delhi.

Reference Books:
1. Jones, "Earth reinforcement and Soil structure", CJEP Butterworths, London
2. Ingold, T.S. & Millar, K.S, "Geotextile Hand Book", Thomas, Telford, London.
3. Hidetoshi Octial, Shigenori Hayshi& Jen Otani, "Earth Reinforcement Practices",Vol. I, A.A. Balkema, Rotterdam
4. Bell F.G, "Ground Engineer's reference Book", Butterworths, London
5. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.
6. Sarsby R W- Editor, "Geosynthetics in Civil Engineering", Woodhead Publishing Ltd & CRC Press, 2007

Course Title: ENVIRONMENTAL ENGINEERING LABORATORY			
As per Choice Based Credit System (CBCS) scheme			
SEMESTER:VII			
Subject Code	17CVL76	IA Marks	40
Number of Lecture Hours/Week	1I+2P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS –02	Total Marks- 100	

Course objectives: This course will enable students,

1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

Revised Bloom's Taxonomy (RBT) Level   **L1,L2,L3**

1. Determination of pH, Acidity and Alkalinity

2. Determination of Calcium, Magnesium and Total Hardness.

3. Determination of Dissolved Oxygen.
4. Determination of BOD.

5. Determination of Chlorides

6. Determination of percentage of available chlorine in bleaching powder,
7. Determination of Residual Chlorine

8. Determination of Solids in Sewage:
    I)   Total Solids,
    II)   Suspended Solids,
    III)   Dissolved Solids,
    IV)   Volatile Solids, Fixed Solids,
    V)   Settle able Solids.
9. Determination of Turbidity by Nephelometer
10. Determination of Optimum Dosage of Alum using Jar test apparatus.

11. Determination of sodium and potassium using flame photometer.

12. Determination Nitrates by spectrophotometer.
13. Determination of Iron & Manganese.

14. Determination of COD. (Demonstration)

15. Air Quality Monitoring (Ambient, stack monitoring , Indoor air pollution) (Demonstration)

16. Determination of Sound by Sound level meter at different location(Demonstration)

Course Outcomes: After studying this course, students will be able to:

1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.

3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

Program Objectives:

1. Evaluation of the test results and assesses the impact on water and waste water treatment.
2. Train student to undertake student project work in 8th semester in the field of environmental engineering.

Question paper pattern:

1. Two experiments shall be asked from the above set
2. One experiment to be conducted and for the other student should write detailed procedure.

Reference Books:

1. Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal
2. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science" , McGraw-Hill Series in Civil and Environmental Engineering

Course Title: COMPUTER AIDED DETAILING OF STRUCTURES			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	**17CVL77**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03 (1I+2D)**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to

- Be aware of the Scale Factors, Sections of drawings,
- Draft the detailing of RC and Steel Structural member.

RBT LEVEL   **L1,L2,L3**

Module -1 Detailing of RCC Structures

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Beams with Bolted and Welded
6. Gantry Girder

Course outcomes: After studying this course, students will be able to:

4. Prepare detailed working drawings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 40 marks.

Text Books:

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures"¸ CBS Publishers, New Delhi

Reference Books:

1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards
2. IS 13920:2016,Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

8th Semester

Course Title: QUANTITY SURVEYING AND CONTRACTS MANAGEMENT As per Choice Based Credit System (CBCS) scheme SEMESTER:VIII			
Subject Code	17CV81	**IA Marks**	40
Number of Lecture Hours/Week	04	**Exam Marks**	60
Total Number of Lecture Hours	50	**Exam Hours**	03
	CREDITS –04	**Total Marks- 100**	

Course objectives: This course will enable students to;
1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project
2. Understand and apply the concept of Valuation for Properties
3. Understand, Apply and Create the Tender and Contract document.

Module -1

Quantity Estimation for Building; study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method.
Estimate of R.C.C structures including Slab, beam, column, footings, with bar bending schedule.

L2,L3

Module -2

Estimate of Steel truss, manhole and septic tanks.
Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads.

L1,L2,L3

Module -3

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings,
Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost
Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

L1,L2,L3

Module-4

Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).
Law of Contract as per Indian Contract act 1872 , Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting.
Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC

L1,L2,L3

Module -5

Contract Management-Post award : Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism, Contract management and administration
Valuation: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation,

valuation for mortgage, valuation of land.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
1. Prepare detailed and abstract estimates for roads and building.
2. Prepare valuation reports of buildings.
3. Interpret Contract document's of domestic and international construction works

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi
2. B.S. Patil, " Civil Engineering Contracts and Estimates", Universities Press
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi

Reference Books:
1. Kohli D.D and Kohli R.C, " Estimating and Costing",12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, " Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi
7. David Pratt , " Fundamentals of Construction Estimating" – 3ed ,
8. PWD Data Book ,CPWD Schedule of Rates (SoR). and NH SoR – Karnataka
9. FIDIC Contract forms
10. B.S. Ramaswamy " Contracts and their Management" 3ed , Lexis Nexis (a division of Reed Elsevier India Pvt Ltd)

Course Title: DESIGN OF PRE STRESSED CONCRETE ELEMENTS			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	17CV82	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course objectives: This course will enable students to learn Design of Pre Stressed Concrete Elements

Module -1

Introduction and Analysis of Members: Concept of Prestressing - Types of Prestressing - Advantages - Limitations –Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.

Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete - prestressed concrete - Force concept - Load balancing concept - Kern point - Pressure line.

L1,L2

Module -2

Losses in Prestress: Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.

Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

L1,L2

Module -3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members

L1,L2,L3

Module -4

Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

L1,L2,L3

Module -5

Composite Sections: Types of composite construction - Analysis of composite sections - Deflection –Flexural and shear strength of composite sections.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
- Understand the requirement of PSC members for present scenario.
- Analyse the stresses encountered in PSC element during transfer and at working.
- Understand the effectiveness of the design of PSC after studying losses
- Capable of analyzing the PSC element and finding its efficiency.
- Design PSC beam for different requirements.

Course Title: EARTHQUAKE ENGINEERING			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	**17CV831**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks-**	**100**

Course Objectives: This course will enable students to learn about
1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Module -1

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake)

L1,L2,L3

Module -2

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

L1,L2,L3

Module -3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

L1,L2,L3

Module -4

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

L2,L3,L4

Module -5

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings

Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

L2,L3,L4

Course outcomes: After studying this course, students will be able to:

1. Acquire basic knowledge of engineering seismology
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry structures thorough exposure to different IS-codes of practices.

Program Objectives:
1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:
- Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
- S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
- Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
- T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

Reference Books:
1. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

Course Title: HYDRAULIC STRUCTURES			
Course Title: HYDRAULIC STRUCTURES **[As per Choice Based Credit System (CBCS) scheme]** **SEMESTER:VIII**			
Subject Code	**17CV832**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS – 03		**Total Marks-100**	

Course objectives: This course will enable students to;
- Analyze and design gravity dams.
- Find the cross-section of earth dam and estimate the seepage loss.
- Design spillways and aprons for diversion works.
- Design CD works and chose appropriate canal regulation works.

Module -1

Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries.

L2, L3

Module -2

Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.

L2, L3

Module -3

Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices.
Diversion Head works: Design of aprons- Bligh's and Koshla's theory, Simple Problems

L2, L3, L4

Module -4

Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.

L2, L3

Module -5

Canal Regulation Works: Introduction, Function of a regulator.
Canal falls: Necessity and types.
Canal outlets: Necessity and types.

L2, L3

Course outcomes: After studying this course, students will be able to:
- Check the stability of gravity dams and design the dam.
- Estimate the quantity of seepage through earth dams.
- Design spillways and aprons for various diversion works.
- Select particular type of canal regulation work for canal network.

Program Objectives:
1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:
1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2. Punmia and PandeyLal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3. K. R. Arora. "Irrigation, Water Power and Water Resources Engineering" Standard

Publications, New Delhi.

Reference Books:
1. R. K. Sharma, "Text Book of Irrigation Engineering and Hydraulic Structures", Oxford and IBH, New Delhi.
2. P. N. Modi, "Irrigation, Water Resources and Water Power", Standard Book House, New Delhi.

Course Title: PAVEMENT DESIGN			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	17CV833	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03
	CREDITS –03	**Total Marks-**	100

Course objectives: This course will enable students to
1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

Module -1

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement
Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above
L2, L3,L4

Module -2

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.
Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above
L5,L6

Module -3

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflectometer, GPR method. Design factors for runway pavements, Design methods for
Airfield pavement and problems on above
L4,L5

Module -4

 Stresses in Rigid Pavement :   Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above
L4,L5,L6

Module -5

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of subgrade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints
L4,L5

Course outcomes: After studying this course, students will be able to:
1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, burmister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky

Reference Books:
1. Yoder & wit zorac , "Principles of pavement design", John Wiley & Sons.
2. Subha Rao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design" , University Press.
4. Relevant recent IRC codes

Course Title: ADVANCED FOUNDATION DESIGN				
As per Choice Based Credit System (CBCS) scheme]				
SEMESTER:VIII				
Subject Code	17CV834		IA Marks	40
Number of Lecture Hours/Week	03		Exam Marks	60
Total Number of Lecture Hours	40		Exam Hours	03
		CREDITS –03	Total Marks-	100

Course objectives: This course will enable students to
1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course (15CV53)
2. Develop profound understanding of shallow and deep foundation analyses
3. Develop understanding of choice of foundation design parameters
4. Learn about cause and effect of dynamic loads on foundation

Module -1

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

L1,L2

Module -2

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure

L2,L3

Module -3

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

L1,L2,L3

Module -4

Well Foundations: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.
Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

L1,L2,L3

Module -5

Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:
4. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
5. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles
6. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons
7. Understand basics of analysis and design principles of machine foundations

Program Objectives:
- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:
1. Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., India
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

Reference Books:
1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India
4. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

Course Title:	INTERNSHIP /PROFESSIONAL PRACTICE		
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VIII			
Subject Code	17CV84	IA Marks	50
Number of Lecture Hours/Week	Industry Oriented	Exam Marks	50
Total Number of Lecture Hours	Industry Oriented	Exam Hours	03
	CREDITS –02	Total Marks-	100

Course objectives: This course will enable students to get the field exposure and experience

Note: Internship /Professional Practice:

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organisations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.
2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions
3. The industry/organisation should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.
4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.
5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.
6. The College shall facilitate and monitor the student internship program.
7. The internship should be completed during vacation after VI and VII semesters.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.

Scheme of Teaching and Examinations and Syllabus
MASTER OF BUSINESS ADMINISTRATION
(Effective from Academic year 2020 - 21)

SCHEME OF TEACHING AND EXAMINATION

				VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examinations – 2020 - 21 **MASTER OF BUSINESS ADMINISTRATION** Choice Based Credit System (CBCS) and Outcome Based Education(OBE)							

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
MASTER OF BUSINESS ADMINISTRATION
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical component	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20MBA11	Management & Organizational Behavior	03	02	03	40	60	100	4
2	PCC	20MBA12	Managerial Economics	03	02	03	40	60	100	4
3	PCC	20MBA13	Accounting for Managers	03	02	03	40	60	100	4
4	PCC	20MBA14	Business Statistics	03	02	03	40	60	100	4
5	PCC	20MBA15	Marketing Management	03	02	03	40	60	100	4
6	PCC	20MBA16	Managerial Communication	03	02	03	40	60	100	4
			TOTAL	**18**	**12**	**18**	**240**	**360**	**600**	**24**

Note:
PCC: Professional Core Course
Practical /Field Work / Assignment are part of contact hours for the faculty and must be considered in the workload.
Four credit courses are designed for 50 hours Teaching – Learning process.

Note:
1. Each course has a theory component of 3hrs (3credits) and a practical component of 2hrs (1credit). The time-table allotment for each course should be 5hrs (3+2). For the practical component it is mandatory to maintain a record.
2. 20% of marks should be allocated for application oriented questions in the **Semester End Examination (SEE)** question paper based on practical component.
3. Each course content has indicative case studies which can be dealt in the class by the course instructor. In addition to this the course instructor may use an extra case from Harvard/Case Centre. The student cannot assume the same cases will be part of the SEE question paper.
4. One industrial visit per semester is mandatory. The department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
5. Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills.
6. **Practical component:**
   Students should interact with industry (small, medium and large) to understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects and for creative and innovative methods for guidance and to solve the identified problem.
7. **The students shall**
   (a) Gain confidence in modeling of management systems.
   (b) Work on different software/s (tools) to simulate, analyse and authenticate the output to interpret and conclude.
   (c) Involve in case studies and field visits/ field work.
   (d) Accustom with the use of standards to narrow the gap between academia and industry.

   All activities should enhance student's abilities to employment and/or self-employment opportunity, management skills, statistical analysis, fiscal expertise etc.

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical Component	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20MBA21	Human Resource Management	03	02	03	40	60	100	4
2	PCC	20MBA22	Financial Management	03	02	03	40	60	100	4
3	PCC	20MBA23	Research Methodology	03	02	03	40	60	100	4
4	PCC	20MBA24	Operations Research	03	02	03	40	60	100	4
5	PCC	20MBA25	Strategic Management	03	02	03	40	60	100	4
6	PCC	20MBA26	Entrepreneurship & Legal Aspects	03	02	03	40	60	100	4
			TOTAL	**18**	**12**	**18**	**240**	**360**	**600**	**24**

Note:
PCC: Professional Core Course
Practical /Field Work / Assignment are part of contact hours for the faculty and must be considered in the workload.
Four credit courses are designed for 50 hours Teaching – Learning process.

Note:
1. Each course has a theory component of 3hrs (3credits) and a practical component of 2hrs (1credit). The time-table allotment for each course should be 5hrs (3+2). For the practical component it is mandatory to maintain a practical record.
2.   20% of marks should be allocated for application oriented questions in the SEE Question Paper, based on practical component.
3. Each course content has indicative case studies which can be dealt in the class by the course instructor. In addition to this the course instructor may use an extra case from Harvard/Case Centre. The student cannot assume the same cases will be part of the question paper.
4. One industrial visit per semester is mandatory. The department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
5. Internship (four weeks) to be carried out by students after second semester during vacation and the report submitted by the students be assessed internally during the third semester.

		Course Code			**Teaching Hours /Week**		**Examination**				
Sl. No	**Course**	**Marketing**	**Finance**	**Human Resource**	**Theory**	**Practical Component**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**

III SEMESTER(Core Courses and Specialisation Courses)

Sl. No	**Course**	**Marketing**	**Finance**	**Human Resource**	**Theory**	**Practical Component**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
1	PCC	20MBA301*	20MBA301*	20MBA301*	03	02	03	40	60	100	4
2	PCC	20MBA302*	20MBA302*	20MBA302*	03	02	03	40	60	100	4
3	PEC	20MBAMM303	20MBAFM303	20MBAHR303	03	02	03	40	60	100	4
4	PEC	20MBAMM304	20MBAFM304	20MBAHR304	03	02	03	40	60	100	4
5	PEC	20MBAMM305	20MBAFM305	20MBAHR305	03	02	03	40	60	100	4
6	PEC	20MBAMM306	20MBAFM306	20MBAHR306	03	02	03	40	60	100	4
7	PCC	20MBA IN 307	20MBA IN 307	20MBA IN 307	-	08	-	40	60	100	4
	TOTAL				**18**	**20**	**18**	**280**	**420**	**700**	**28**

Note:
PCC: Professional Core Course, PEC: Professional Elective Course.
Practical /Field Work / Assignment are part of contact hours for the faculty and must be considered in the workload.
Four credit courses are designed for 50 hours Teaching – Learning process.
* Interdisciplinary Core Courses may be taught by engineering faculty/subject expert.

Note:
1. Each course has a theory component of 3hrs (3credits) and a Practical component of 2hrs (1credit). The time-table allotment for each course should be 5hrs (3+2). For the practical component it is mandatory to maintain a practical record.
2. 20% of marks should be allocated for application oriented questions in the SEE Question Paper, based on practical component.
3. One industrial visit per Semester is mandatory. The Department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
4. Each course content has indicative case studies which can be dealt in the class by the course instructor. In addition to this the course instructor may use an extra case from Harvard/Case Centre. The student cannot assume the same cases will be part of the question paper.
5. Project (six weeks) to be carried out by students after third semester and the report submitted by the students during the fourth semester.

		Course Code			Teaching Hours /Week		Examination				

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III SEMESTER (Core Courses and Dual Specialisation)

Sl. No	Course	Marketing & Finance	Finance& Human Resource	Human Resource & Marketing	Theory	Practical Component	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	20MBA301*	20MBA301*	20MBA301*	03	02	03	40	60	100	4
2	PCC	20MBA302*	20MBA302*	20MBA302*	03	02	03	40	60	100	4
3	PEC	20MBAMM303	20MBAFM303	20MBAHR303	03	02	03	40	60	100	4
4	PEC	20MBAMM304	20MBAFM304	20MBAHR304	03	02	03	40	60	100	4
5	PEC	20MBAFM303	20MBAHR303	20MBAMM303	03	02	03	40	60	100	4
6	PEC	20MBAFM304	20MBAHR304	20MBAMM304	03	02	03	40	60	100	4
7	PCC	20MBA IN 307	20MBA IN 307	20MBA IN 307	--	08	--	40	60	100	4
	TOTAL				**18**	**20**	**18**	**280**	**420**	**700**	**28**

Note:
PCC: Professional Core Course, PEC: Professional Elective Course.
Practical /Field Work / Assignment are part of contact hours for the faculty and must be considered in the workload.
Four credit courses are designed for 50 hours Teaching – Learning process.
* Interdisciplinary Core Courses may be taught by engineering faculty/subject expert.

Note:
1. Each course has a theory component of 3hrs (3credits) and a practical component of 2hrs (1credit). The time-table allotment for each course should be 5hrs (3+2). For the practical component it is mandatory to maintain a practical record.
2. 20% of marks should be allocated for application oriented questions in the SEE Question Paper, based on practical component.
3. One industrial visit per semester is mandatory. The Department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
4. Each course content has indicative case studies which can be dealt in the class by the course instructor. In addition to this the course instructor may use an extra case from Harvard/Case Centre. The student cannot assume the same cases be part of the question paper.
6. Project (six weeks) to be carried out by students after third semester and the report submitted by the students during the fourth semester.

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III SEMESTER					
Core Courses					
Subject Code	**Title of the Subject**	**Subject Code**	**Title of the Subject**	**Subject Code**	**Title of the Subject**
20MBA301	Emerging Exponential Technologies	20MBA301	Emerging Exponential Technologies	20MBA301	Emerging Exponential Technologies
20MBA302	Technology & Operational Strategy	20MBA302	Technology & Operational Strategy	20MBA302	Technology & Operational Strategy
Specialisation Courses					
Marketing Professional Elective Courses		**Finance Professional Elective Courses**		**Human Professional Elective Courses**	
Subject Code	**Title of the Subject**	**Subject Code**	**Title of the Subject**	**Subject Code**	**Title of the Subject**
20MBAMM303	Services Marketing	20MBAFM 303	Investment Management	20MBAHR303	Recruitment & Selection
20MBAMM304	Marketing Research & Analytics	20MBAFM304	Direct Taxation	20MBAHR304	Human Resource Analytics
20MBAMM305	Consumer Behaviour	20MBAFM305	Banking and Financial Services	20MBAHR305	Industrial Relations and Labour Laws
20MBAMM306	Retail Management	20MBAFM306	Advanced Financial Management	20MBAHR306	Compensation & Reward System
20MBAIN307	Internship	20MBAIN307	Internship	20MBAIN307	Internship

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IV SEMESTER (Specialisation Courses)

Sl. No	Course	Specialisation Courses			Teaching Hours /Week		Examination				Credits
		Marketing	Finance	Human Resource	Theory	Practical Component	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PEC	20MBAMM401	20MBAFM401	20MBAHR401	03	-	03	40	60	100	3
2	PEC	20MBAMM402	20MBAFM402	20MBAHR402	03	-	03	40	60	100	3
3	PEC	20MBAMM403	20MBAFM403	20MBAHR403	03	-	03	40	60	100	3
4	PEC	20MBAMM404	20MBAFM404	20MBAHR404	03	-	03	40	60	100	3
5	PEC	20MBAMM405	20MBAFM405	20MBAHR405	03	-	03	40	60	100	3
6	PEC	20MBAMM406	20MBAFM406	20MBAHR406	03	-	03	40	60	100	3
7	PCC	20MBAPR407	20MBAPR407	20MBAPR407	-	12	-	40	60	100	6
	TOTAL				**18**	**12**	**18**	**280**	**420**	**700**	**24**

Note:
PEC: Professional Elective Course.
Practical /Field Work / Assignment are part of contact hours for the faculty and must be considered in the workload.
Three credit courses are designed for 40 hours Teaching – Learning process.

Note:
1. Each Course has a theory component of 3hrs (3credits). The Time-Table allotment for each course should be 3hrs.
2. 20% of marks should be allocated for application oriented questions in the SEE Question Paper, based on practical component.

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IV SEMESTER(Dual Specialisation)										

Sl. No	Course	Subject Code			Teaching Hours /Week		Examination				Credits
		Marketing & Finance	**Finance& Human Resource**	**Human Resource & Marketing**	Theory	Practical Component	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PEC	20MBAMM401	20MBAFM401	20MBAHR401	03	-	03	40	60	100	3
2	PEC	20MBAMM402	20MBAFM402	20MBAHR402	03	-	03	40	60	100	3
3	PEC	20MBAMM403	20MBAFM403	20MBAHR403	03	-	03	40	60	100	3
4	PEC	20MBAFM401	20MBAHR401	20MBAMM401	03	-	03	40	60	100	3
5	PEC	20MBAFM402	20MBAHR402	20MBAMM402	03	-	03	40	60	100	3
6	PEC	20MBAFM403	20MBAHR403	20MBAMM403	03	-	03	40	60	100	3
7	PCC	20MBAPR407	20MBAPR407	20MBAPR407	-	12	-	40	60	100	6
	TOTAL				**18**	**12**	**18**	**280**	**420**	**700**	**24**

Note:
PEC: Professional Elective Course.
Practical /Field Work / Assignment are part of contact hours for the faculty and must be considered in the workload.
Three credit courses are designed for 40 hours Teaching – Learning process.

Note:
1. Each Course has a theory component of 3hrs (3credits). The Time-Table allotment for each course should be 3hrs.
2. 20% of marks should be allocated for application oriented questions in the SEE Question Paper, based on practical component.

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IV SEMESTER (Specialisation Courses)

Marketing Specialization		Financial Specialization		Human Resource Specialization	
Subject Code	**Title of the Subject**	**Subject Code**	**Title of the Subject**	**Subject Code**	**Title of the Subject**
20MBAMM401	B2B Marketing Management	20MBAFM401	Risk Management and Insurance	20MBAHR401	Organizational Leadership
20MBAMM402	Logistics and Supply Chain Management	20MBAFM402	Financial Derivatives	20MBAHR402	Personal Growth & Interpersonal Effectiveness
20MBAMM403	Digital Marketing Management	20MBAFM403	Indirect Taxation	20MBAHR403	International Human Resource Management
20MBAMM404	Strategic Brand Management	20MBAFM404	Mergers, Acquisitions & Corporate Restructuring	20MBAHR404	Organization Change and Development
20MBAMM405	Agri Business Marketing	20MBAFM405	Corporate Valuation	20MBAHR405	Human Recourse Audit
20MBAMM406	International Marketing Management	20MBAFM406	International Financial Management	20MBAHR406	Management Consulting for Business Excellence
20MBAPR407	Project Report	20MBAPR407	Project Report	20MBAPR407	Project Report

Programme Outcomes (POs)

1. Students are given sufficient theoretical knowledge and are enabled to apply them to solve practical problems in business and other organizations/institutions of importance
2. Students are provided effective communication skills with a high degree of lateral and critical thinking that enhances learn ability, developed for being continuously employable.
3. Students are instilled with leadership qualities, ethically sound, enabled with decision making skills that reflect a high degree of social consciousness
4. Students are trained for sustained research orientation to comprehend a growingly complex, economic, legal and ethical environment
5. Students are equipped with self sustaining entrepreneurship qualities that encourages calculated risk taking.

MANAGEMENT & ORGANIZATIONAL BEHAVIOUR			
Course Code	20MBA11	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. The student will be able to recite the theories and models of Management and Organisational Behavior.
2. The student will be able to apply and solve the workplace problems.
3. The student will be able to classify in differentiating between the best methods to solve the problem.
4. The student will be able to compare the appropriate framework for solving the problems at the workplace
5. The student will be able to design model in dealing with the problems in the organisation.

Module-1 Introduction to Management	9 hours

Management -Introduction, Meaning, Nature, Objectives, Importance, Difference between Administration and Management, Levels of Management, Types of Managers, Managerial Skills, Managerial Competencies, Scope of Management, Functions of Management, Evolution of Management Thought, Fayol's fourteen principles of Management, Recent Trends in Management.

Module -2 Functions of Management	10 hours

Planning- Definition, Features, Nature, Importance, Types, Steps in Planning, Planning Tools and Techniques, Essentials of a Good Plan. **Organisation-**Definitions, Importance, Principles, Types of Organisation Structures, Span of Control, Centralisation and Decentralisation of Authority. **Directing-**Definitions, Importance, Elements of Directing, Principles of Directing, Characteristics of Directing; **Controlling-**Definitions, Need of Controlling, Characteristics of Control, Steps in the Controlling Process, Resistance to Control, Design of Effective Control System, Types of Control, Control Techniques. **Decision-making-** Concepts, Types, Models, Difficulties in Decision-making, Decision-making for Organisational Effectiveness, Decision-making Styles.

Module -3 Organisational Behaviour	10 hours

Organisational Behaviour: Introduction, Definitions, Nature, Goals, Importance, Approaches to Organisational Behaviour, Models. **Attitude-** Meaning, Definition, Types, Components, Attitudes and Behaviour, Changing Attitudes in the Workplace; **Perception-**Perception, Perceptual Process, Factors Influencing Perception, Perception and Decision-making; **Personality-**Definitions, Factors Influencing Personality, Big Five Personality Traits, Myers–Briggs Type Indicator (MBTI), Personality Tools and Tests; **Motivation-**Definitions, Process of Motivation (Cycle of Motivation), Nature, Importance, Types, Theories.

Module -4 Managing Human at Work	7 hours

Group Dynamics- Meaning of Group, Group Characteristics, Classification of Groups, Models of Group Development, Meaning of Group Dynamics, Group Behaviour, Impact of Group on Individual's Behaviour, Impact of External Factors on Group Behaviour. **Teamwork-** Nature of Teams, Team Characteristics, Teams Versus Groups, Teamwork, Processes of Teamwork, Types of Teams, Reasons for Team Failure, Creating Effective Teams.

Module-5 Organizational Power, Politics and Culture	7 hours

Power and Politics- Nature of Power and Politics, Early Voices, Questioning Power and Authority, Sources of Power for Individuals, Managing Organisational Politics. **Culture-** Definitions of Organisational Culture, Strong Versus Weak Culture, Characteristics, Types, Levels, Dimensions, Creating Organisational Culture, Changing Organisational Culture.

Module - 6 Change and Stress Management	7 hours

Change- Nature, Characteristics, Process, Forces Responsible for Change in Organizations, Resistance to Change, Managing Resistance to Change. **Stress Management-**Definitions, Understanding Stress, Relation between Stress and Performance, Level, Signs and Symptoms of Stress, Types of Stress, Causes of Stress, Managing Stress.

Course Outcomes:
1. Gain practical experience in the field of Management and Organization Behaviour
2. Acquire the conceptual knowledge of Management, various functions of Management and theories in Organizational Behaviour.
3. Apply managerial and behaviour knowledge in real world situations.
4. Develop a greater understanding about Management and Behavioural aspects to analyse the concepts related to individual behavior, attitude, perception and personality.
5. Understand and demonstrate their exposure on recent trends in management.

Practical Component:
- Visit an Organisation and meet HR / Manager and note the Roles played in a Day.
- Conduct an event and try understanding the dynamics that goes on group.
- Develop few questions, interact with people in the organisation and try observing personality and reaction.
- Meet any Leader / HOD / Dean and observe the Management of depts. under the leader.

Note: Faculty can either identify the organizations/ leaders/job profile or students can be allowed to choose the same.

CO-PO Mapping

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X	X	X		X
CO2	X			X	
CO3	X				X
CO4	X	X	X		X
CO5	X	X	X	X	X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Essentials of Management	Koontz	McGraw Hill	8e, 2014
2	Principles and Practices of Management and Organisational Behaviour	Chandrani Singh and Aditi Khatri	Sage Publication	2016
3	Organizational behaviour	Stephen P Robbins, Timothy	Pearson	14e, 2012

Reference Books

1	Organizational Behaviour	Fred Luthans,	McGraw Hill International	12/e, 2011
2	Principles of Management	Ramesh B. Rudani	Tata McGraw-Hill	2013
3	Masters of Management Thought	Mahanand Charati& M M Munshi	Swapna Book House	2015

MANAGERIAL ECONOMICS			
Course Code	20MBA12	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:
1. To introduce the fundamentals, tools and theories of managerial economics.
2. To provide an understanding of the application of Economics in Business
3. To learn the basic Micro and Macroeconomic concepts.
4. To have an understanding of Demand, Production, Cost, Profit and Market competitions with reference to a firm and industry.

Module -1 Introduction	7 hours

Managerial Economics: Meaning, Nature, Scope, & Significance, Uses of Managerial Economics, Role and Responsibilities of Managerial Economist. Theory of the Firm: Firm and Industry, Objectives of the firm, alternate objectives of firm. Managerial theories: Baumol's Model, Marris's Hypothesis, Williamson's Model.

Module -2 Demand Analysis	9 hours

Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand –Classification of Price, Income & Cross elasticity, Advertising and promotional elasticity of demand. Uses of elasticity of demand for Managerial decision making, Measurement of elasticity of demand. Law of supply, Elasticity of supply, Demand forecasting: Meaning & Significance, Methods of demand forecasting. (No problems).

Module -3 Cost Analysis & Production analysis	9 hours

Concepts of Production, production function with one variable input - Law of Variable Proportions. Production function with 2 variable inputs and Laws of returns to scale, Indifference Curves, ISO-Quants & ISO-Cost line, Least cost combination factor, Economies of scale, Diseconomies of scale. Technological progress and production function. Types of cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve **Break Even Analysis** – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions (with simple Problems).

Module -4 Market structure and Pricing Practices	9 hours

Perfect Competition, Features, Determination of price under perfect competition, Monopoly: Features, Pricing under monopoly, Price Discrimination. Monopolistic Competition: Features, Pricing Under monopolistic competition, Product differentiation. Oligopoly: Features, Kinked demand Curve, Cartels, Price leadership.

Descriptive Pricing Approaches: Full cost pricing, Product line pricing, Pricing Strategies: Price Skimming, Penetration Pricing, Loss leader pricing, Peak Load pricing.

Module -5 Indian Business environment	9 hours

Nature, Scope, Structure of Indian Business Environment – Internal and External Environment. Political and Legal Environment, Economic Environment, Socio – Cultural Environment, Global Environment

Basic Macro Economic Concepts: Open and Closed Economies, Primary, secondary and Tertiary sectors and their contribution to the economy. SWOT Analysis for the Indian economy. Measuring the Economy: Measuring GDP and GDP Growth rate, Components of GDP.

Module-6 Indian Industrial Policy	7 hours

Industrial Policies and Structure: A critical look at Industrial Policies of India, New Industrial Policy 1991; - Private Sector- Growth, Problems and Prospects, SMEs –Significance in Indian economy-problems and prospects. **Fiscal policy and Monetary Policy. Foreign Trade:** Trends in India's Foreign Trade, Impact of WTO on India's Foreign Trade.

Course outcomes:

At the end of the course the student will be able to:
1. The student will understand the application of Economic Principles in Management decision making.
2. The student will learn the micro economic concepts and apply them for effective functioning of a Firm and Industry.
3. The Student will be able to understand, assess and forecast Demand.
4. The student will apply the concepts of production and cost for optimization of production.
5. The student will design Competitive strategies like pricing, product differentiation etc. and marketing according to the market structure.
6. The student will be able to understand macroeconomic concepts.

Practical Component:
- Assessment of Demand Elasticity – Price, Income, Cross, Advertising.
- Demand Forecasting:
- Application of qualitative and quantitative methods of demand forecasting to various sectors (Automobile, Service, Pharmaceutical, Information Technology, FMCG, Hospitality etc.) in India.
- Preparing a Project proposal for a Business Venture.(Compulsory)

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X		
CO2	X	X		X	
CO3	X				X
CO4	X				X
CO5	X			X	
CO6	X			X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 80 percent theory and 20 percent problems in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Managerial Economics	Geethika, Ghosh & Choudhury	McGraw Hill	2/e, 2011
2	Managerial Economics	Dominick Salvotore,	Oxford Publishers	2e, 2016

Reference Books

1	Managerial Economics	R. Panneerselvam, P. Sivasankaran, P. Senthilkumar	Cengage	2015
2	Managerial Economics	Samuelson & Marks	Wiley	5/e, 2015
3	Managerial Economics	D.M Mithani	HPH	2016
4	Managerial Economics	H.L Ahuja Samuelson & Marks	S.Chanda	2014

ACCOUNTING FOR MANAGERS			
Course Code	20MBA13	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives

1. To explain fundamental accounting concepts, the elements of financial statements, and basic accounting vocabulary.

2. To explain and use the accounting equation in basic financial analysis and explain how the equation is related to the financial statements.

3. To prepare basic entries for business transactions and present the data in an accurate and meaningful manner.

4. Prepare basic financial statements and explain the articulation between the basic statements.

5. To analyze a company's financial statements and come to a reasoned conclusion about the financial situation of the company.

Module-1 Introduction to Accounting	7 hours

Financial Accounting: Need and Types of Accounting, Single Entry System, Double Entry System, Concepts and Conventions of Accounting, Relation of Accounting with other disciplines, Journal, Ledgers, Trial balance.

Module -2 Financial Statements	10 hours

Preparation of final accounts of companies in vertical form as per Companies Act of 2013 (Basic problems of Final Accounts), Window dressing. Case Study problem on Final Accounts of Company-Appropriation accounts.

Module -3 Analysis of Financial Statements	10 hours

Limitations of Financial Statements; Meaning and Purpose of Financial Statement Analysis, Trend Analysis, Comparative Analysis, Financial Ratio Analysis, Preparation of Financial Statements using Financial Ratios, Case Study on Financial Ratio Analysis. Preparation of Cash flow Statement (indirect method). **Lab compulsory for Financial Statement Analysis using excel.**

Module -4 Management Accounting	9 hours

Scope, Purpose of Management Accounting

Cost Volume Profit Analysis: Meaning-Methods of determination-Applications. Managerial Decision-Making-Make /Buy etc: Short-run Decision Analysis-Decision situations: Sales-volume related, Sell or further process, Make or Buy, Operate or shut-down.

Module -5 Functional and Flexible Budgeting	7 hours

Functional budgets, Flexible Budgets: Meaning-Measure of Volume-Cost Behaviour with change in volume-Fixed, variable & mixed costs.Variance Analysis: Cost Variances – Revenue Variances-Variance Reporting-Disposition of variances.

Module-6 Emerging Issues in Accounting and Computerised Accounting	7 hours

Emerging Issues in Accounting: Human Resource Accounting, Forensic Accounting, Sustainability Reporting, Applicability of Ind AS – Indian Accounting Standards.

Computerised Accounting Systems-Structuring Database for Accounting- Accounting system Using Database Management systems- Illustration of Accounting Database.

Course outcomes:

At the end of the course the student will be able to:

1. Demonstrate theoretical knowledge and its application in real time accounting.
2. Capable of preparing financial statement of companies.
3. Independently undertake financial statement analysis and take decisions.
4. Comprehend emerging trends in accounting and computerization of Accounting systems.

Practical Components:

• To collect Annual reports of the companies and analyzing the financial statements using different techniques and presenting the same in the class.

• To analyze the companies' cash flow statements and presenting the same in the class.

• To get exposed to use of accounting software's (preferably Tally. ERP 9).

• To identify the sustainability report of a company and study the contents.

CO-PO MAPPING

CO	PO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	X		X		X
CO2	X	X	X		
CO3	X	X	X		
CO4	X	X		X	X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Accounting for Management-Text & Cases	S.K.Bhattacharya & John Dearden	Vikas Publishing House Pvt. Ltd.	3e, 2018
2	Financial Accounting	S.N.Maheshwari, Suneel K. Maheshwari, Sharad K. Maheshwari	Vikas Publishing House Pvt. Ltd.	6e, 2018
3	Computerized Accounting	Neeraj Goyal, Rohit Sachdeva	Kalyani Publishers	1e, 2018

Reference Books

1	Accounting for Managers	J.Made Gowda	Himalaya Publishing House	1e, 2007
2	Financial Accounting for Management	N. Ramachandran, Ram Kumar Kakani	McGraw Education (India) Private Limited	4e., 2016
3	Management Accounting : Text, Problems and Cases	M Y Khan, P K Jain	Tata McGraw-Hill Education	7e, 2007
4	Accounting and Finance for Non-finance Managers	Jai Kumar Batra	Sage Publications	1e, 2018

BUSINESS STATISTICS			
Course Code	20MBA14	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:
1. To make the students learn about the applications of statistical tools and Techniques in decision making.
2. To emphasize the need for statistics and decision models in solving business problems.
3. To enhance the knowledge on descriptive and inferential statistics.
4. To develop analytical skills in students in order to comprehend and practice data analysis at different levels.
5. To familiarize the students with analytical package MS Excel.

Module -1 Introduction to Statistics	**9 hours**

Introduction to Statistics: Meaning and Definition, functions, scope and limitations, Collection and presentation of data, frequency distribution, measures of central tendency - Mean, Median, Mode, Geometric mean, Harmonic mean. **Measures of dispersion:** Range – Quartile Deviation – Mean Deviation -Standard Deviation – Variance- Coefficient of Variance - Comparison of various measures of Dispersion.

Module -2 Correlation and Regression	**7 hours**

Scatter Diagram, Karl Pearson correlation, Spearman's Rank correlation (one way table only), simple and multiple regressions (problems on simple regression only).

Module -3 Probability Distribution	**9 hours**

Probability Distribution: Concept and definition - Rules of probability –Random variables – Concept of probability distribution – Theoretical probability distributions: Binomial, Poisson, Normal and Exponential – Baye's theorem (No derivation) (Problems only on Binomial, Poisson and Normal).

Module -4 Time Series Analysis	**8 hours**

Time Series Analysis –Objectives, Variations In Time Series - Methods Of Estimating Trend: Freehand Method - Moving Average Method - Semi-Average Method - Least Square Method. Methods of Estimating Seasonal Index: Method Of Simple Averages - Ratio To Trend Method - Ratio To Moving Average Method.

Module -5 Hypotheses	**7 hours**

Types, characteristics, source, formulation of hypotheses, errors in hypotheses. Parametric and Non-Parametric Tests- t-test, z-test, f-test, u-test, K-W Test (problems on all tests). Normality and reliability of hypothesis. Statistical analysis- Bivariate and Multivariate Analysis- ANOVA-one-way, two-way classification (theory only).

Module-6 Computer lab for Statistics	**10 hours**

MS Excel: Functions, Formulas, Types of errors in excel, Data analysis using MS-Excel- Mean, Median, Mode, Geometric Mean, Harmonic mean, Standard Deviation, Correlation

Course Outcomes:
At the end of the course the student will be able to:
1.   Facilitate objective solutions in business decision making under subjective conditions.
2.   Demonstrate different statistical techniques in business/real-life situations.
3.   Understand the importance of probability in decision making.
4.   Understand the need and application of analytics.
5.   Understand and apply various data analysis functions for business problems.

Practical Component:
• Students are expected to have a basic excel classes.
• Students need to be encouraged to do a small primary research inside the classroom in groups and to analyze the data using statistical tools like Mean, SD, Correlation(Ex: Motivation, Stress etc)
• Students can also be encouraged to go out for a live survey in Malls, Showrooms and in other Colleges to collect data's and to analyze it. Ex: Buying behavior, Brand aspects etc)
   Lab compulsory-minimum 10 hours.

CO-PO MAPPING					
CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X			X	X
CO2	X	X	X		X
CO3	X		X		X
CO4	X		X		
CO5	X	X	X	X	X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Fundamentals of Statistics	S C Gupta	Himalaya Publications	2012
2	Research Methodology	Ranjit Kumar	Sage Publications	2018
3	Parametric and Non Parametric Statistics	Vimala Veeraraghavan and Suhas	Sage Publication	2017

Reference Books

1	Statistical Methods	Dr. S P Gupta	Sultan Chand Publications	2014
2	Research Methodology	C R Kothari	Viswa Prakasam Publication	2015
3.	Business Research Methods	S.N.Murthy and U.Bhojanna.	Excel Books	3e, 2016

MARKETING MANAGEMENT			
Course Code	20MBA15	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives

1. Make students have an understanding of the fundamental concepts of marketing & the environment in which marketing system operates.
2. To analyze the motives influencing buying behaviour & Describe major bases for segment marketing, target marketing, and market positioning.
3. Identify a Conceptual framework, covering basic elements of the marketing mix.
4. To understand fundamental premise underlying market driven strategies.
5. Giving them hands on practical approach to subject study.

Module-1 Introduction to Marketing	9 hours

Marketing V/s Selling, Customer value, Components of customer value and components of customer cost. Marketing Ethics- green marketing and green economy. Marketing Myopia.Marketing Environment - Components of Environment to be analysed- Micro/ Macro Environment, Technological environment, Socio-cultural environment, Economic Environment, Legal Environment, Consumer/demographic environment, Government policies, Political environment. Techniques used in Environment Analysis. Contemporary Indian Marketing Environment. Cause and Social Marketing alternate concepts like 3V concepts of Nirmalaya Kumar Social Responsibility of marketing- new marketing realities, new responsibilities, new-age marketing, societal marketing concept, Corporate Social Responsibility. Emerging areas- Neuro Marketing , Sensory Marketing-concepts only. **Assignment:** Contemporary Indian Marketing Environment

Module -2 Analysing Consumer Behaviour	9 hours

Connecting with consumers and consumer in sighting, Factors influencing Consumer Behaviour, Consumer characteristics influencing buying behaviour- personal factors and cultural factors. Consumer Buying Decision Process, Buying Roles, Buying Motives. The black box model of consumer behaviour. Psychological Processes underlying consumer behaviour. **Market Segmentation:** Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Segmentation method – Geographic segmentation and Demographic segmentation, psychographic segmentation, behavioural segmentation, volume segmentation, deep segmentation. Indian Consumer- Features about consumer India, Classifying Indian consumer by Income B2B marketing Vs Consumer Marketing. **Assignment- Live projects on Consumer Behaviour.**

Module -3 Product, Brand Equity, Services Marketing	9 hours

Product Management- fundamentals, primary objective of product management, product hierarchy, product line, product mix, product mix strategies, Appraisal of product lines, products and brands. Managing PLC of product/brand, New Product Development, packing as a marketing tool, Role of labelling in packing. Main tasks in product management. Components of Product personality. Brand- selecting brand name, selecting logo, brand extension- effects. Introducing new product, innovations, new product development, stages in new product development, pricing strategy for new product. Branding - Concept of Branding, Types, Brand Equity, Branding strategies.Services Marketing & its Characteristics- tasks involved in service marketing, differentiating, positioning and brand building in services, premiumisation in service marketing.Market Segmentation, Targeting & Positioning (STP): Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Product Differentiation Strategies, Tasks involved in Positioning. Monitoring brands performance and positioning.

Module -4 Pricing , Marketing Channels	7 hours

Pricing decisions: Significance of pricing, factor influencing pricing (Internal factor and External factor), objectives, Pricing Strategies-Value based, Cost based, Market based, Competitor based, Pricing Procedure.
Marketing Channels: Roles and purpose of Marketing Channels, Factors Affecting Channel Choice, Channel Design, Channel Management Decision, Channel Conflict, Designing a physical Distribution System, Network Marketing. Contemporary Channels and Retailing in India.**Product Distribution Logistics:** Product distribution Concept. Distinction between distribution logistics and Supply Chain Management..

Module -5 Direct Marketing & Digital Marketing:	9 hours

Concept and scope of direct marketing, concept and components of digital marketing. Digital marketing communications, digital marketing in India. **Promotions-** Marketing communications- Integrated Marketing

Communications (IMC)-communication objectives, steps in developing effective communication, Stages in designing message. Advertising: Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model, Traditional Vs Modern Media- Online and Mobile Advertising, Social Media for Advertising. Customer Relationship Management- components. Significance of Marketing Research- importance of data.

Module - 6 Sales Promotion, Marketing Planning and Rural Marketing	**7 hours**

Sales Promotion: Tools and Techniques of sales promotion, Push-pull strategies of promotion. Personal selling: Steps/process involved in Personal Selling. Publicity/Public Relation-word of mouth, sponsorships. Database marketing: Basic concepts of e-commerce, e-marketing, m-Commerce, m-marketing, e-networking, CRM, MkIS.
Marketing Planning: Meaning, Steps involved in Marketing planning. Marketing Audit- Meaning, components of Marketing Audit. Market Share analysis, Marketing cost analysis, Marketing Strategic Planning Process.
Concept of Rural Marketing: Flumist (HBR) and Saffola Journey- Case Studies
Classroom Exercise: Brand Communication (create and enact a commercial)

Course outcomes:
At the end of the course the student will be able to:
1. Develop an ability to assess the impact of the environment on marketing function.
2. To formulate marketing strategies that incorporate psychological and sociological factors which influence buying .
3. Understand concept of Branding, development of product and significance of market segmentation , targeting and positioning.
4. Identifying marketing channels and the concept of product distribution.
5. Identifying techniques of sales promotion , significance of marketing research.
6. Synthesize ideas into a viable marketing plan for various modes of marketing

Practical Components:
- Understanding Contemporary Indian Marketing Environment.
- Understanding and demonstrating their exposure on consumer behaviour
- Effectively using their skill in creating and enacting a commercial on brand communication.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X		
CO2	X	X	X		X
CO3	X	X	X		
CO4	X	X			X
CO5	X			X	
CO6	X			X	X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Marketing Management- Indian Context, Global Perspective.	Ramaswamy & Namakumari	SAGE	6th Edition

2	Marketing Management: A South Asian Perspective.	Kotler, Keller, Koshy & Jha	Pearson Education	Latest edition
3	New Product Management	Merle Crawford and Anthony Di Benedetto	McGraw-Hill	Latest Editon
4	Advertisement Brands & Consumer Behaviour	Ramesh Kumar	Sage Publications	2020
Reference Books				
1	Marketing in India: Text and Cases	Neelamegham S	Vikas	Latest edition
2	Marketing	Lamb, Hair, Mc Danniel	Cengage Learning	Latest edition
3	Fundamentals of Marketing Management,	Etzel M J BJ Walker & William J Stanton	Tata Macgraw Hill	Latest edition

MANAGERIAL COMMUNICATION			
Course Code	20MBA16	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:

1. To enable the students to become aware of their communication skills and sensitize them to their potential to become successful managers.
2. To enable learners with the mechanics of writing and also help them to draft business letters in English precisely and effectively.
3. To introduce the students to some of the practices in managerial communication those are in vogue.
4. To prepare students to develop the art of business communication with emphasis on analysing business situations.
5. To train Students towards drafting business proposals.

Module -1 Introduction	7 hours

Introduction: Meaning & Definition, Role, Classification – Purpose of communication – Communication Process – Characteristics of successful communication. Communicating within Organizations – Levels of communication, Communication flow, Communication barriers, Media choices, Legal Consequences and Ethics, Communication in a cross-cultural setting.

Module -2 Oral Communication	7 hours

Oral Communication: Meaning – Principles of successful oral communication, Conversation control –Reflection and Empathy: two sides of effective oral communication.

Oral Presentation: Role of business presentations, Planning and Organizing Presentation, Planning Team and Online Presentations, Developing Visual Support for Business presentation, Practicing and Delivering Presentation - Refining your delivery.

Business Pitch:10 steps in Pitching, Elevator Pitching

Class room Exercise: Business pitch with video recording using PowerPoint and feedback.

Module -3 Written Communication	9 hours

Written Communication: Purpose of writing – Clarity in writing –Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication Pre writing – Writing – Revising. Audience analysis, Writing Positive, Neutral, Persuasive and Bad-news Messages

Types of Written Communication in Business: Business Letters, Employee Reviews, Recommendation Letters, Thank You Letters, Memos, proposals and Reports, Planning Documents, Press Releases, Proactive Media Writing and E-mail.

Module -4 Business Reports	9 hours

Business Reports: Purpose, Kinds and Objectives of reports – Organization & Preparing reports, short and long reports Writing, writing executive summary.

Business Case Analysis: What is a case? Characteristics of Case and its Analysis, Process of Case Analysis, Requirements of Case analysis, The structure of written cases analysis.

Meeting Documentation: Notice, Agenda, and Resolution & Minutes

Assignment: Executive summary to be submitted.

Module -5 Employment communication	9 hours

Employment communication: Putting your best self forward, Preparing your resume, Writing covering letters and Inquiry Emails, Preparing for a Job Interview, Conducting Yourself during the Interview, Following up throughout the process, Practicing business etiquette.

Business Meetings: Format, planning, facilitating, participating and following-up.

Lab component: Video conferencing across stakeholders.

Module-6 Interpersonal Communication	9 hours
Interpersonal Communication: Nonverbal communication and Listening. **Conflict Management and Negotiation skills:** Meaning and characteristics of Conflict, Conflict management through communication, Managing the process of communication in Conflict, Verbal skills for communicating in conflict. Communication for effective negotiation – Meaning, nature and need for negotiation, Factors affecting negotiation, stages in negotiation process, Negotiation strategies. **Technological Advancement and Business Communication:** Intranet, Internet, Teleconference, Video conference, Blogs, Webinars, Chat rooms, Voice and Text messaging. **Social Media:** Introduction, Characteristics, Classification, Nature and scope of Six types of Social Media, Choosing the most suitable social media. Using Social Media to build business relationships. **Lab component: Creating a Blog** **Note: Suggested for practical component: Effective Communication Development.** **Subject faculty to design suitable practical components for the topics in syllabus.**	

Course Outcomes:

At the end of the course the student will be able to:

1. The students will be aware of their communication skills and know their potential to become successful managers.
2. The students will get enabled with the mechanics of writing and can compose the business letters in English precisely and effectively.
3. Students will get exposure in drafting business proposals to meet the challenges of competitive environment.
4. The students will be introduced to the managerial communication practices in business those are in vogue.
5. Students will get trained in the art of Interpersonal communication and technological advancement and social media usage in communications, with emphasis on analysing business situations.

Practical component:

- Make students enact and analyze the non-verbal cues.
- Conduct a mock meeting of students in the class identifying an issue of their concern. The students should prepare notice, agenda and minutes of the meeting.
- Organize a mock press conference addressing to the launch of new product by an organization.
- Students should be given an assignment to draft a proposal to undertake research project.
- Video conferencing across stakeholders
- Create a Blog
- Business pitch with video recording using PowerPoint and feedback

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X	X		X	
CO2	X	X	X		
CO3	X	X	X		X
CO4	X	X			
CO5	X	X	X		X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Communicating in Business	Ober Newman	Cengage	8th Edition, 2018
2	BCOM A South-Asian Perspective	Lehman, Dufrene,Sinha	Cengage Learning	2nd Edition, 2012
3	Business Communication	P D Chaturvedi Mukesh Chaturvedi	Pearson	3rd Edition, 2013
4	Business and Professional Communication	Kelly m. Quintanilla Shawn T. Wahl	SAGE South Asia Edition	2017

Reference Books

1	Communicating in Business	Williams,Krizan Logan,Merrier	Cengage Learning	8th Edition, 2017
2	Business Communication: Process	Mary Ellen Guffey	Cengage Learning	3rd Edition, 2002
3	Business Communication	Lesikar,Flatley,Rentz ,Pande	TMH	11th Edition, 2011
4	Communicating in Business	Williams, Krizan, Logan & Merrier	Cengage Learning	8e, 2014

II SEMESTER

HUMAN RESOURCE MANAGEMENT

Course Code	20MBA21	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives

1. The student will be able to recite the theories and various functions of Human Resources Management
2. The student will be able to describe and explain in her/his own words, the relevance and importance of Human Resources Management at workplace
3. The student will be able to apply and solve the workplace problems through Human Resources Management intervention
4. The student will be able to classify and categorise in differentiating between the best method to solve the problem
5. The student will be able to compare and contrast different approaches of HRM for solving the complex issues and problems at the workplace
6. The student will be able to design and develop an original framework and model in dealing with the problems in the organization.

Module-1 Introduction	7 hours

Human Resource Management and Personnel Management, The Importance of Human Resource Management, Models of Human Resource Management, Evolution of Human Resource Management, HRM in India, The Factors Influencing Human Resource Management , Human Resource Management and Line Managers, The HR Competencies, Human Resource Management and Firm Performance.

Module -2 Human Resource Planning	9 hours

Importance of HR Planning, Manpower Planning to HR Planning, Factors Affecting HR Planning, Benefits of HR Planning, HRP Process, Tools for Demand Forecasting, Attributes of an Effective HR Planning, Barriers to HR Planning, The Challenges for HR, Process of Job Analysis and Job Evaluation.

Recruitment and Selection: Importance of Recruitment, Recruitment Policies, Factors Influencing Recruitment, Recruitment Process, Sources, Evaluation of Recruitment Process, Recruitment Strategy ; Selection, Future Trends in Recruitment; Selection Process; Selection Tests; Factors Influencing Selections, Challenges in Selection, Application Tracking System using MS-Excel

Learning, Training, and Development: Training, Learning and Development, Learning Theories, The Future of Training, Learning, and Development: Crystal Gazing into the Future, World of Learning. Process of training and Techniques of Training

Module -3 Performance Management and Appraisal	9 hours

Objectives of Performance Management, Performance Management and Performance Appraisal, Common Problems with Performance Appraisals, Performance Management Process, Types of Performance Rating Systems, Future of Performance Management.

Compensation and Benefits

Introduction, Definitions, Total Compensation, Total Rewards System, Forms of Pay, Theories of Compensation, External Factors, Internal Factors, Establishing Pay Rates, Employee Benefits.

Industrial Relations

Decent Workplace: International Labor Organisation, Industrial Relations, The Objectives of Industrial Relations, Approaches of Industrial Relations Systems, The Actors in Industrial Relations, Indian Context, Industrial Relations and Human Resource Management.

Employment Relations - The Definition, Traditional Employment Relations, Actors in the Fray: Role-taking, The New Frameworks for Employment Relations, The Future of Employee Relations.

Module -4 Human Resource Management in Small and Medium Enterprises	9 hours

Definition of SMEs, Human Resource Management and Performance in SMEs, The Difference in Adoption of Human Resource Management: SMEs and Large Firms, Indian Experience, Impact of Weak Adoption of Human Resource Management in SMEs, Factors Influencing the Adoption of Human Resource Management Practices in SMEs, Future of Human Resource. Management in SMEs.

Human Resource Management in the Service Sector

Introduction, The Emergence of the Services Sector, Implications for Human Resource, Management Function, Differences Between Services Sector and the Manufacturing Sector, Difference in Human Resource Management

Practices in Services and Manufacturing Sectors, Human Resource Management and Service Quality Correlation, Some Specific Industries in Services Sector, Trade Unions in Services Sector, Models of Union Strategies.
Case Study on "Training Program at ABC Cement". .

Module -5 Human Resource Management Innovations	9 hours

Introduction, Human Resource Management and Innovations, Factors Affecting the Innovation Process in Organisations, Characteristics of Human Resource Management Innovations, Conditions Necessary for Successful HRMI Implementation, Current Trends in Human Resource Management Innovations, Innovative Human Resource Management Practices in India, How Human Resource Management Practices Contribute to Organisational Innovation, How to Make Human Resource Management Innovations Sustainable.

Module - 6 HR Leadership and Organisation Transformation	7 hours

Future of Human Resource Management: The next generation HR professionalism, Critical HR Issues of Today and Tomorrow, Changing Mental Models: HR's Most Important Task, HR roles critical for business survival, HR profession in today's changeful workplace, HR and Technology.

Course Outcomes:
At the end of the course the student will be able to:
1. Gain practical experience in the field of Human Resource Concepts, functions and theories.
2. Acquire the conceptual insight of Human Resource and various functions of HR.
3. Apply personnel, managerial and welfare aspects of HR.
4. Develop a greater understanding about HR practices, analyse the trends in the field of HR.

Practical Component:
- An visit to Organisation and interact with HR Manager and list out the roles played by HR manager.
- Meet Recruitment Manager and ask- 10 questions one asks during Interview.
- Meet Training and Development Manager and list out various training given to employees; basis of training program; Need analysis.
- Visit any Service Organisation and observe HR functions; List them.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X	X	X		X
CO2	X	X		X	
CO3	X	X	X		
CO4	X			X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Human Resource Management: Theory and Practices,	R. C. Sharma, Nipun Sharma	Sage Publication India Pvt. Ltd., ~~2019~~	2019
2	Human Resource Management: Concepts	Amitabha Sengupta	Sage Publication India Pvt. Ltd.	2019

3	Leadership: Theory and Practices	Peter G. Northouse	Sage Publication	2016
4	Human Resources Management	T.P Renuka Murthy	HPH.	2015
Reference Books				
1	The HR Scorecard: Linking People, Strategy, and Performance	Brian Becker, Dave Ulrich, and Mark A. Huselid	Harvard Business School Press	2001
2	The HR Answer Book: An Indispensable Guide for Managers and Human Resources Professionals	Shawn Smith and Rebecca Mazin	AMACOM	2011
3	Performance Management and Appraisal Systems HR Tools for Global Competitiveness	T. V. Rao		First Edition, 2004
4	Human Resource Management	Appasaba L.V and Kadakol A M	College Book House	2016
5	Human Resource Management	V.S.P Rao		2014

FINANCIAL MANAGEMENT			
Course Code	20MBA22	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:

1. To familiarize the students with basic concepts of financial management and financial system.
2. To understand concept of time value of money and its implication.
3. To evaluate the investment proposals.
4. To understand the management of working capital in an organization.
5. To analyze capital structure and dividend decision.

Module-1 Introduction	9 hours

Meaning and objectives of Financial Management, changing role of finance managers. Interface of Financial Management with other functional areas. Indian Financial System: Financial markets, Financial Instruments, Financial institutions and financial services. Emerging issues in Financial Management: Risk Management, Behavioural Finance, Financial Engineering, Derivatives (Theory).

Module-2 Time value of money	9 hours

Meaning of Time value of money –Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization. (Theory & Problem). Case Study on Loan amortization. Computer lab for calculation of future value, present value and loan amortisation in MS excel.

Module-3	9 hours

Sources of Financing: Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only). **Cost of Capital:** Basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model) - Cost of retained earnings - Determination of Weighted average cost of capital (WACC) and Marginal cost of capital. (Theory & Problem). Case Study on WACC.

Module-4 Investment Decisions	9 hours

Capital budgeting process, Investment evaluation techniques – [Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rate of return Problem). Risk analysis in capital budgeting-Case Study on replacement of capital project. (Numerical problems). Computer lab for calculation of NPV, IRR, PI, Payback period, ARR in MS excel.

Module-5 Working Capital Management	7 hours

Factors influencing working capital requirements - Current asset policy and current asset finance policy- **Determination of operating cycle and cash cycle on Excel**- Estimation of working capital requirements of a firm. (Does not include Cash, Inventory & Receivables Management). Case study on Working Capital Determination and the impact of negative working capital Amazon-negative working capital and profitability. Computer lab for calculation of working capital cycle and operating cycle in MS excel.

Module-6 Capital structure and dividend decisions	7 hours

Capital structure and dividend decisions – Planning the capital structure-Governance of Equity and Debt, Fall in interest rates and perils of Debt funding. Leverages, EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy. Dividend policy – Factors affecting the dividend policy - Dividend Policies- Stable Dividend, Stable Payout (No dividend theories to be covered). Case Study on EBIT-EPS analysis & Leverages.

Course outcomes:

At the end of the course the student will be able to:

1. Understand the basic financial concepts
2. Apply time value of money
3. Evaluate the investment decisions
4. Estimate working capital requirements
5. Analyze the capital structure and dividend decisions

Practical Components:
- Identifying the small or medium sized companies and understanding the Investment evaluation techniques used by them.
- Using the annual reports of selected companies, students can study the working capital management employed by them. Students can also compare the working capital management of companies in the same sector.
- Students can choose the companies that have gone for stock split and Bonus issue in the last few years and study the impact of the same on the stock price.
- Students can study any five companies capital structure
- Students can do Company analysis for select companies using profitability and liquidity ratios.

CO-PO MAPPING

CO	PO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	X				
CO2	X	X			
CO3	X		X		
CO4	X		X	X	
CO5	X		X		

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Financial Management	Khan M. Y.& Jain P. K,	TMH	7/e,
2	Financial Management	Prasanna Chandra	TMH	9/e,
3	Financial Management	Prahlad Rathod ,Babitha Thimmaiah and Harish Babu	HPH	1/e, 2015
4	Financial Management: A Strategic Perspective	Nikhil Chandra Shil & Bhagaban Das	Sage Publications	1/e, 2016

Reference Books

1	Financial Management	I M Pandey	Vikas Publishing	11/e, 2012
2	Principles of Corporate Finance	Brealey, Myers, Allen & Mohanty	McGraw Hill Education	11/e, 2014
3	Cases in Financial Management	I.M.Pandey & Ramesh Bhat	McGraw Hill Education	3/e, 2015
4	Corporate Finance	Vishwanath S. R.	Sage Publications	3/e, 2019

RESEARCH METHODOLOGY			
Course Code	20MBA23	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:
1. To understand the basic components of research design.
2. To Gain an insight into the applications of research methods.
3. To equip students with various research analytical tools used in business research.
4. To equip students with necessary critical thinking skills using excel.

Module-1 Business Research	9 hours

Business Research: Meaning, types, process of research- management problem, defining the research problem, formulating the research Hypothesis, developing the research proposals, research design formulation, sampling design, planning and collecting the data for research, data analysis and interpretation. Research Application in business decisions, Features of good research study.

Module -2 Business Research Design	9 hours

Meaning, types and significance of research design. Exploratory and Conclusive Research Design.

Exploratory Research: Meaning, purpose, methods- Literature search, experience survey, focus groups and comprehensive case methods. Conclusive Research Design - Descriptive Research - Meaning, Types – Cross sectional studies and longitudinal studies.

Experimental Research Design – Meaning and classification of experimental designs- formal and informal, Pre experimental design, Quasi-experimental design, True experimental design, statistical experimental design.

Module -3 Sampling	7 hours

Sampling: Concepts- Types of Sampling - Probability Sampling – simple random sampling, systematic sampling, stratified random sampling, cluster sampling -Non Probability Sampling –convenience sampling-judgemental sampling, snowball sampling- quota sampling - Errors in sampling.

Module -4 Data Collection	9 hours

Meaning of Primary and Secondary data, Primary data collection methods - observations, survey, interview and Questionnaire, Qualitative Techniques of data collection, Questionnaire design – Meaning - process of designing questionnaire. Secondary data -Sources – advantages and disadvantages.

Measurement and Scaling Techniques: Basic measurement scales-Nominal scale, Ordinal scale, Interval scale, Ratio scale. Attitude measurement scale - Likert's Scale, Semantic Differential Scale, Thurstone scale, Multi-Dimensional Scaling. Case Study as per the chapter needs.

Module -5	7 hours

Data Analysis and Report Writing: Editing, Coding, Classification, Tabulation, Validation Analysis and Interpretation- Report writing and presentation of results: Importance of report writing, types of research report, report structure, guidelines for effective documentation.

Module – 6	9 hours

Advanced Excel and real time application: V Look Up, H Look up, Sort and filter, concatenate, Conditional Formatting., Pivot Table, If statement, Nested If, Charts. Statistical tests and how to interpret statistical outputs.

Course outcomes:
At the end of the course the student will be able to:
1. Understand various research approaches, techniques and strategies in the appropriate in business.
2. Apply a range of quantitative / qualitative research techniques to business and day to day managemen problems.
3. Demonstrate knowledge and understanding of data analysis, interpretation and report writing.
4. Develop necessary critical thinking skills in order to evaluate different research approaches in Business using excel in particular

Practical components:
• To identify research problem and collect relevant literatures for data analysis.
• To write the research design by using Exploratory and Descriptive Research methods.
• To conduct Market survey and to investigate consumer perception towards any FMCG and to conduct the data analysis using excel and need to submit a small report.

• To demonstrate Report writing and Presentation methods.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X			X	
CO2	X			X	
CO3	X	X	X		X
CO4	X		X	X	X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Research Methodology	C R Kothari	Viswa Prakasam Publication	2014
2	Business Research Methods	S. N. Murthy & U. Bhojanna	Excel Books	3e, 2016
3	Research Methods	M MMunshi & K Gayathri Reddy	HPH	2015

Reference Books

1	Research Methodology	Ranjit Kumar	Sage Publications	
2	Excel for dummies	Harvey .G	John Wiley & Sons	2016
3	Research Methodology	Deepak Chawla and Neena Sondhi	Vikas Publications	2014

OPERATIONS RESEARCH			
Course Code	20MBA24	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course objectives:
- Understand the mathematical tools that are needed to solve optimisation problems
- Solve linear programming problems using appropriate techniques to take informed Decision
- To understand and practice allocation problems, Assignments problems, Transportation problems and Network Analysis (PERT & CPM).

Module -1 Introduction	**7 hours**

Definition, scope of Operations Research, characteristics, advantages and limitations. Quantitative approach to decision making models (Theory Only)

Module -2 Linear programming	**9 hours**

Structure of linear program model, Assumption, Advantages, Limitations, General mathematical model, Guidelines for formulation of linear programming model, Formulation of problems, graphical method.

Module -3 Transportation problem	**7 hours**

General structure of transportation problem, methods of finding initial basic feasible solution (NWCM, LCM & VAM), Degeneracy, Optimality Test using Stepping Stone and MODI Methods (theory only). Assignment problems - Introduction, General structure. Problems on minimization & maximization.

Module -4 Decision theory	**9 hours**

Decision under uncertainty- Maxmin & Minmax, Decision under Risk- Expected Value, Simple decision tree problems. (Only theory). Job Sequencing- N Jobs-two machines and N Jobs-three machines, 2 jobs-M machines cases. (Only theory).

Module -5 Theory of games	**9 hours**

Formulation of game models, Two person Zero sum games & their solution, 2 x N and M x 2 games, pure strategy games with saddle point, Mixed strategies (Graphical and algebraic methods), Limitations of game theory.
Simulation: process of simulation, types of simulation, steps in simulation process, Monte Carlo simulation, Simple problems on Simulation applications in Inventory, Queuing, finance problems, Advantages & Disadvantages.

Module-6 Project management	**9 hours**

Structure of projects, phases of project management-planning, scheduling, controlling phase, work breakdown structure, project control charts, network planning, PERT & CPM, Network components & precedence relationships, critical path analysis, probability in PERT analysis, Theory of crashing (Theory Only), Theory of Constraints (Theory only).

Course outcomes:
1. Get an insight into the fundamentals of Operations Research and its definition, characteristics and phases
2. Use appropriate quantitative techniques to get feasible and optimal solutions
3. Understand the usage of game theory , Queuing Theory and Simulation for Solving Business Problems
4. Understand and apply the network diagram for project completion

Practical component:
- Learn and use TORA Software for analysis of all the ORTechniques and Real life Problems.
- Student should demonstrate the application of the techniques covered in this course.

CO – PO MAPPING.

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X		X	X	X
CO3	X		X		X
CO4	X		X		X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Operation Research: An Introduction	H.A. Taha	Pearson Publication	2012
2	Operation Research	J K Sharma	McMillan Publications	2014

Reference Books

1	Quantitative Techniques in management	N D Vohra	McGraw Hill	2015
2	Operation Research	J K Sharma	McMillan Publications	2016

STRATEGIC MANAGEMENT			
Course Code	20MBA25	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course objectives:
1. To provide insights into the core concepts of strategic management.
2. To evaluate various business strategies in dynamic market environments.
3. To gain insights into various strategic management models.

Module-1 Introduction	7 hours

Meaning and Nature of Strategic Management, its Importance and Relevance and. Characteristics of Strategic Management, The Strategic Management Process. Relationship Between a Company's Strategy and its Business Model. **Case Study related to the Module.**

Module -2 External Analysis	9 hours

Strategically Relevant Components of a Company's External Environment – Industry Analysis - Factors Driving Industry Change and its Impact - Porter's Dominant Economic Feature - Competitive Environment Analysis - Porter's Five Forces Model – Key Success Factors Concept and Implementation. **Case Study on external analysis.**
Students Assignment: Industry External Analysis.

Module -3 Internal Analysis	9 hours

Describe Strategic Vision, Mission, Goals, Long Term Objectives, Short-Term Objectives and Discuss Their Value to the Strategic Management Process, Resources, Capabilities, Competencies, Resource Based View of the firm (RBV), Balanced Score Card, SWOC Analysis, Value Chain Analysis, Benchmarking. **Case Study on internal analysis.**
Students Assignment: Industry Internal Analysis.

Module -4 Strategy Formulation	9 hours

Business Strategies –Porter's Generic Strategies: Low Cost, Differentiation, Best Cost, Focused Low Cost and Focused Differentiation, Corporate Strategies – Growth Strategies (Internal Growth, External Growth, Integration, Diversification, Mergers, Strategic Alliances), Ansoff's Matrix, Stability Strategies (No-Change, Profit and Proceed With Caution), Retrenchment Strategies (Turnaround, Divestment and Liquation), International Business Level Strategies. **Case Study on Strategic Formulation. Students Assignment: Strategies of listed companies**.

Module -5 Strategy Implementation	9 hours

Strategy Implementation -Organisational Structure, Strategic Leadership and Organisational Culture
Strategy and Innovation - Introduction to Innovation: Process, Product and Platform; Creative Destruction and Disruptive Technologies; Designing Organisations for Innovation; Innovation Environments: Institutional Innovation and Environments, The Co-creation of Value, Open Innovation and Open Strategy, National Innovation Systems, Learning Networks and Clusters, Social Innovation. **Case Study on Strategy Implementation**.

Module - 6 Strategic Control	7 hours

Strategic Control: Focus of Strategic Control, Establishing Strategic Controls (Premise Control, Strategic Surveillance, Special Alert Control, Implementation Control), Exerting Strategic Control (through Competitive Benchmarking, Performance and Formal and Informal Organisations). Case Study on Strategic Control.

Course outcomes:
At the end of the course the student will be able to:
1. Students should get clear idea about the concept of Strategic Management, its relevance, Characteristics, process nature and purpose.
2. Student to acquire an understanding of how firms successfully institutionalize a strategy and create an organizational structure for domestic and overseas operations and gain competitive advantage.
3. To give the students an insight on strategy at different levels of an organization to gain competitive advantage.
4. To help students understand the strategic drive in multinational firms and their decisions in different markets.
5. To enable the students to gain knowledge of strategy implementation and the control measures for effective decision-making.

Practical Component:
- Analyzing the Mission and Vision statements of selected Indian companies.
- Applying Michael Porter's model to an industry (Retail, Telecom, Infrastructure, FMCG, Insurance, Banking etc(Industry Note to be submitted)
- Internal Analysis & Strategies of a listed company in the form of the report to be submitted.
- Pick a company that has performed very badly compared to its competitors. Collect information on why the

company failed. What were the issues in strategy and execution that were responsible for the company's failure in the market; analyze the internal and external factors.
- Map out GE 9-cell matrix and BCG matrix for some companies and compare them.
- Conduct SWOT analysis of companies around your campus.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X	X	X		
CO3	X		X		
CO4	X		X	X	X
CO5	X		X	X	X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Crafting and Executing Strategy: The Quest for Competitive Advantage – Concepts and Cases	Arthur A. Thompson Jr. Margaret A. Peteraf John E. Gamble A. J. Strickland III Arun K. Jain	McGraw Hill Education	19/e 2017
2	Strategic Management: A South-Asian Perspective	Michael A. Hitt R. Duane Ireland Robert E. Hoskisson S. Manikutty	Cengage Learning	9/e 2016

Reference Books

1	Strategy: Theory & Practice	Stewart Clegg Chris Carter Marting Kornberger Jochen Schweitzer	Sage Publications	3/e ,2020
2	Strategy Management: Theory & Practice	John Parnell	Biztantra	2004
3	Strategic Management: Planning for Domestic and Global Competition	John A. Pearce Richard B. Robinson	McGraw Hill Education	14/e 2015

ENTREPRENEURSHIP AND LEGAL ASPECTS			
Course Code	20MBA26	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:
1. To develop and strengthen entrepreneurial quality and motivation in students.
2. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.
3. To provide insights to students on entrepreneurship opportunities, sources of funding and institutions supporting entrepreneurs.
4. To make students understand the ways of starting a company of their own.

Module -1 Introduction to Entrepreneur & Entrepreneurship	7 hours

Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Types of Entrepreneur - Intrapreneur- an emerging class - Concept of Entrepreneurship -Entrepreneurial Culture - Stages in entrepreneurial process.
Creativity and Innovation: The role of creativity – The innovation Process – Sources of New Ideas – Methods of Generating Ideas – Creative Problem Solving – Entrepreneurial Process.

Module -2 Developing Business Model	9 hours

Importance of Business Model – Starting a small scale industry -Components of an Effective Business Model, Osterwalder Business Model Canvas.
Business Planning Process: Meaning of business plan - Business plan process - Advantages of business planning - Final Project Report with Feasibility Study - preparing a model project report for starting a new venture.
Lab Component and assignment: Designing a Business Model Canvas

Module -3 Marketing function and forms of organisation	9 hours

Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process
Forms of business organization: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives.

Module -4 Entrepreneurial finance	7 hours

Entrepreneurial finance- Estimating the financial needs of a new venture, internal sources of finance, external sources of finance, components of financial plan
Institutions supporting Entrepreneurs: Small industry financing developing countries - A brief overview of financial institutions in India - Central level and state level institutions - SIDBI - NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - DIC - Single Window - Latest Industrial Policy of Government of India.

Module -5 Rules And Legislation	9 hours

Applicability of Legislation; Industries Development (Regulations) Act, 1951; Factories Act, 1948; Industrial Employment (Standing Orders) Act, 1946, Suspension, Stoppage of work, Termination of employment; Karnataka Shops and Establishment Act, 1961; Environment (Protection) Act, 1986; The sale of Goods Act, 1930; Industrial Dispute Act 1947.

Module-6 Company Incorporation	9 hours

Process of Company Incorporation; process of registration; Importance of Marketing; Funding, Four stages of Start Up.
Intellectual property protection and Ethics: Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges.

Course outcomes:
At the end of the course the student will be able to:
1. Display keen interest and orientation towards entrepreneurship, entrepreneurial opportunity Modules' in order to setup a business and to think creatively.
2. To know about the various business models and B-Plans across Business sectors.
3. Able to understand the importance of marketing and different forms of businesses.
4. Become aware about various sources of funding and institutions supporting entrepreneurs.
5. Awareness about legal aspects and ways to protect the ideas.
6. To understand the ways of starting a company and to know how to protect their ideas.

Practical Component:
- Make a business plan for your intended business - talk to bankers to find out what they look for in a business plan - modify accordingly and present it in the class.
- Analyze the performance of listed family firms. How is their performance compared to the performance of other firms? Does a family firm successfully manage to create wealth for non-family investors?
- Design a Business Model Canvas
- Interview a local entrepreneur to find out his/her major motivations to start a business - which of the skills and characteristics do you find in the entrepreneur?
     -Examine how he/she started a business, funding opted, protection of ideas etc.
- Study a local for-profit business and try to list out the positive social impacts of the business.
- Visit a trade show and try to compare the marketing activities of various stalls in that show - make a list of good practices you come across in the show.

CO-PO MAPPING

CO	PO				
	Po1	PO2	PO3	PO4	PO5
CO1	X				x
CO2	X	X			X
CO3	X		x	X	
CO4	X		X		
CO5	X		X		X
CO6	X		X		x

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Vasant Desai	The Dynamics of Entrepreneurial Development and Management	Himalaya Publishing House	2010
2	Donald F. Kuratko and Richard M. Hodgetts	Entrepreneurship	South-Western	2012

Reference Books

| 1 | Gupta S.L., Arun Mittal | Entrepreneurship Development | International Book House | 2012 |
| 2 | Sudha G. S | Management and Entrepreneurship Development | Indus Valley Publication | 2009 |

EMERGING EXPONENTIAL TECHNOLOGIES			
Course Code	20MBA301	CIE Marks	40
Teaching Hours/Week	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Objective of the Course:
1. To understand the emerging technologies applicable in field of Management.
2. To study data science as a tool for decision making in Management
3. To understand the concept of AI, IOT and AR.
4. To study other emerging technologies in Management.

Module -1 Introduction to Emerging Technologies	**9 hours**

Evolution of technologies; Introduction to Industrial revolution; Historical background of the Industrial Revolution; Introduction to Fourth industrial revolution (IR 4.0); Role of data for Emerging technologies; Enabling devices and networks for emerging technologies (programmable devices); Human to Machine Interaction; Future trends in emerging technologies.

Module -2 Data Science	**7 hours**

Overview for Data Science; Definition of data and information; Data types and representation; Data Value Chain; Data Acquisition; Data Analysis; Data Curating; Data Storage; Data Usage; Basic concepts of Big Data.

Module -3 Artificial Intelligence(AI)	**9 hours**

Concept of AI, meaning of AI, History of AI, Levels of AI, Types of AI, Applications of AI in Agriculture, Health, Business (Emerging market), Education, AI tools and platforms (eg: scratch/object tracking).

Module -4 Internet of Things (IoT)	**9 hours**

Overview of IOT; meaning of IOT; History of IOT; Advantages of IOT; Challenges of IOT; IOT working process; Architecture of IOT; Devices and network; Applications of IOT at Smart home; Smart grid; Smart city; Wearable devices; Smart farming; IOT tools and platforms; Sample application with hands on activity.

Module-5 Augmented Reality (AR) and Virtual Reality (VR)	**9 hours**

Introduction to AR, Virtual reality (VR), Augmented Reality (AR) vs mixed reality (MR), Architecture of AR systems. Application of AR systems (education, medical, assistance, entertainment) workshop oriented hands demo.

Module-6 Ethics, Professionalism and Other Emerging Technologies	**7 hours**

Technology and ethics, Digital privacy, Accountability and trust, Treats and challenges.
Other Technologies: Block chain technology, Cloud and quantum computing, Autonomic computing, Computer vision, Cyber security, Additive manufacturing (3D Printing)

Course Outcomes:
By the end of this course the student will able to:
1. Identify different emerging technologies
2. Select appropriate technology and tools for a given task
3. Identify necessary inputs for application of emerging technologies
4. Understand the latest developments in the area of technology to support business

Practical Component:
- Big data analysis using an analytical tool
- Study the Application of AI in any one field and prepare a Report
- Study the Ethical practices of a Company
- 3D model Printing by Group or team
- Exposing the students to usage of IoT

CO-PO mapping

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	×				
CO2	×	×		×	
CO3	×	×		×	
CO4	×				

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Designing for Emerging Technologies: UX for Genomics, Robotics, and the Internet of Things	Follett, J.	O'Reilly Media	2014
2	Emerging Technologies for Emerging Markets	Vong, J., & Song, I.	Springer Singapore	2014
3	Disruption: Emerging Technologies and the Future of Work	Del Rosal, V.	Emtechub.	2015
4	Emerging Internet-Based Technologies	Sadiku, M. N. O	CRC Press	2019
Reference Books				
1	Digital Economy. Emerging Technologies and Business Innovation,	Mohamed Anis Bach Tobji, Rim Jallouli, Yamen Koubaa, Anton Nijholt		2018
2	Virtual & Augmented Reality for Dummies	Paul Mealy,		2018
3	Augmented Reality and Virtual Reality: Empowering Human, Place and Business,	Timothy Jung, M. Claudia tom Dieck		**2019**

Technology & Operational Strategy			
Course Code	20MBA302	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. To acquaint the student with the basic management principles with respect to production and operations management.
2. To Familiar the student with different types of Production Systems.
3. To explain the students regarding various techniques used in Operations Management.

Module-1 Introduction to Production and Operation Management (POM)	7 hours

Introduction Operations Management: Meaning, Definition, Scope and Functions. Difference Between Production and Operations Management. Management Guru's and their Contribution. The Roles and Functions of Operations Manager. Industry 4.0;   Productions and Operations Management in Indian Context.

Module -2 Process Management Mapping	9 hours

Process Mapping, Process Flow charts, Ishikawa Diagrams, Fishbone Diagram and Cause and Effect Relationship, 5M, 8P, and 4S Systems, Theory Z Approach.

Module -3 Lean Manufacturing	9 hours

Concept of Lean Manufacturing; meaning of lean manufacturing; History of Lean Operations, Types of Waste, "5S" Technique of Eliminating the Waste, Lean Operations in the service sector, Role of Leadership, Lean Operations and Just In Time(JIT).

Module -4 Production System	9 hours

Production System: Meaning, Types- Batch and Continuous Production, TPS: Introduction, Overview of Toyota Production Systems – Focused Areas, Techniques: 5S, JIT, JIDOKA, KANBAN, KAIZEN, POKAYOKE, Toyota Production Systems.

Module -5 Total Quality Management(TQM)	9 Hours

Evolution of quality; Concept, Meaning and Features of TQM, Eight building blocks of TQM; TQM tools. Benchmarking: Concepts, Meaning, Benefits, Elements, Reasons for benchmarking, Process of benchmarking, FMEA; Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Quality Circles. Total Productive Maintenance (TPM) – Concept and need.

Module-6 Quality Systems	7 Hours

ISO: ISO role; Functions of ISO, Quality System Family Series ISO 9000; ISO 14000; ISO21000.
Six Sigma: Features of Six Sigma, Goals of Six Sigma, DMAIC, Six Sigma implementation.
Supply Chain and Operations: Supply Chain "KEIRETSU", Core Competency, Relationship of Operations and Supply Chain; Relationship of Purchasing and Supply Chain; Sources, Service Quality and Supply Chain.

Course Outcomes:
At the end of the course the student will be able to:
1. Acquire the knowledge about the concepts of production and operation management
2. Demonstrate the basic concepts of process mapping
3. Evaluate the importance of Lean Manufacturing
4. Develop strategies of Total quality management
5. Understand the roles of ISO standards and production system

Practical Component:
- Students should understand process management
- Students to visit an organization and study the quality management system
- Students has to understand production system
- Study the role of leader in operation management and prepare a Report
- Students need to understand the practicality of the ISO standards

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X			X	
CO4	X		X	X	X
CO5	X		X		X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks				
Sl No	**Title of the book**	**Name of the Author/s**	**Publisher Name**	**Edition and year**
1	Production and Operations Management	S. N. Chari.	Mc Graw Hill.	6/e
2	Operations Management Theory and Practical	B. Mahadevan	Pearson.	3/e
3	Operations Management	Jay Heizer Barry Render, Chuck Munson, Amit Sachan	Pearson.	12/e
4	Production and Operations Management	R. Panneerselvam.	PHI	3/e
Reference Books				
1	The Goal: Process of Improvement	Eliyahu M. Goldratt	North River Press	3/e
2	The Toyota Way	Jeffery Liker.		

MARKETING SPECIALISATION COURSES

SERVICES MARKETING			
Course Code	20MBAMM303	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. To acquaint the students with the characteristics of services and their marketing implications.
2. To discuss and conceptualize the service quality, productivity in services, role of personnel in service marketing and to manage changes in the environment.
3. To familiarize the students with the GAPS model and strategizing towards closing the GAPS for effective services marketing.

Module-1 Introduction to services	9 hours

Reasons for the growth of services sector and its contribution; difference in goods and service marketing; characteristics of services; concept of service marketing triangle; service marketing mix; GAP models of service quality.
Consumer behaviour in services: Search, Experience and Credence property, consumer expectation of services, two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services.
Customer perception of services-Factors influencing customer perception of service, Service encounters, Customer satisfaction, Strategies for influencing customer perception.

Module -2 Market Research for Customer Expectation	9 hours

Key reasons for gap using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies –Relationship marketing, Evaluation Of customer relationships, Benefits of customer relationship, levels of retention strategies, Market segmentation-Basis & targeting in services.

Module -3 Customer defined service standards	9 hours

"Hard" & "Soft" standards, challenges of matching supply & demand in capacity, four common types of constraints facing services, optimum v/s maximum use of capacity, strategies for matching capacity & demand.
Yield management-balancing capacity utilization, pricing. Waiting line strategies- four basic Waiting line strategies.
Leadership &Measurement system for market driven service performance-key reasons for GAP-2 service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality In offensive and defensive marketing.

Module -4 Employee role in service designing and Delivery	7 hours

Boundary spanning roles, Emotional labour, Source of conflict, Quality- productivity trade off, Strategies for closing GAP 3.
Customer's role in service delivery-Importance of customer & customer's role in service delivery, Strategies for enhancing-Customer participation, Delivery through intermediaries-Key intermediaries for service delivery, Intermediary control strategies.

Module -5 Role of services marketing communication	9 hours

Role of services marketing communication- Key reasons for GAP 4 involving communication, four categories of strategies to match service promises with delivery.
Pricing of services- Role of price and value in provider GAP 4, Role of non-monitory cost, Price as an indicator of service quality –Approaches to pricing services, pricing strategies, SERVQUAL Model.
Mini Project – On measuring SERVQUAL

Module - 6 Physical Evidence in Services	7 hours

Physical evidence in services: Importance of Physical Evidence, Elements of Physical Evidence, Physical Evidence Strategies, Guidelines for Physical Evidence.
Service scapes: Types of service scapes-Objective and Goals of services capes Role of services capes, Approaches for understanding service scapes effects, Frame work for understanding services capes & its effect on behaviour-Guidance for physical evidence strategies.

Course outcomes:

At the end of the course the student will be able to:

1. Develop an understanding about the various concepts and importance of Services Marketing.
2. Enhance knowledge about emerging issues and trends in the service sector.
3. Learn to implement service strategies to meet new challenges.

Practical Component:

- Ask students to choose a service industry of their choice at the beginning of the semester
- Ask them to do an in-depth study of the industry and give a presentation at the end of the every Module relating the concepts to the particular industry(GAPS).
- Students can prepare service blueprints for any service of their choice.
- Identify any existing services, locate loopholes in the design and suggest modifications.
- Visit a service industry and analyze the role of customers in service delivery.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X		X		X

Question paper pattern:

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- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and
1	Services Marketing	Valarie A Zeithmal & Mary Jo	McGraw Hill	6/e 2018
2	Services Marketing	Christopher Lovelock	Pearson Education	2014
3	Services Marketing	Rajendra Nargundkar	McGraw Hill	2015
4	Marketing Research	Kumar	Sage Publications	4/e, 2018

Reference Books

1	Services Marketing	Parasuraman	Sage Publications	2018
2	Services Marketing	Hoffman & Bateson	Cengage Learning	2017
3	Services Marketing: Operation, Management and Strategy	Strategy-Kenneth E Clow& David L. Kurtz	Biztantra	2016

MARKETING RESEARCH & ANALYTICS			
Course Code	20MBAMM304	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. To provide an understanding of the basics of marketing research process.
2. To orient on the theoretical and practical aspects of marketing research.
3. Encourage the students to take up analytical thinking through research.
4. To highlight importance marketing research for enhancing marketing strategies.

Module-1 Marketing Research Dynamics	**9 hours**

Meaning of Marketing research; when marketing research is unnecessary; Nature and Scope of Marketing Research; Marketing Research in the 21st Century (Indian Scenario); limitations of Marketing Research; threats to marketing research; Introduction to marketing intelligence: concept of marketing intelligence (MI), components, need for MI, Domains of MI. Ethics in marketing research. Design of consumer experiments using Conjoint Analysis. Case Study on Marketing Research Dynamics.

Module -2 Marketing Research Projects	**7 hours**

Design and implementation of Marketing Research Projects, defining research questions, identifying respondents, sampling accuracy and sufficiency. Issues around studying human subjects.
Lab on socially acceptable responses- managing

Module -3 Decision Support System	**9 hours**

Marketing Decision Support System-meaning, Use of Decision Support Systems in Marketing Research, Data base & Data warehousing. The three Vs: Volume, Velocity & Varity, The Fourth V: Value. Elements of data base, types of data base, using marketing data base for marketing intelligence, ways to gather consumer data.

Module -4 Applications of Marketing Research	**9 hours**

Applications of Marketing Research: Introduction, Consumer Market Research, Business-to-Business Market Research, Product Research, Pricing Research, Motivational Research, Distribution Research, Advertising Research, Media research, Sales Analysis and Forecasting.
Live project & Assignment: Agriculture Marketing or B2B marketing

Module -5 Predictive analysis	**9 hours**

Meaning of predictive analysis, how good are models at predictive behavior, benefits of predictive models and applications of predictive analysis, reaping the benefits, avoiding the pitfalls, importance of predictive model, process of predictive analytics. Predictive Analytics, Data Mining and Big Data_ Myths, Misconceptions and Methods by Steven Finlay.

Module - 6 Product Research	**7 hours**

Product Research- Analysis of Diffusion of products, Adoption decisions, Product – services tradeoffs, evaluating prototypes, Luxury and Lifestyle products.
Live project: New Product adoption

Course outcomes:
The student should be able to:
1. Comprehend the objectives of Market research & its application in solving marketing problems.
2. Appreciate the use of different data collection methods, sampling design techniques, measurement methods to analyze the data.
3. Generalize and interpret the data with the help of various measurement techniques.
4. To understand the emergence of new trends in research.

Practical Component:
- Choose 5 successful products or services and identify the insight behind them through a field survey.
- Do a comprehensive essay on the difference between consumers vs. trade vs. Competition insights & how best to exploit them.
- Take 5 recent digital innovations like twitter or face book and identify the insights.
- Running case with real data Dell, Comprehensive critical thinking case Baskin-Robbins.
- Data Analysis case with real data IBM.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X		
CO2	X	X		X	
CO3	X		X		X
CO4	X			X	X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Marketing Research- An Applied Orientation	Naresh K Malhotra & SatyaBhushan Dash	Pearson	7th Edition
2	Marketing Analytics Using Excel	.Ajithab Dash	Sage publications	2019
3	Essentials of Marketing Research	William G Zikmund et. al	Cengage Learning	7/e
4	Marketing Research	V Kumar	Sage Publications	1/e, 2015

Reference Books

1	Market Research: Text and cases	Rajendra Nargundkar	Mc Graw Hill	3rd Edition
2	The Effective Use of Market Research: How to drive and focus better business decisions	Robin J Birn	Viva	4th Edition
3	Marketing Research: Methodological Foundations	Gilbert A Churchill & Dawan Lacobucci		8th Edition

CONSUMER BEHAVIOUR			
Course Code	20MBAMM305	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. To understand the concept of consumer behaviour, decision making by consumers, behavioural variables and its influences on consumer behaviour.
2. To comprehend the social and cultural dimensions of consumer behaviour.
3. To provide an insight of the psychological and behavioural concepts of consumers.

Module-1 Introduction	7 hours

Meaning of Consumer Behaviour; Difference between Consumer & Customer; Nature & characteristics of Indian Consumers; Consumerism: meaning; Consumer Movement in India; Rights & Responsibilities of consumers in India; Benefits of consumerism. Research on Consumer Behaviour; Consumer Behaviour and Society.

Module -2 Models of Consumer Behaviour	9 hours

Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences, External Influences.
Consumer Decision Making: Consumer Buying Decision Process, Levels of Consumer Decision Making – Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages.
Situational Influences- Nature of Situational Influence, Situational Characteristics and consumption behaviour.
Class Exercise: Conducting consumer experiments.

Module -3 Individual Influences on Consumer Behaviour and CRM Part –I	9 hours

a) Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals. Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives.
b) Personality: Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity, Brand Personality, Self and Self-Image.
c) Perception: Basics of Perception & Marketing implications, Elements of Perception, Dynamics of Perception, Influence of perception on CB, Consumer Imagery, Perceived price, Perceived quality, price/quality relationship, Perceived Risk, Types of risk, How to consumers' handle risk.

Module -4 Individual Influences on Consumer Behaviour and CRM Part –II	9 hours

d)Learning: Elements of Consumer Learning, Marketing Applications of Behavioural Learning Theories, Classical Conditioning – Pavlovian Model, Neo-Pavlovian Model, Instrumental Conditioning.
e) Attitude: Basics of attitude, the nature of attitude, Models of Attitude and Marketing Implication, (Tri-component Model of attitude, Multi attribute attitude models. Elaboration Likelihood Model).
Persuasive Communication: Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation

Module -5 External Influences on Consumer Behaviour	9 hours

Social Class: Social Class Basics, What is Social Class? (Social class & Social status, the dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India.
Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour. Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures. Cross Culture - Cross-cultural consumer analysis - Cross-cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problems.
Groups: Meaning and Nature of Groups, Types Family: The changing structure of family, Family decision making and consumption related roles, Dynamics of husband-wife decision making, The family life cycle & marketing strategy, Traditional family life cycle & marketing implications, Reference Groups: Understanding the power & benefits of reference groups, Factors that affect reference group influence, Types of reference group, Reference Group Appeals.

Module - 6 Consumer Influence and Diffusion of Innovations	7 hours

Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders.
Diffusion of Innovations: Diffusion Process, Adoption Process: Stages, categories of adopters, Post Purchase Processes.

Customer Relationship Management- Meaning & Significance of CRM, Types of CRM Strategies for building relationship marketing, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e-CRM
Case Study: Pillsbury Cookie Challenge.

Course outcomes:
At the end of the course the student will be able to:
1. Explain the background and concepts vital for understanding Consumer Behaviour.
2. Identify the role of variables that determines Consumer Behaviour in Social & cultural domain.
3. Identifying the psychological and behavioural practices adopted by organizations to enhance the Consumer Behaviour.

Practical Components:
• Students can go to malls and unorganized retail outlets and observe the behaviour of consumers of different demographic segments while buying different category of goods. The students need to present the findings / observations followed with a group discussion.
• Students have to prepare a questionnaire and conduct the survey on consumer buying behaviour and present the findings in the class.
• Find three advertisements that appeal to the need for power, affiliation and achievement. Discuss their effectiveness. Rewrite these for persons in different levels of Maslow's Hierarchy?
• Meet your friends and conduct a survey to find what are the important factors in their purchase of mobiles, shoes, bags etc.
• Conduct a study on advertisements regarding a specific product and find out how consumer deal with the information overload.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X		X	X	
CO3	X				X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
• The question paper will have 8 full questions carrying equal marks.
• Each full question is for 20 marks.
• Each full question will have sub question covering all the topics under a Module.
• The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
• 100 percent theory in the SEE.

Texbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Consumer Behaviour	Leon Schiffman, Leslie	Pearson	Latest Edition
2	Consumer Behaviour: A Managerial Perspective	Dr.Dheeraj Sharma, Jagdish N Sheth, Banwari Mittal	Cengage Learning	Latest Edition
3	Consumer Behaviour	Sethna	Sage Publications	4/e, 2018
4	Advertisement Brands & Consumer Behaviour-Case Book	Ramesh Kumar	Sage Publications	2017

	Reference Books			
1	Consumer Behaviour in Indian Perspective	Suja Nair	Himalaya Publications	2015
2	Consumer Behaviour: Building Marketing Strategy	Dell, Hawking & others	Tata McGraw Hill	Latest Edition
3	Consumer Behaviour	Satish K Batra & S H H Kazmi	Excel Books	Latest Edition

RETAIL MANAGEMENT			
Course Code	20MBAMM306	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1.To provide an understanding of the concepts, techniques and approaches in Sales Management
2. To emphasize on the Sales Manager's problems and dilemmas.
3.To develop skills for generating, evaluating and selecting sales strategies.
4.To develop an understanding of the contemporary retail management, issues, strategies and trends.
5.To highlight the importance of retailing and its role in the success of modern business.
6.To acclimatize with the insights of retailing, key activities and relationships.

Module-1 Sales Management	**7 hours**

Meaning, Personal Selling, the sales management process Emerging Trends in Sales Management, Qualities and Responsibilities of a sales manager. Selling skills & selling strategies: selling and buying styles, selling situations, selling skills, selling process.

Module -2 Management of Sales Territory & Sales Quota	**7 hours**

Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, Methods of setting quota. Recruitment and selection of sales force, Training of sales force.

Module -3 Retail Management	**10 hours**

Introduction and Perspectives on Retailing World of Retailing, Retail management, introduction, meaning, characteristics, emergence of organizations of retailing - Types of Retailers (Retail Formats) - Multichannel Retailing -Customer Buying Behaviour, role of retailing, trends in retailing, FDI in Retail - Problems of Indian Retailing - Current Scenario. **Assignment: History and current trends including Indian retail FDI Policy.**

Module-4 Setting up Retail organization	**10 hours**

Size and space allocation, location strategy, factors Affecting the location of Retail, Retail location Research and Techniques, Objectives of Good store Design. Retail Market Strategy - Financial Strategy Human Resource Management, Information Systems and supply chain management & Logistics.

Store Layout and Space planning: Types of Layouts, role of Visual Merchandiser, Visual Merchandising Techniques, Controlling Costs and Reducing Inventories Loss, Exteriors, Interiors.

Store Management: Responsibilities of Store Manager, Store Security, Parking Space Problem at Retail Centers, Store Record and Accounting System, Coding System, Material Handling in Stores, Management of modern retails stores.

Assignment: *Merchandise Planning and Category Management, Mall Management-key aspects*

Module -5 Retail Pricing	**9 hours**

Retail Pricing: Factors influencing retail pricing, Retail pricing strategies, Retail promotion strategies

Relationship Marketing in Retailing: Management & Evaluation of Relationships in Retailing, Retail **Research in Retailing:** Importance of Research in Retailing, Trends in Retail Research, Areas of Retail Research. Customer Audits, Brand Management in retailing Retail Audit and ethics in Retailing Undertaking an audit, responding to a retail Audit, problems in conducting a retail audit

Retail Analytics Case Study: Customer Analytics at Big Basket.

Module – 6 Internationalization of Retailing	**7 hours**

Evolution of International Retailing, Motives of International Retailing, International Retail Environment – Socio-Cultural, Economic, Political, Legal, Technological and issues in international retailing.

Course Outcomes:
1.Career development in the field of sales
2.Management of sales
3.Find out the contemporary retail management, issues, and strategies.
4.Evaluate the recent trends in retailing and its impact in the success of modern business.
5.Relate store management and visual merchandising practices for effective retailing.

Practical Component:
- Interview a salesperson in a retail store and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why they chose a sales career, and what does it take to

succeed in this profession.

- Go to a kirana store and a supermarket and compare the following: a) store arrangement b) No of brands carried c) pricing policies – are discounts given? d) Service – personal or impersonal? Etc.
- Go to at least three kirana stores in your neighbourhood (around 2 kms) and discuss with them the importance of location, pricing, credit policy, etc. What percentages of goods are sold 'loose' in each locality and compare this with the approximate income range of the customers? What are the retailer's losses when a customer defaults in payment? Does he make up for it by increasing his prices to other customers?
- Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products into low risk and high risk ones. Does this buying behavior also depend on the personality of the individual doing the buying? Or the one doing the selling?
- Student can make a presentation on any product or the services of student choice, covering selling strategies and one day work exposure towards merchandising in any big retail outlets of respective places where institute is operating. Rural colleges can send the students to the city nearby to observe the merchandising planning in retail outlets and to make a small report.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X	X	
CO2	X		X	X	
CO3	X				X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 perecent theory in the SEE.

Texbooks

1	Sales & Distribution Management	Tapan K. Panda & Sunil Sahadev,	6/e, Oxford University Press	2012
2	Managing of Sales Force	Spiro Stanton Rich	TMH	2003.
3	Sales Management	Charles M. Futrell		2012
4	Retail Management	Levy &Weitz	McGraw Hill	Latest Edition
5	Retail Management	Chetan Bajaj	Oxford University	
3	Retail Management-A Global Perspective: Text and Cases	Dr.Harjit Singh	S.Chand	Reprint 2018

Reference Books

	Sales & Distribution Management	Gupta S. L	Excel Books	2010
2	Retail Marketing Management	Dravid Gilbert,	Pearson Education	Latest Edition
3	Retail Management: A Strategic Approach	Barry Berman, Joel R. Evans	Pearson Education	Latest Edition

INVESTMENT MANAGEMENT

Course Code	20MBAFM303	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. To understand the capital market and various instruments for investment.
2. Learn valuation of equity, debt and mutual funds.
3. To learn theories of portfolio management.
4. To learn diversification of securities for risk return trade off in capital market.
5. To lean portfolio construction for retail investors, high net worth individuals, mutual funds.

Module -1 Introduction to Investment	7 hours

Investment Avenues, Attributes, Investor V/s speculator, Features of a good Investment, Investment Process. Financial Instruments: Money Market Instruments, Capital Market Instruments, Derivatives.
Securities Market: Primary Market, Secondary Market. Stock Market Indicators- Indices of Indian Stock Exchanges (only Theory).

Module -2	7 hours

Return and Risk Concepts: Concept of return, individual security returns, rate of return, Concept of Risk, Causes of Risk, Types of Risk- Systematic risk- Market Price Risk, Interest Rate Risk, Purchasing Power Risk, Unsystematic Risk- Business risk, Financial Risk, Insolvency Risk, Risk-Return Relationship, Concept of diversifiable risk and non-diversifiable risk. Calculation of Return and Risk of Individual Security (Theory & Problems).

Module -3 Valuation of Securities	9 hours

Bond features, Types of Bonds, Determinants of interest rates, Bond Valuation, Bond Duration, Bond Management Strategies. Preference Shares- Concept, Features, Valuation. Equity Shares- Concept, Valuation, Dividend Valuation Models, P/E Ratio valuation model. (Theory & Problems).

Module -4	7 hours

Macro-Economic and Industry Analysis: Fundamental analysis-EIC Frame Work, Economy Analysis, Industry Analysis, Company Analysis- Financial Statement Analysis.
Market Efficiency: Efficient Market Hypothesis, Forms of Market Efficiency, Empirical test for different forms of market efficiency.
Technical Analysis – Concept, Theories- Dow Theory, Eliot Wave theory. Charts-Types, Trends and Trend Reversal Patterns. Mathematical Indicators –Moving Average Convergence-Divergence, Relative Strength Index (Theory only).

Module -5 Modern Portfolio Theory	11 hours

Markowitz Model- Diversification, Portfolio Return, Portfolio Risk, Efficient Frontier. Sharpe's Single Index Model, Capital Asset Pricing Model: Assumptions, CAPM Equation, Capital Market Line, Security Market Line, CML V/s SML. Sharpe's Optimum Portfolio Construction. Arbitrage Pricing Theory: Equation, Assumption, CAPM V/s APT (Theory & Problems).

Module-6 Portfolio Management Strategies and Performance Evaluation	9 hours

Portfolio Management Strategies: Active and Passive Portfolio Management strategy. Portfolio Revision: Portfolio Revision Strategies – Objectives, Performance plans. **Mutual Funds**: Concept of Mutual Funds, Participants in Mutual Funds, Advantages of Investment in Mutual Fund, Measure of Mutual Fund Performance.
Portfolio performance Evaluation: Measures of portfolio performance (Theory & Problems).

Course outcomes:
At the end of the course the student will be able to:
1. The student will understand the capital market and various Instruments for Investment.
2. The learner will be able to assess the risk and return associated with investments and methods to value securities.
3. The student will be able to analyse the Economy, Industry and Company framework for Investment Management.
4. The student will learn the theories of Portfolio management and also the tools and techniques for efficient portfolio management.

<div align="center">**CO-PO MAPPING**</div>

Practical Components:
• Each student will be given a virtual cash of Rs.10 Lakhs and they will be asked to invest in equity shares based on fundamental analysis throughout the semester. At the end the best investment will be awarded based on the final net worth. Virtual on line trading account can be opened for the student and every week 2 hours can be allotted to invest, monitor and evaluate.
• Students should study the stock market pages from business press and calculate the risk and return of selected companies.
• Students can do a macro economy using GDP growth.
• Students' are expected to do Industry analysis for specific sectors.
• Students can do Company analysis for select companies using profitability and liquidity ratios.
• Practice technical analysis using Japanese candle sticks.

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	X
CO3	X				X
CO4	X			X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
  40 percent theory and 60 percent problems in the SEE.

Textbook/ Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Investment Analysis and Portfolio management	Prasanna Chandra	Tata McGraw Hill Education	3/e, 2010
2	Investments	ZviBodie, Kane, Marcus & Mohanty	Tata McGraw Hill Education	8/e, 2010
3	Security Analysis & Portfolio Management	J Kevin	Tata McGraw Hill Education	2014

Reference Books

1	Analysis of Investments & Management	Reilly & Brown	Cengage Publications,	10e/2017
2	Security Analysis & Portfolio Management	Punithavathy Ehavathy Pandian	Vikas Publications	2/e, 201/8
3	Investment management (Security Analysis and & Portfolio Management)	Bhalla V.K.	Vikas Publications	19/e, 2018

DIRECT TAXATION			
Course Code	20MBAFM304	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives

1. To provide the students with a comprehensive understanding of basic concepts of Income tax
2. To understand the computation of taxable Income under different heads.
3. To know the deductions available while computing Income.
4. To understand corporate taxation system in India

Module-1 Income Tax Act, 1961	7 hours

Income Tax Act, 1961, Basic Concepts and definitions, Capital and revenue – receipts, expenditures, Basis of charge and scope of total income , Residential Status and Incidence of Tax, Incomes which do not form part of Total Income (Sec.10), Tax Planning, Tax Evasion and Tax Management. (Problems on residential Status of Individual assessee).

Module -2 Income from Salaries	9 hours

Meaning of Salary, Allowances, Valuation & Taxability of Perquisites, Death cum Retirement benefits, Deductions against Salary. Income from House Property (Theory Only). (Problems on salary Income).

Module -3 Income from Business or Professions	9 hours

Income under the head Profit and Gains of Business or Professions and its computation- basic method of accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation. (Problems on computation of income from business/ profession of Individual assessee and Depreciation).

Module -4 Income under capital gain	9 hours

Income under capital gain, basis of charge, transfer of capital asset, inclusion & exclusion from capital asset, capital gain, computation of capital gain, deductions from capital gains. Income from Other Sources (Theory Only). (Problems on computation of Income from capital gain).

Module -5 Permissible Deductions	9 hours

Permissible deductions under section 80C to 80U, computation of tax liability of Individuals. Setoff and carry forward of losses (Theory only). (Problems on Computation of taxable Income and tax liability of Individuals).

Module -6 Computation of taxable income of a company	7 hours

Computation of taxable income of a company with special reference to MAT. (Problems on MAT).

Course outcomes:

At the end of the course the student will be able to:

1. Understand the basics of taxation and process of computing residential status.
2. Calculate taxable income under different heads.
3. Understand deductions and calculation of tax liability of Individuals.
4. Know the corporate tax system.

Practical Components:

• Calculation of Taxable income and tax liability using Excel.
• Encouraging the students to register as tax return preparers.
• Students can be exposed to filing of tax returns of Individual assesses.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X				
CO4	X				

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 600 percent problems in the SEE

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Direct Taxes Law and practice	Vinod Singhania and Kapil Singhania	Taxman Publications	2019/2020 Edition
2	Students Guide to Income Tax Vinod Singhania and Kapil Singhania	Vinod Singhania and Kapil Singhania	Taxman Publications	2019/2020 Edition

Reference Books

1	Students Handbook on Taxation	T N Manoharan	Snow White Publications Pvt. Ltd	Jan 2020 Edition
2	Income Tax Law & Practice	B.B.Lal & N. Vashisht	Pearson	33e/2019
3	Income Tax	H.C.Mehrotra & S.P.Goyal	Sahithya Bhavan Publications	60 e/2019

BANKING & FINANCIAL SERVICES			
Course Code	20MBAFM305	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:
1. To understand the structure and functions of central and Commercial banking in India.
2. To learn the functions of various financial services in India.

Module-1 Structure of Banking in India	**7 hours**

Structure of Banking in India: Functions of RBI, Monetary system, Sources of funds, Quantitative and qualitative measures of credit control. Banking sector reforms, Bank performance analysis and Future of Banking.(Theory)

Module -2 Commercial Banking	**9 hours**

Commercial Banking: Structure, Functions - Primary & secondary function, Role of commercial banks in socio-economic development, Services rendered. Banking Technology- Concept of Universal Banking-Home banking– ATMs-Internet Banking– Mobile Banking-Core Banking Solutions–Debit, Credit and Smart Cards– Electronic Payment systems-MICR- Cheque Truncation-ECS- EFT – NEFT-RTGS. (Theory)

Module -3 Merchant Banking	**9 hours**

Merchant Banking: Categories, Services offered, Issue management – Pre and Post issue management, Issue pricing, preparation of prospectus, Issue Management, Underwriting, Private Placement, Book Building Vs. Fixed price issues.(Theory)

Module -4 NBFCs; Micro-finance; Leasing & Hire Purchase Banking	**9 hours**

A. NBFCs: An Overview -Types of NBFCs in India-Regulatory framework.
B. Micro-finance: Models, Services, Challenges.
C. Leasing & Hire Purchase: Concept, Types, Evaluation. Problems in Evaluation of Leasing & Hire Purchase. (Theory& Problems)

Module -5 Credit Rating; Venture Capital; Depository System & Securitisation of Debt	**9 hours**

A. Credit Rating: Meaning, Process, Methodology, Agencies And Symbols.
B. Venture Capital: Concept, Features, Process. Stages, Performance of Venture Capital Funded Companies In India.(Theory)
C. Depository System: Objectives, Activities, NSDL& CDSL. Process of Clearing and Settlement.
D. Securitization of Debt: Meaning, process, Types, Benefits. (Theory)

Module-6 Mutual Funds	**7 hours**

Meaning, Structure, Functions, Participants, Types of Funds, Types of Schemes, Performance of Mutual Funds, Regulations for Mutual Funds.

Course outcomes:
At the end of the course the student will be able to:
1.   The Student will be acquainted to various Banking and Non-Banking financial services in India.
2.   The Student will understand the activities of Merchant Banking and credit rating.
3.   The Student will be equipped to understand micro financing and other financial services in India.
4.   The Student will understand how to evaluate and compare leasing & hire purchase.

Practical Components:
- Study and compare the performance of Public and private sector banks.
- Issue management: Study the recent public issues.
- Factoring and forfeiting business in India.
- Venture capital funding and start up challenges.
- Status of securitization in India

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X				X
CO4	X			X	

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 80 percent theory and 20 percent problems in the SEE.

Textbook/ Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Financial services	Khan M Y	McGraw Hill	6/e
2	Banking and Financial Services	Mukund Sharma	Himalaya Publishing House	2015
3	Financial Services in India: Concept and Application	Rajesh Kothari	Sage Publications	1/e, 2010

Reference Books

1	Financial Markets and Services	Gordon & Natarajan	Himalaya Publishing House	7/, 2011
2	Merchant Banking & Financial	Vij & Dhavan	McGraw Hill	1/e, 2011
3	Investment Banking	Pratap G Subramanyam	Tata McGraw Hill	2012
4	Behavioural Finance	Sujata Kapoor & Jaya Mamta Prosad	Sage Publications	1/ e, 2019

ADVANCED FINANCIAL MANAGEMENT			
Course Code	20MBAFM306	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. To understand the concept capital structure and capital structure theories.
2. To assess the dividend policy of the firm.
3. To be aware of the management of working capital and its financing.
4. To understand the techniques of managing different components of working capital.

Module -1 Capital Structure Decisions	9 hours

Capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, Traditional approach. Planning the capital structure: EBIT and EPS analysis. ROI & ROE analysis. (Theory and Problems).

Module -2 Dividend Policy	9 hours

Dividend policy – Theories of dividend policy: relevance and irrelevance dividend decision. Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. (Theory and Problems).

Module -3 Working Capital Management Policy	9 hours

Working capital management – Determination of level of current assets. Sources for financing working capital. Bank finance for working capital. (No problems on estimation of working capital). Working capital financing: Short term financing of working capital, long term financing of working capital. Working capital leverage. (Theory).

Module -4 Inventory Management	7 hours

Inventory Management: Determinations of inventory control levels: ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis. (Theory and problems)

Module -5 Receivables Management	7 hours

Receivables Management – Credit management through credit policy variables, marginal analysis, Credit evaluation: Numerical credit scoring and Discriminate analysis. Control of accounts receivables, Problems on credit granting decision. (Theory and Problems)

Module-6 Cash Management	9 hours

Cash Management – Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-Orr model, Strategies for managing surplus fund. (Theory and Problems)

Course outcomes:
At the end of the course the student will be able to:
1.   Get an overview of capital structure theories.
2.   Understand and assess the dividend policy of the firm.
3.   Realize the importance of management of working capital in an organization.
4.   Be aware of the techniques of cash, inventory and receivables management

Practical Component:
• Study the working capital financing provided by a Bank and submit the report on the same.
• Study the annual report of any two companies and prepare a cash budget for next year.
• Study dividend policy of companies and its impact on shareholders' wealth.
• Study implications of bonus issues/stock splits of companies.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X				
CO4	X				X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Financial Management	M.Y.Khan & P.K.Jain	TMH	6/e, 2011
2	Financial Management	Prasanna Chandra	TMH	8/e, 2011
3	Corporate Finance-Text and Cases	Vishwanath S.R.	Sage Publishing	3/e, 2019

Reference Books

1	Financial Management & Policy	Vanhorne	Pearson	12/e,
2	Financial Planning: Theory and Practice	Sid Mittra, Shailendra Kumar Rai, Anandi P Sahu & Harry Starn, Jr.	Sage Publishing	1/e, 2015
3	Financial Management-A	Rajesh Kothari	Sage Publishing	2/e, 2017

RECRUITMENT AND SELECTION

Course Code	20MBAHR303	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives
1. The student will be able to recite the theories and various steps involved in Recruitment and Selection
2. The student will be able to describe and explain in her/his own words, the relevance and importance of Recruitment and Selection in the Organization
3. The student will be able to apply and solve the workplace problems through Recruitment and Selection intervention
4. The student will be able to classify and categorize in differentiating between the best method to be adopted by organization related to Recruitment and Selection
5. The student will be able to compare and contrast different approaches of Recruitment and Selection framework for solving the complex issues and problems
6. The student will be able to design and develop an original framework and framework in dealing with the problems in the organization.

Module-1 Workforce Planning and Recruitment Analytics	**9 hours**

Concept of Work, Organisation's Work and Jobs; Millennials at the work place; Key Characteristics of Millennials; Types of Millennial; The Evolution of Work Structure; Organising the Work; Strategic Job Redesign and Its Benefits; Strategic Issues in Recruitment; What make Bad Recruitment; Overview of the Hiring Process; Recruitment Metrics; Factors Affecting Recruitment; Recruitment Strategy: An Internal Approach; Recruitment Strategy: An External Approach; Legal and Ethical Considerations; Organisational Best Practices.

Module -2 Job Analysis, Job Description and Job Design	**9 hours**

Identify the Job to Examine; Determine Appropriate Information Sources and Collect Job-Related Data; Job Description; Competency and Competency Ice Berg Model; Why Competency Based Recruitment; Sources of Recruitment; Different steps of job search; Motivational Job Specification; Creation of Functional Specification; Creation of Behavioural Specification; Employer branding; Social Media; Job Design.

Module -3 Job Evaluation	**7 hours**

The Job Evaluation Process; Obtain Job KSAOs, Qualifications, Working Conditions, and Essential Duties; Examine Compensable Factors Using the Rating/Weighting Evaluation Method; Determine Overall Job Value; Hay Group—Pioneer in Job Evaluation; Determining Compensation using Job Evaluation Data; Legal and Ethical Considerations for Job Evaluation; Online Salary Survey.

Module -4 Selection and Interview Strategy	**9 hours**

Interview Strategy and Process; Millennials shaping the Recruitment landscape in the organizations; Strategies for recruiting and selecting Generation Y into the workforce Developing Effective. Interviewers; Interviewing Techniques; Legal and Ethical Considerations in the Interview Process; The overall BEI Process; Assessment Centre's; Simulations.

Module -5 Testing and Assessment	**9 hours**

Testing in Occupational Selection; Test related to Assessment of Knowledge, Skills, and Abilities; Personality Assessment; The Birkman method and MBTI® comparison; FIRO-B; Honesty and Integrity Assessment; Various Non-Interviewing Methods; Graphology;   Skills Assessment; Games and Group Activity for Leadership Assessment; Administration of Tests and Assessments; Key Interviewer Skills.

Module – 6 Making the Hire; Assessment of Candidate and Job Fit	**7 hours**

Unique Recruitment strategies; Biodata and Application Forms; Implications of Using Social Media Content in Hiring Decisions; Background Checks; Reference Checks; Pre-employment Testing; Making a Job Offer; Transitioning from Job Candidate to Employee; Induction; Placement.

Course outcomes:
At the end of the course the student will be able to:
1. Gain the practical insight of various principles and practices of recruitment and selection.
2. Acquire knowledge of latest conceptual framework used in recruitment and selection process and procedure applied in various industries.

3. Illustrate the application of recruitment and selection tools and techniques in various sectors.
4. Develop a greater understanding about strategies for workforce planning and assessment, analyse the hiring management system followed in various industries.

Practical Component:
- Design and Job Advertisement and Calculate the Cost; Paper Print mode; Social Media formalities.
- Meet a Manager (which ever stream), interact and design and JD for that role.
- Meet HR Manager / Officer, and ask Best 10 Interview Questions they ask during Candidate interaction.
- Visit HR department, and take part on shortlisting/ Scrutiny the CV.

CO-PO MAPPING

CO	PO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	X				
CO2	X			X	
CO3	X				X
CO4	X		X	X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	How to Recruit, Incentives and Retain Millennials.	Rohtak	Sage Publications	2019
2	Recruitment and Selection- Strategies for Workforce Planning & Assessment	Carrie A. Picardi	Sage Publication	2019
3	Human Resource Management	R. C. Sharma	Sage Publication	2019

Reference Books

1	Human Resource Management:	Amitabha Sengupta	Sage Publication	2018
2	Leadership: Theory and Practices	Peter G. Northouse	Sage Publication India Pvt. Ltd	7/e, 2016
3	Performance Management and	T. V Rao	Response Books	2004

HUMAN RESOURCE ANALYTICS			
Course Code	20MBAHR304	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives

1. The student will be able to describe and Identify the application of HR Analytics in the Organisation
2. The student will be able to describe and explain in her/his own words, the relevance and importance of HR Analytics in the Organisation
3. The student will be able to apply and solve the workplace problems through application of HR Analytics in the Organisation
4. The student will be able to classify and categorise different models of HR Analytics in the Organisation
5. The student will be able to compare and contrast different approaches of HR Analytics in the Organisation
6. The student will be able to design and develop an original framework and model in dealing with the problems in the organisation.

Module-1 Introduction	7 hours

Evolution of Business Analytics, Motivation for Studying Business Analytics, Emergence of Business Analytics, Understanding Business Analytics, Managing a Business Analytics Project, Advantages of Business Analytics, Making the Best Use of Business Analytics, Challenges to Business Analysts, Analytics in Different Domains of Business, Levels of Analytics Maturity.

Module -2 Rise of Human Resource(HR)Analytics	7 hours

Meaning of HR Analytics; Pitfalls of HR Analytics; What is not HR Analytics; Evolution of HR Analytics, Levels of Analysis, Conducting HR Analytics, Who Are Applying HR Analytics, Future of HR Analytics, The Scope of Big Data in HR Analytics, Scope of Text Analytics in HR Analytics.

Module -3 Applications of HR Metrics and Creating HR Dashboards	9 hours

HR Metrics, Types of HR Metrics, Staffing Metrics, Training and Development Metrics, Application-oriented Exercises : Dashboards: Few Key Excel Add-ins/Functions to Help Create Dashboards, Name Range, The Developer Tab, Form Controls, Important Excel Formulas Useful for Creating Dashboards, VLOOKUP, INDEX, SUMIF, AVERAGEIF and COUNTIF, Application of Excel Functions in Creating HR Dashboards, Storyboarding: Connecting the Dots and Integrating the Findings.

Module -4 Correlation and Regression for HR Analytics	9 hours

Correlation Analysis, Output of Correlation Analysis, The Case of Outlier, Software for Statistical Analysis 1-GNU PSPP, Plotting Scatter Plot in PSPP, Conducting Correlation in PSPP , Software for Statistical Analysis 2: R and R Commander, The Advantage of Free OSS over Closed Software, Simple Linear Regression Analysis, Co-variation of the Cause and Effect, Temporal Precedence, Plausible Alternative Explanations, Assumptions of Regression Analysis, Interpretation of the Output of Simple Linear Regression Analysis, Conducting Simple Linear Regression Analysis in PSPP, Conducting Simple Linear Regression Analysis in R Commander, Multiple Regression Analysis, Interaction Effects.

Module -5 HR Analytics Applications using ANOVA	9 hours

One-Sample T-test, Null and Alternate Hypotheses, One-Sample T-Test, Assumptions of One-Sample T-test , Conducting One-Sample T-Test in PSPP, Conducting One-Sample T-Test in R Commander, Interpreting the Output of One-Sample T-Test, Paired Sample T-Test, Conducting Paired-Sample T-Test in PSPP, Conducting Paired-Samples T-Test in R Commander, Independent-Sample T-Test, Conducting Independent-Sample T-Test in PSPP, Conducting Independent-Sample T-Test in R Commander, Analysis of Variance, Conducting Independent One-Way ANOVA in PSPP, Conducting Independent One-Way ANOVA in R Commander, Steps to Analyse the Output of ANOVA, Advanced Concepts.

Module – 6 HR Analytics Applications using Regression	9 hours
Logistic Regression with Single Nominal Predictor, Assumptions of Logistic Regression Analysis Conducting Logistic Regression Analysis in PSPP, Conducting Logistic Regression Analysis in R Commander, The Output of Logistic Regression Analysis, Multiple Predictors, Conducting Logistic Regression Using Rattle Package, Advanced Concepts , Pros and Cons of Logistic Regression as a Supervised Learning Algorithm; Factor Analysis and Cluster Analysis: Factor Analysis, Assumptions of Factor Analysis, Considerations Before Conducting Factor Analysis; Conducting Factor Analysis in PSPP, Conducting Factor Analysis in R Commander, Interpretation of the Output of Factor Analysis, Cluster Analysis, Assumptions of Cluster Analysis, Conducting Cluster Analysis in PSPP, Conducting Cluster Analysis in R Commander, Conducting Cluster Analysis in Rattle, Interpreting the Output of Cluster Analysis, Advanced Concepts.	

Course Outcomes:
At the end of the course the student will be able to:
1. Gain practical insight of HR Processes, HR analytics and predictive modelling used in HR functions.
2. Acquire conceptual knowledge of HRA frameworks, models and approaches.
3. Illustrate the application of datafication of HR, predictive analytics tools and techniques.
4. Analyse the employee data set, considering the various concepts and functions of HR, facilitating the decision making in business context.

Practical Component:
- To visit an Organisation and interact with Analyst who deals with HR function; Know how the data is used and worked.
- Prepare a dashboard and analysis various functions and interrelations of data.
- Work on Excel through real time data of any company and generate the output.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				X
CO2	X			X	
CO3	X	X		X	
CO4	X			X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year

1	Practical Applications of HR Analytics	Pratyush, Banerjee; Jatin Pandey; Manish Gupta	Sage Texts, India	2019
2	HR Analytics- Understanding Theories and Applications	Bhattacharya, Dipak Kumar	Sage Texts, India	2017
3	Winning on HR Analytics- Leveraging Data for Competitive Advantage	Ramesh, Soundarajan and Kuldeep Singh	Sage Publication India Pvt. Ltd.	2016
Reference Books				
1	Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives and Improving Collaboration	Sesil James, C	Pearson, New Jersey	2017
2	Predictive Analytics- Mastering the HR Matrix	Martin Edwards and Kirsten Edwards	Kogan Page	2019
3	Fundamentals of HR Analytics: A Manual on Becoming HR Analytical	Fermin Diez, Mark Bussin, Venessa Lee	Emerald Publishing Limited	2019

INDUSTRIAL RELATIONS AND LABOUR LAWS			
Course Code	20MBAHR305	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives

1. The student will be able to describe and Identify the application of Labour Laws regulating Industrial Relations in Organisation
2. The student will be able to describe and explain in her/his own words, the relevance and importance of Labour Laws and Industrial Relations in Organisation
3. The student will be able to apply and solve the workplace problems through Labour Laws
4. The student will be able to classify and categorise different Laws and Codes
5. The student will be able to create and reconstruct Industrial Relations System to be adopted in the Organisation
6. The student will be able to appraise and judge the practical applicability of Labour Laws regulating Industrial Relations in Organisation

Module-1 Fundamental Aspects of Industrial Relations	9 hours

Introduction, Nature of Industrial Relations, Approaches to Industrial Relations, Trade Unions: The Participants of Industrial Relation Activities, State and Employer/Management. The Participants of Industrial Relation Activities; **Evolution of Labour Legislation in India -** History of Labour Legislation in India, Objectives of Labour Legislation, Types of Labour Legislations in India, Constitutional Provisions for the Protection of Labour Workforce in India, Rights of Woman Workers; The Present Labour Laws and Codes

Module -2 Factories Act, 1948	7 hours

Introduction, Objectives, Scope and Important Definitions, Approval, Licensing and Registration of Factories, Health and Safety of Workers, Provisions Related to Working Conditions, Hazardous Processes, Employee Welfare and Working Hours, Employment of Young Persons and Women, Annual Leaves with Wages, Penalties and Contingence of Offences

Module -3 Social Security Act	9 hours

The Employees' Compensation Act, 1923
Introduction, Objectives, Scope and Important Definitions of the Act, Eligibility, Rules for Workmen's Compensation, Amount and Distribution of Compensation, Notice, Claims and Other Important Provisions, Enforcement of Act and Provisions for Penalty
The Employees' State Insurance Act, 1948
Introduction, Objectives, Scope and Important Definitions, Administration of the Act, Finance and Audit, Contribution, Benefits, Obligations of Employers under the Act, Adjudication of Disputes, Claims and Penalties, Exemptions
The Maternity Benefit Act, 1961
Introduction, Objectives, Scope and Important Definitions, Provisions Related to Maternity, Benefits, Enforcement of the Act, Penalties and Offences, Miscellaneous Provisions of the Act
The Employees' Provident Funds and Miscellaneous Provisions Act, 1952
Introduction, Objectives, Scope and Important Definitions, Administration of the Schemes under the Act, Administration of the Act, Calculation of Money Due from Employers, Their Recovery and Employees', Provident Funds Appellate Tribunal, Enforcement of the Act, Penalties and Offences, Miscellaneous Provisions of the Act
The Payment of Gratuity Act, 1972
Introduction, Objectives, Scope and Important Definitions, Payment and Forfeiture of Gratuity and Exemption, Compulsory Insurance and Protection of Gratuity, Determination and Recovery of Gratuity, Enforcement of the Act, Penalties and Offences.

Module -4 Wages Act	9 hours

The Payment of Wages Act, 1936
Introduction, Objectives, Scope and Important Definitions, Provisions for Payment of Wages, Deductions from Wages, Enforcement of the Act, Penalties and Offences, Miscellaneous, Provisions of the Act
The Minimum Wages Act, 1948
Introduction, Objectives, Scope and Important Definitions, Fixation and Revision of Wages, Payment of

Minimum Wages, Enforcement of the Act, Penalties and Offences, Miscellaneous, Provisions of the Act

The Payment of Bonus Act, 1965

Introduction, Objectives, Scope and Important Definitions of the Act, Eligibility, Disqualification and Amount of Bonus, Calculation of Bonus, Special and Miscellaneous Provisions, Dispute, Penalties and Offences

Module -5 Regulating Employer-Employee Relations Act	9 hours

The Industrial Disputes Act, 1947

Introduction, Objectives, Scope and Important Definitions, Procedure for Settlement of Industrial Disputes and Authorities under the Act, (Chapter II), Notice of Change in Conditions of Service (Chapter II-A), References of Disputes to Boards, Courts or Tribunals and Voluntary References

(Chapter III) Award and Settlements, Strikes and Lockouts (Chapter V), Layoff and Retrenchment (Chapters V-A and V-B), Transfer and Closing Down of Undertakings, Special Provisions Related to Layoff, Retrenchment and Closure (Chapter V-B), Unfair Labour Practices (Chapter V-C), Miscellaneous Provisions of the Act (Chapter VII)

The Industrial Employment (Standing Orders) Act, 1946

Introduction, Objectives, Scope and Important Definitions of the Act, Procedure for Certification of Standing Orders, Other Provisions Relating to Standing Orders, Miscellaneous Provisions of the Act, Penalties and Offences

The Trade Unions Act, 1926

Introduction, Objectives, Scope and Important Definitions, Registration and Cancellation of Registration of Trade Unions, Rights and Duties of Registered Trade Unions, Amalgamation and Dissolution of Trade Union, Penalties

Module – 6 Contract Labour (Regulation and Abolition) Act, 1970	7 hours

Contract Labour (Regulation and Abolition) Act, 1970

Introduction, Objectives, Scope and Important Definitions, Registration of Establishments Employing Contract Labour, The Advisory Boards, Prohibition of Employment of Contract Labour, Appointment of Licensing Officer and Licensing of Contractors, Welfare and Health of Contract Labour, Offences by Companies

The Employment Exchanges (Compulsory Notification of Vacancies) Act, 1959

Introduction, Objectives, Scope and Important Definitions, Notification of Vacancies, Penalties Miscellaneous Provisions, The Employment Exchanges (Compulsory Notification of Vacancies)

Amendment Bill, 2013

Course outcomes:

At the end of the course the student will be able to:
1. Gain practical experience related to labour legislations in India across various sectors.
2. Acquire conceptual knowledge of Industrial relations and labour laws followed within industries.
3. Develop the greater understanding of IR concepts and its application in solving various issues in IR.
4. Apply the IR and labour laws concepts in various industries in India.

Practical Component:
- Visit Any Organisation and discuss the applicability of Laws at the workplace
- Meet HR Manager and discuss the statutory and non-statutory measure
- Visit Labour Dept, Government, and Interact with Labour Commissioner

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X		X		X
CO4	X		X		

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Texbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Industrial Relations and Labour Laws for Managers	Parul Gupta	Sage Publication India Pvt. Ltd	2019
2	The SAGE Handbook of Industrial Relations	Paul Blyton, Edmund Heery, Nicolas Bacon, Jack Fiorito	SAGE Publications	2008
3	Labour and Industrial Laws	P. K. PADHI	Prentice Hall India Pvt., Limited	2017

Reference Books

1	Bare Acts, Ministry of Labour	GOI	GOI	2019
2	The Idea of Labour Law	Guy Davidov, Brian Langille	The Oxford University Press	2011
3	Labour and Industrial Laws	PADHI, P. K	PHI Learning Pvt. Ltd	2019

COMPENSATION MANAGEMENT AND REWARD SYSTEM			
Course Code	20MBAHR306	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives

1. The student will be able to describe and Identify the application of Compensation Management in the Organisation
2. The student will be able to describe and explain in her/his own words, the relevance and importance of Compensation Management in the Organisation
3. The student will be able to apply and solve the workplace problems through application of Compensation Management
4. The student will be able to classify and categories different models and approaches of Compensation Management adopted in the Organisation
5. The student will be able to formulate and prepare Compensation Management to be adopted in the Organisation
6. The student will be able to design and develop an original framework and model in dealing with compensation problems in the organisation.

Module-1 Compensation	7 hours

Compensation, Meaning of compensation, Total Compensation/Reward and Its Components and Types, Importance of the Total Compensation Approach, Wages/Salaries, Some Other Terms, Theories of Wages, Does Compensation Motivate Behaviour?, Compensation Philosophy, Compensation Strategy, Compensation Policy, Base of Compensation Management, The Psychological Contract, Compensation and Legal Issues in Compensation Management, Factors Affecting Employee Compensation/Wage Rates/Wage Structure/Levels of Pay.

Module -2 Compensation Management	7 hours

Meaning of Compensation Management, Methods of Wage Payment, Essentials of a Satisfactory Wage System, National Wage Policy in India, Wage Policy at the Organisational Level, Wage Problems in India, Components/Functions of Compensation Management/W&S Admin, Divergent Systems and Institutions for Wage Fixation in India.

Module -3 Wage Determination Practices in India	9 hours

Divergent Systems for Wage Determination in Practice in Indian Organisations
Introduction, Management's Strategy, Reward Policy, Reward Management Processes, Reward Management Procedures, Pay Reviews, Planning and Implementing Pay Reviews, Procedures for Grading Jobs and Pay, Rates Fixation, Controlling Payroll Costs, Evaluation of Reward Processes, Some Other Trends, Boardroom Pay; Divergent Systems and Institutions for Wage Fixation in Practice in India, Management Strategy; Fringe Benefits, Fringe Benefits and Current Practices, Internal Audit of Compensation and Benefits; Different types of Direct and Indirect compensation include: Base Pay / Base pay; Commissions; Overtime Pay; Bonuses, Profit Sharing, Merit Pay; Stock Options; Travel/Meal/Housing Allowance; Benefits including: dental, insurance, medical, vacation, leaves, retirement, taxes; Merit pay; Incentive Pay; Deferred Pay ; Pay for time; Recreational facilities.

Module -4 Contingent Pay, Pay for Performance, Competence	9 hours

Competency-Based Pay, Skill-Based Pay, Team-Based Rewards, Gainsharing, Profit-Sharing Profit-Related Pay and Beyond Other Cash Payments and Allowances Overtime Payments Attendance Bonuses, Shift Pay, Clothing Allowances, Honoraria, Payments for Qualifications, Pay for Person, Pay for Excellence, Managerial Compensation and Rewards, Sales Force Incentive Programmes, Competency based Pay- Framework, Model and Challenges; Pay for Performance : Steps involved in the design for pay for performance - Intent ; Eligibility; Participation; Performance and Goal Criteria-Measurements ; Funding; Pay Outs and Timing; Benefits Impact & Administration; Evaluation.

Module -5 Administration & Controlling Salary Costs and Salary Review	9 hours

Salary Survey data, Salary Costs, Salary Planning, Salary Budget, Salary Control, Salary Reviews, Guidelines for Salary Review Process, Responding to Negative Salary Review, Five Key Steps: Manager's Guide to Annual Salary Review, Fixing of Salary, Method of Paying Salary, Flexibility, Process of Wage and Salary Fixation.

Module - 6 Operating, Non-financial Benefits(Intrinsic and Relational Rewards)	9 hours

on, Role of Non-financial Benefits/Rewards on Employee Motivation, Types of Non-financial Benefits/Rewards, Planning the Non-financial Benefits/Rewards, A Few Most Effective Non-financial Benefits/Rewards to Motivate Employees, Heineken's Refreshing Approach to Reward, Non-financial Metrics Intellectual Capital Assessment and Market Implications of Human Capital, Recognition, Praise, Learning and Development, Achievement, Value Addition in Personality Others.

Course outcomes:
At the end of the course the student will be able to:
1. Gain insights of various conceptual aspects of Compensation and Benefits to achieve organizational goals.
2. Determine the performance based compensation system for business excellence and solve various cases.
3. Designing the compensation strategies for attraction, motivation and retaining high quality workforce.
4. Understand the Legal & Administrative Issues in global compensation to prepare compensation plan, CTC, wage survey and calculate various bonus.

Practical Component:
- To understand the theoretical and practical aspects in the area of compensation and benefits.
- Exposure to MS-Excel or HRIS packages recommended.
- Acquire knowledge of compensation and reward system policies, processes and procedure.
- Apply the concepts of compensation administration and intrinsic and extrinsic reward system in national and global perspective.
- Analyse the divergent system and wage determination practices followed in various sectors.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				X
CO2	X	X	X		
CO3	X	X			
CO4	X			X	X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Compensation Management	R. C. Sharma, Sulabh Sharma	Sage Publication India Pvt. Ltd	2019
2	Compensation and Benefit Design	Biswas, Bashker, D	Pearson	2013
3	Managing Employees Performance and Rewards	Shields	Cambridge Press	2007

	Reference Books			
1	Human Resource Information Systems: Basics, Applications, and Future Directions	Michael J. Kavanagh, Mohan Thite, Richard D. Johnson	Sage Publication India Pvt. Ltd	3/e, 2015
2	Competency-Based Human Resource Management	Anindya Basu Roy, Sumati Raym	Sage Publication India Pvt. Ltd	2019
3	Compensation and Reward Management	Singh, B D	Excel Books	2007

GUIDELINES FOR INTERNSHIP 20MBA IN 307
(BETWEEN 2ND AND 3RD SEMESTER MBA)

INTERNSHIP			
Course Code	20MBA IN 307	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:0:8	SEE Marks	60
Credits	04	Exam Hours	00

OBJECTIVE
To expose the students to understand the working culture of the organization and apply theoretical concepts in real life situation at the work place for various functions of the organization.
STRUCTURE
The Internship shall consist of study of an organization for 4 credits for 4 weeks.
GENERAL GUIDELINES
- The Internship shall be for a period of 4 weeks immediately after the completion of 2nd Semester Examinations but before the commencement of the 3rd semester classes
- The Course code of the Internship shall be 20MBA IN 307 and shall be compulsory for all the students.
- No two students of an institute shall work on the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance. Student need to identify an external guide (Working in the organization) and seek guidance from him/her.

Submission of Report: Students shall submit one hard copy of the report to the college with hard bound color of royal blue and a soft copy in PDF file (Un-editable Format)
Evaluation:
Internal evaluation will be done by the internal guide.
Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective institution where a student is expected to give a presentation of his/ her work. The viva –voce examination will be conducted by the respective HOD or Senior Professor or Internal Guide of the department and an external evaluator drawn from industry. In case of non availability of industry professional, a senior professor or a faculty with more than 10 years of experience may be invited to conduct the viva-voce examination. Internship carries 100 marks consisting of 40 marks for Internship report (evaluated by internal guide) and 60 marks for viva-voce examination.
Contents of the Internship Report
- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution (scanned copy) indicating bonafide performance of Internship by the student.
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs

Executive summary
Chapter 1: Introduction about the Organisation & Industry.
Chapter 2: Organization Profile
  i. Back ground,
  ii. Nature of business,
  iii. Vision mission, quality policy
  iv. Workflow model
  v. Product/service profile
  vi. Ownership pattern
  vii. Achievements/awards if any
  viii. Future growth and prospects
Chapter 3: Mckensy's 7S framework and Porter's Five Force Model with special reference to Organization under study.
Chapter 4: SWOT Analysis
Chapter 5: Analysis of financial statements

Chapter 6: Learning experience.
Bibliography
Annexure relevant to the Internship such as figures, graphs, photographs, Financial statements etc.,
Format of the Internship: Report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1" margin all sides (1.5" on left side due to binding) and 1.5line spacing. The Internship report shall not exceed 60 pages.

Rubrics for Internship 20MBAIN 307 Marks

SL. No		Particulars	Marks
1	CIE	Assessment by the Guide- Interaction with the student	20
2	CIE	Report Evaluation by the Guide	20
3	SEE	Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/Institute	60
		Total	100

Mark sheet for Viva voce Examination (SEE)
Visvesvaraya Technological University
Name of the Institution
Name of the Department

Course Code and Course Title: 20MBA IN 307 Internship

SL. No	Aspects	Marks
1	Introduction	5
2	Understanding the Industry	5
3	Understanding the Corporate Functions/Company profile	10
4	Mckensy's 7S framework and Porter's Five Force Model	10
5	SWOT/SWOC analysis justification	10
6	Financial statement analysis	10
7	Learning experience	10
	Total	**60**

Marks Sheet for Viva Voce examination

SL No	USN	1	2	3	4	5	6	7	Total
1									
2									
3									
4									
5									
	Total								

Signature of Internal Examiner   **Signature of External Examiner**
Name and Designation with affiliation   **Name and Designation with affiliation**

IV SEMESTER
MARKETING SPECIALISATION COURSES

B2B MARKETING MANAGEMENT			
Course Code	20MBAMM401	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives
1. Make students have an understanding of B2B Marketing and its characteristics
2. To analyze the purchasing decisions of online customers
3. Analysing traditional marketing approach vis-a vis modern marketing approach using the B2B strategy
4. To enhance knowledge of emerging trends in integrated marketing communications.
5. Managing innovation in the B2B context and understand concept of Relationship portfolio and Key Account Management.

Module-1 B2B Marketing	7 hours

B2B-Introduction, significance and concept of B2B Marketing. Business Markets, characteristics. Classification of Business Products and Markets.

Module -2 Purchasing Behaviour	7 hours

Factors affecting purchasing decisions, purchasing orientation, Segmenting purchase categories. Purchase Process- variations. Buying situations and marketer actions. Online buying.
Traditional marketing approach- uncertainties of buyer and supplier/ marketer. Supplier uncertainties. Relationship variables. Impact of IT. Inter-firm Relationships and Networks. **Case Study**

Module -3 B2B strategy and Market Segmentation	7 hours

Process, approach. Responsible strategy-CSR and sustainability, Customer value and strategy. Researching B2B markets. Standard industrial classification.
B2B Market Segmentation- Significance of segmentation. Basis of segmentation. Challenges of segmentation in B2B markets. B2B positioning**. Case Study.**

Module -4 Market Communication	7 hours

Brand expression, Communication mix and customer acquisition process. Relationship Communication, sales responsibilities. The relationship communication process, call preparation, selling to low-priority and high-priority customers. Value selling and consequences- order fulfilment-relationship building.**Case Study.**

Module -5 Relationship Portfolio & Key Account Management	7 hours

Principles of Portfolio management, identifying key accounts, Classification criteria. Relationship life-cycle, declassification, managing loyalty. **Case Study**.
Assignment: Implementing KAM

Module – 6 B2B product Offerings and Price Setting	5 hours

Elements of B2B offering, strategic tools for managing product offerings, managing innovation in the B2B context.
Price setting in B2B markets- 3 C's of pricing-cost, customer and competition-Pricing- strategy, price positioning, role of sales force in pricing, bid pricing, internet auctions, ethical aspects of B2B pricing.
Case Study

Course outcomes:
At the end of the course the student will be able to:
1. Understand significance of B2B marketing .
2. Ability to create an integrated marketing communications plan which includes promotional strategies.
3. Effectively use marketing communication for customer acquisition
4. Define and apply knowledge of various aspects of managerial decision making related to marketing communications strategy and tactics.

Practical Component:
- Interview a salesperson and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why chose sales career, and what does it take to succeed in this profession.
- Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products into low risk and high risk ones. Does this buying behaviour also depend on the personality of the individual doing the buying? Or the one doing the selling?
- Students can make a presentation on any product or the services of student choice, covering selling strategies

and one day work exposure towards merchandising in any big retail outlets of respective places where the institute if operating.

- Rural colleges can send the students to the city nearby to observe the merchandising planning in retail outlets and to make a small report.
- Roles and functions of sales manager and sales people are different in every organization Sales people view the roles of sales managers in their own way and vice versa. You are the sales manager of a company. You make an analysis of what you feel should be roles of a sales manager and a salesperson for maximizing sales of the organization.
- Your company is active in internet trading. A current issue in internet trading is : how to make internet selling safe. Different methods have been suggested for safety or security of internet trading. You have to analyze different methods and recommend a method for your company.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X	X	X		
CO3	X	X	X		X
CO4	X		X	X	X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Business to Business Marketing	Ross Brennan, Louise Canning & Raymond McDowell	Sage Publications	3e -2014
2	B2B Marketing Strategy: Differentiate, Develop and Deliver Lasting Customer Engagement	Heidi Taylor	Kogan Page	1/e, 2017

Reference Books

| 1 | Innovative B2B Marketing: New Models, Processes and Theory | Simon Hall | Kogan Page | 1/e, 2017 |
| 2 | Product and Brand Management | Michael Baker and Stuart Hart | Pearson | 4/e, 2014 |

LOGISTICS AND SUPPLY CHAIN MANAGEMENT			
Course Code	20MBAMM402	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives
1. To understand the basic concepts, processes and key elements of a supply chain.
2. To understand the elements and scope of logistics in supply chain management
3. To provide insights for establishing efficient, effective, and sustainable supply chains.
4. To comprehend the role of warehouse management
5. To gain knowledge about Inventory Management
6. To provide insights into International Logistics
7. To explain the role of technology in supply chain planning, visibility, and execution.

Module-1 Supply Chain	7 hours

Concept, significance and key challenges. Scope of SCM- historical perspective, essential features, decision phases – process view, supply chain framework, key issues in SCM and benefits.
Definition and scope of Logistics. Elements of Logistics, types, incremental value delivery through Logistics management. Innovations in Supply Chain. Estimating customer demand, forecasting in Supply Chain.
Case Study.

Module -2 Warehouse Management System	7 hours

Warehousing – scope, primary functions. Efficient Warehouse Management. Types of Warehouse. Warehouse Layout Design, criteria. Warehouse Management System,
Distribution Management, Designing the distribution network, role of distribution, factors influencing distribution, design options, distribution networks in practice, network design in the supply chain, factors affecting the network design decisions. HUB & SPOKE vs Distributed Warehouses. **Case Study**

Module -3 Inventory Management	7 hours

Concept, various costs associated with inventory, EOQ, buffer stock, lead time reduction, reorder point / re-order level fixation, ABC analysis, SDE/VED Analysis. Goals, need, impact of inventory management on business performance. Types of Inventory, Alternative approach for classification of inventories, components of inventory decisions, inventory cost management, business response to stock out, replenishment of inventory, material requirements planning.
Dealing with demand uncertainty in Supply Chain- managing uncertainty in Supply Chain, (Bullwhip Effect) ,Impact of uncertainties. **Case Study**

Module -4 Transportation	5 hours

Role, functions, mode of transportation and criteria of decision. Transportation Infrastructure. Factors impacting road transport cost, hazards in transportation, State of Ocean Transport, global alliances.
Packaging Issues in Transportation, role of containerisation. **Case Study**

Module -5 Logistics Management	7 hours

Logistics of part of SCM, logistics costs, logistics, sub-systems, inbound and out bound logistics bullwhip effects in logistics, distribution and warehousing management. Demand Management and Customer Service: Demand Management, CPFRP, customer service, expected cost of stock outs.
Recent Issues in SCM: Role of computer/ IT in supply chain management, CRM Vs SCM, Benchmarking concept, features and implementation, outsourcing – basic concepts, value addition in SCM.
Case Study

Module - 6 International Logistics	7 hours

Logistics and Environment, Methods and tools facilitating International Logistics, challenges, Integrated Supply Chain and Logistics Value Chain, Supply Chain Security Initiatives in the USA, Logistics Industry in India.
Sourcing Decisions in Global SCM- Logistics, trends, Key issues in Global sourcing, Factors influencing Outsourcing. Performance Management in Supply Chain introduction. **Case Study**

Course outcomes:
The student should be able to:
1. Demonstrate knowledge of the functions of logistics and supply chain management.
2. To relate concepts and activities of the supply chain to actual organizations.
3. Highlight the role of technology in logistics and supply chain management.
4. Evaluate cases for effective supply chain management and its implementation.

Practical Components:
• Students are expected to choose any four Indian Organizations and study their supply chain in terms of drivers of the Supply chain and submit a report.
• Students should visit different logistics companies and understand the services provided by them and submit a report.
• Students should identify any product/service and study the type of distribution system used and understand the reason for using that particular type and present it in the class.
• Students should identify the various types of IT applications employed by Indian Organizations in their Supply chain

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X		X	X	
CO3	X				X
CO4	X			X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
• The question paper will have 8 full questions carrying equal marks.
• Each full question is for 20 marks.
• Each full question will have sub question covering all the topics under a Module.
• The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
• 100 percent theory in SEE

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	A Logistic approach to Supply Chain Management	Coyle, Bardi, Longley	Cengage Learning	Latest edition
2	Integrated Supply Chain and Logistics Management	Rajat K. Baisya	Sage	2020
3	Supply Chain Management- Text and Cases	Janat Shah	Pearson	Latest edition
4	Supply Chain Management- Strategy, Planning and Operation	Sunil Chopra, Peter Meindl, D.V.Kalra	Pearson	Latest edition
5	Marketing Channels	Anne Coughlan, Anderson, Stern and El-Ansary		

Reference Books

1	The Box	Marc Levinson		
2	Essentials of Supply Chain Management	Michaael H Hugos		
3	Logistics and Supply Chain	Martin Christopher	FT Publishing	5th Editon
4	Supply chain Logistics Management	Donald J Bowersox,	Mc Graw Hill	4th Edition

DIGITAL MARKETING MANAGEMENT			
Course Code	20MBAMM403	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives
1. To understand the important concepts related to e-marketing
2. To learn the use of different electronic media for designing marketing activities.
3. To acquaint the students with the latest techniques of e-marketing.

Module-1 Introduction to Digital Marketing	**7 hours**

Concept of Digital Marketing, Origin, traditional versus Digital Marketing. Digital Marketing Strategy- The P-O-E-M Framework, Segmenting and customising Messages, Digital Landscape. Digital advertising Market in India. Skills required in Digital Marketing, Digital Marketing Plan

Module -2 Display Advertising	**7 hours**

Concept of Display Advertising, types of display ads, buying models, display plan
Targeting- contextual targeting placement targeting, remarketing, interest categories, geographc and language tagging, demographics, mobile, other targeting methods. Programmatic digital advertising, You Tube Advertising.

Module -3 Search Engine Advertising	**7 hours**

Understanding Ad Placement, Understanding Ad Ranks, Creating First Ad Campaign, Performance Reports.
Social Media Marketing: Building a successful Strategy
Live Project: Create a digital marketing plan

Module -4 Social Media Marketing	**7 hours**

Face Book Marketing: Facebook for business & facebook insights
LinkedIn Marketing: LinkedIn Strategy, LinkedIn Analytics
Twitter Marketing: Building Content Strategy, twitter usage , Twitter Analytics
Instagram & Snanpchat: Objectives of Instagram, Hashtags. What is Snanpchat. Digital Public Relations

Module -5 Mobile Marketing	**7 hours**

Mobile Usage, Mobile Advertising- Mobile Advertising Models, advantages of Mobile advertising, Mobile Marketing Toolkit, Mobile Marketing features- Location based services, Social marketing on mobile, QR Codes, Augmented Reality, Gamification.**Tracking mobile campaigns-** Mobile Analytics.
Live Project: Create a mobile advertising project..

Module – 6 Search Engine Optimization	**5 hours**

Search Engine Optimization: How search engines work, concept of search engine optimisation (SEO), On Page Optimisation, Off Page Optimisation, Social media Reach, Maintenance- SEO tactics, Google Search Engine, Web Analytics- Key Metrics- concepts only

Course outcomes:
At the end of the course the student will be able to:
1. Recognize appropriate e-marketing objectives.
2. Appreciate the e-commerce framework and technology.
3. Illustrate the use of search engine marketing, online advertising and marketing strategies.
4. Develop social media strategy's to solve business problems.

Practical Components:
- Students will learn to create a digital marketing plan.
- Students will learn to create a mobile advertising project.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X	X			
CO3	X		X	X	
CO4	X		X		X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Digital Marketing	Seema Gupta	McGraw Hill Education	2017
2	Markeing 4.0: Moving from Traditinal to Digital	Philip Kotler, Hermawan Kartajaya, Iwan Setiawan	Wiley	2017
3	Fundamentals of Digital Marketing	Puneet Bhatia	Pearson	2/e, 2014
4	Social Media Marketing	Tracy L Tuten, Michael R Solomon	Sage Publications	3/e, 2020

Reference Books

1	Digital Marketing	Swaminathan T N, Karthik Kumar	Cengage Learning India Pvt. Ltd	2019
2	Digital Marketing	Hanlon	Sage Publications	2/e, 2017
3	Digital Marketing	Ian Dodson	Wiley	2016

STRATEGIC BRAND MANAGEMENT			
Course Code	20MBAMM404	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives
1. To appreciate the relationship between corporate strategy and Brand Management.
2. To explore the various issues related to Brand Management, brand association, brand identity, brand architecture, leveraging brand assets, brand portfolio management.
3. To develop familiarity and competence with the strategies and tactics involved in building, leveraging and defending strong brands in different sectors.

Module-1 Brand Management	7 hours

Concept, Meaning of Brand, Evolution of Brands, Functions of Brand to consumer, Role of Brand-Advantages of Brand, Product Vs Brand. **Branding-** Meaning, Creation of Brands through goods, services, people, Organisation, Retail stores, places, online, entertainment, ideas, challenges to Brand builders.
Brand Management-Meaning & Definition. Strategic Brand Management Process-Meaning, Steps in Brand Management Process Strong Indian Brands.

Module -2 Customer Based Brand Equity(CBBE)	5 hours

Meaning, Model of CBBE, Brand Equity: Meaning, Sources, Steps in Building Brands, Brand building blocks Resonance, Judgments, Feelings, performance, imagery, salience-Brand Building Implications, David Aaker's Brand Equity Mo del. Brand Identity & Positioning: Meaning of Brand identity, Need for Identity & Positioning, Dimensions of brand identity, Brand identity prism, Brand positioning – Meaning, Point of parity & Point of difference, positioning guidelines Brand Value: Definition, Core Brand values, Brand mantras, Internal branding,

Module -3 Choosing Brand Elements to Build Brand Equity	7 hours

Criteria for choosing brand elements, options & tactics for brand elements-Brand name, Naming guidelines, Naming procedure, Awareness, Brand Associations, Logos & Symbols & their benefits, Characters & Benefits, Slogans & Benefits, Packaging. Leveraging Brand Knowledge: Meaning of Brand Knowledge,
Dimensions of Brand Knowledge, Meaning of Leveraging Secondary Brand Knowledge & Conceptualizing the leverage process.

Module -4 Brand Value chain	7 hours

Designing Brand Tracking studies, Establishing brand Equity Management Systems. 58 Methods for measuring Brand Equity-Quantitative Techniques & Quantitative Techniques, Comparative methods-Brand based comparisons, marketing based comparisons Conjoint Analysis, Holistic methods. Managing Brand Equity: Brand Reinforcement, Brand Revitalization, Brand Crisis

Module -5 Designing and sustaining branding strategies	7 hours

Brand hierarchy, Branding strategy, Brand extension and brand transfer, Managing Brands overtime. Brand Architecture and brand consolidation. Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation Vs Later market entry, First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies.
Assignment: Measuring Brand Strength

Module – 6 Making Brands go Global	7 hours

Making Brands go Global: Geographic extension, sources of opportunities for global brand, single name to global brand, consumers & globalization, conditions favouring marketing, barriers to globalization, managerial blockages, organization for a global brand, pathways to globalization. Luxury Brand Management: Luxury definition and relativity, luxury goods and luxury brands, basic psychological phenomena associated with luxury purchase, luxury marketing mix, luxury retail, International luxury markets: historical leaders and emerging countries.

Course outcomes:
At the end of the course the student will be able to:
1. Comprehend & correlate all the management functions which are happening around with fundamental concepts and principles of management.
2. Understand the overview of management, theory of management and practical applications of the same.
3. Effectively use their skills for self-grooming, working in groups and to achieve organizational goals .

4.Demonstrate their acumen in applying managerial and behavioral concept in real
world/situation.
5.Understand and demonstrate their exposure on recent trends in management

Practical Component:
- Go to a supermarket and find the brand elements in various brands of soaps, mobiles, jeans, and other product.
- If you would start an MBA College, what would the positioning be with POP's and POD's?
- Pick up your college, analyse its positioning and how would you reposition it?
- Pick a multiproduct company and as completely as possible analyze its brand portfolio and brand extensions?
- Consider some groups like Tata's , Birla's, Infosys etc – what is their branding strategy.
- Students are supposed to assess the product life cycle and appraise alternative approaches to luxury brand management.
- Students can select any two popular brands and identify and examine the criteria for success in the luxury brand industry.

CO-PO MAPPING

CO	PO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	X				
CO2	X				
CO3	X		X		X
CO4	X		X		X
CO5	X		X	X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Strategic Brand Management, Building Measuring & Managing	Kevin Lane Keller	Pearson Education	Latest Edition
2	Brand Management -The Indian Context	Y L R Moorthi	Vikas Publication	Latest Edition
3	Strategic Brand Management	Jean, Noel, Kapferer	Kogan Page India	Latest Edition

4	M B Parameswaran	Brand Building and Advertising Concepts and Cases	Tata McGraw Hill Publication	Latest Edition
Reference Books				
1	Compendium Brand Management	Chunnawalla	HPH,	Latest Edition
2	Strategic Brand Management	Richard Elliott & Larry Perclu	Oxford Press	Latest Edition
3	Creating powerful brands	Chernatony	Elsevier	Latest Edition
4	Brand Management for B2B	Shard Sharin	Sage Publications	1/e, 2015

AGRI BUSINESS MARKETING			
Course Code	20MBAMM405	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives
1. To provide a conceptual understanding on the Rural Marketing with special reference to Indian context.
2. To create awareness about the applicability of the concepts, techniques and processes of marketing in rural context.
3. To familiarize with the special problems related to sales in rural markets.

Module-1 Introduction to Indian Rural Marketing	**7 hours**

Scope of rural marketing, concepts, classification of rural markets, rural vs. urban markets. Rural marketing environment: Population, occupation pattern, income generation, location of rural population, expenditure pattern, literacy level, land distribution, land use pattern, irrigation, development programs, infrastructure facilities, rural credit institutions, rural retail outlets, print media in rural areas, rural areas requirement, rural demand and rural market index, problems in rural marketing.

Module -2 Rural Consumer behaviour	**7 hours**

Consumer buying behaviour models, Factors affecting Consumer Behaviour, Social factors, Technological Factors, Economic Factors, Political Factors, Characteristics of Rural consumer-Age and Stages of the Life cycle, Occupation and Income, Economic circumstances, Lifestyle, Personality and Brand Belief, Information Search and pre-purchase Evaluation, Rise of Consumerism, Consumer Buying Process, Opinion Leadership Process, Diffusion of Innovation, Brand Loyalty. 60 Researching Rural Market: Sensitizing rural market, Research design-reference frame, Research approach, Diffusion of innovation, Development studies, PRA approach, The need for PRA, Sampling, Operational aspects of data collection.

Module -3 Rural Marketing of FMCG's	**7 hours**

Rural Marketing of FMCG's: Indian FMCG industry, characteristics of Indian FMCG sector, Challenges in the FMCG industry, Rural Marketing of FMCG's: Select case studies Rural Marketing of Consumer durables: Issues related to consumer durables in the rural market, Rural Marketing of Consumer durables: Select case studies Rural marketing of financial services: Marketing objectives and approaches, Evolution of rural banking after independence, Challenges in marketing for banking services in rural, opportunities for banking in rural areas, marketing strategies for banking services.

Module -4 Marketing of agricultural inputs	**5 hours**

Indian tractor industry: A brief overview, Challenges for Indian tractor industry, factors suggesting better future prospects for tractor industry, marketing strategies for tractor industry Fertilizer industry in India: Marketing of fertilizer industry, classification of fertilizer industry, Challenges for marketing of fertilizer industry, marketing strategies for fertilizer industry.

Module -5 Marketing of agricultural products	**7 hours**

Profiling of Indian agricultural produces marketing, challenges in marketing of agricultural produce, Strategies to promote marketing of agricultural produce. Corporate sector in agri-business: Reasons for increased interest of corporate sector in agribusiness, opportunities in the agri-business, benefits of corporate driven agri-business system involvement of corporate sector in agri-business.

Module - 6 Distribution and Communication Strategy	**7 hours**

Distribution Strategy: Introduction Accessing Rural Markets, Coverage Status in Rural Markets, Channels of Distribution, Evolution of Rural Distribution Systems- Wholesaling, Rural Retail System, Vans, Rural Mobile Traders: The last Mile Distribution, Haats/Shandies, Public Distribution System, Co-operative Societies Behaviour of the Channel, Prevalent Rural Distribution Models- Distribution Models of FMCG Companies, Distribution Model of Durable Companies, Distribution of fake products, Emerging Distribution Models- Corporate –SHG Linkage, Satellite Distribution, Syndicated Distribution, ITC's Distribution Model, Petrol pumps and Extension counters.

Communication strategy: Challenges in Rural Communication, A view of Communication Process, Developing Effective- Profiling the Target Audience, Determining communication objectives, designing the message, selecting the communication channels, deciding the promotion mix, Creating advertisement for rural audiences

rural media- Mass media, Non-Conventional Media, Personalized media, Rural Media: The importance of the two-step flow of communication Media Typology, The Media Model, Media innovation, Influence of Consumer Behaviour on Communication strategies.

Live Project: Visit a Rural santhe in village setting (Producer market) and submit a report

Course outcomes:
At the end of the course the student will be able to:
1. Highlight the characteristics of Indian rural markets and describe the differences between rural and the urban economy.
2. Analyze the roadblocks of Indian rural market and advocate solutions for the problems of rural markets.
3. Emphasize the different strategies adopted by Indian companies for rural markets.
4. Apply the strategies to be adopted for influencing the rural consumers.

Practical Components:
- Visit to the various Micro Finance Institutes, who extend their services in catering rural market.
- Visit to a village and understand the market structure and also understand the functioning part of the rural markets.
- Students should come up with new product designing with the rural marketing mix 4 As (Awareness, Acceptability, Adaptability and Affordability).
- Students can do a survey on corporate farming and its effect on income of the rural farmer.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X	X			
CO2	X			X	
CO3	X		X		X
CO4	X		X		X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Rural Marketing	Pradeep Kashyap& Siddhartha Raut	Biztantra.	2108
2	Rural marketing: Challenges and OpportModuleies	Dinesh Kumar & Punam Gupta	SAGE	2017
3	Rural Marketing	Gopal Swamy T. P	Vikas Publishing	2108

Reference Books

1	Rural Marketing	Dogra &KarminderGhuman	TMH	2018
2	Rural Marketing	Sanal Kumar Velayudhan	Response Publication	2014
3	Agricultural Marketing In India	Acharya	Oxford I B H.	2015

INTERNATIONAL MARKETING MANAGEMENT			
Course Code	20MBAMM406	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives

1. To introduce students to the international marketing management process, design and theories
2. To develop skills relating to international trade.
3. To familiarize the steps involved in import export documentation.

Module -1 Introduction to International Marketing	5 hours

Scope, Challenges, Reasons and Motivations, Concepts to the management of international marketing function, differences between international marketing and domestic marketing – transition from domestic to international markets - World Trade and India's foreign trade: an overview.

Module -2 International Trade Theories and Market research	5 hours

International Trade Theories- Absolute cost-comparative Cost- H-O Theorem- New Trade Theories- Porter's Diamond Theory- Managerial Implications. Developing a global vision through market research : Breadth and scope of international marketing research , problems in availability and use of secondary data, problems in gathering primary data , multi cultural research – a special problem , research on internet – a new opportunity , estimating market demand, responsibility for conducting marketing research, communicating with decision makers. Identifying foreign markets – classification based on demand , based on the stage of development ,other basis for division of world markets.

Module -3 Planning and organization	7 hours

Planning and organization: Global perspective – global gateways – global marketing management – an old debate and a new view – planning for global markets – alternative market entry strategies – organizing for global competition. Global marketing environment – cultural Environment Political and Legal Environment, Economic Environment- Modes of entry in to foreign business.

Module -4 International Product Policy for Consumers	9 hours

: Quality – green marketing and product development, products and culture – analyzing product components for adaptation – products for consumers in global markets, product development, product adaptation, product standardization, Cross country segmentation, Product life cycle in International Marketing, International Packaging.
Product and services for businesses. Demand in global business to business markets- Quality and global standards – business services – tradeshows crucial part of business to business marketing – relationship markets in business to business context.

Module -5 International Pricing, Promotion and distribution decision	9 hours

Pricing decision: global pricing frame work, pricing basics, marginal cost pricing and its importance. Transfer pricing, counter trade, systems pricing, pricing and positioning price quotation-INCO terms.
Promotion decision: International Advertising, Sales promotion in International, direct mailing, personal selling, exhibition – generic promotion in international marketing.
Global Distribution decision - Introduction, distribution as competitive advantage, rationalizing local channels, global channel design, Channel alternatives – Importance of Channel decision – Factors influencing the Channel decision – Channel Selection decision.
Assignment: Identifying a International luxury product and relate it to either pricing or promotion or distribution

Module – 6 Import –Export procedure and documentation	5 hours

Import policy – procedure and Documentation - balance of trade and payments , Institutional infrastructure for exports promotions in India-India's trade policy- export assistance- exports documentation and procedures including different stages of documentations.
International Retailing.
International expansion of retailers – International retailing defined – retail format – variations in different markets – general merchandise at Retailing – issues in international retailing.

Course outcomes:

At the end of the course the student will be able to:

1. Understand the differences between domestic marketing and international marketing.
2. Understand the concept of international pricing and distribution decision.
3. Acquire the knowledge of import export documentation.

Practical Components:

- Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied in Module 2 and justifying why such structures are chosen by those organizations.
- Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities and behaviors with respects to the trait, behavioural and contingency theories studied.
- Identifying any five job profiles and listing the various types, abilities required for those jobs and also the personality traits/attributes required for the jobs identified.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X		X	X	
CO3	X				X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in SEE.

Recommended Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	International Marketing	Catero, Graham	TataMcGrawHill	Latest Edition
2	International Marketing	Varshney, Bhattacharya	S.Chand	Latest Edition
3	Global marketing management	Warren J.Keegan	Pearson	Latest Edition
4	International Marketing Management: Text and Cases	U C Mathur	SAGE	2008

Reference Books

1	International marketing: analysis and strategy	Sak Onkvisit, Johnshaw	Biztantra	Latest Edition
2	International marketing	Rakesh mohan Joshi	Oxford	Latest Edition
3	International marketing	Michael Czinkota, Illka A. Ronkainen	Cenage Learning	Latest Edition

RISK MANAGEMENT AND INSURANCE

Course Code	20MBAFM401	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives
1. To provide an understanding of different types of risk.
2. To provide an understanding of the risk identification and measurement.
3. To give an overview of role of Life Insurance in risk management.
4. To provide an understanding of general insurance contract.

Module -1 Introduction to Risk Management	**5 hours**

and Risk Identification: Risk-Risk and Uncertainty-Types of Risk-Burden of Risk-Sources of Risk-Methods of handling Risk-Degree of Risk-Management of Risk. Risk Identification-Business Risk Exposures-Individual Exposures-Exposures of Physical Assets -Exposures of Financial Assets -Exposures of Human Assets - Exposures to Legal Liability - Exposure to Work-Related Injury. (Theory).

Module -2 Risk Measurement	**7 hours**

Evaluating the Frequency and Severity of Losses-Risk Control-Risk Financing Techniques-Risk Management Decision Methods-Pooling Arrangements and Diversification of Risk. Advanced Issues in Risk Management: The Changing Scope of Risk Management-Insurance Market Dynamics-Loss Forecasting-Financial Analysis in Risk Management -- Decision Making Other Risk Management Tools. (Theory).

Module -3 Introduction to Insurance	**7 hours**

Risk and Insurance- Definition and Basic Characteristics of Insurance-Requirements of an Insurable Risk-Adverse Selection and Insurance-Insurance vs. Gambling Insurance vs. Hedging Types of Insurance-Essentials of Insurance Contracts. Indian Insurance Industry -Historical Framework of Insurance, Insurance sector Reforms in India. IRDA-Duties and powers of IRDA-IRDA Act 1999. (Theory).

Module -4 Life Insurance	**7 hours**

Basics of Life Insurance-Growth of Actuarial Science-Features of Life Insurance-Life Insurance Contract-Life Insurance Documents-Insurance Premium Calculations. Life Insurance Classification-Classification on the Basis –Duration-Premium Payment Participation in Profit-Number of Persons Assured-Payment of Policy Amount-Money Back Policies-Module Linked Plans. Annuities-Need of Annuity Contracts, Annuity V/s Life Insurance, Classification of Annuities. (Theory).

Module -5 General Insurance	**7 hours**

Laws Related to General Insurance-General Insurance Contract-General Insurance Corporation (GIC). Health Insurance-Individual Medical Expense Insurance – Long Term Care Coverage – Disability Income Insurance – Medi-claim Policy – Group Medi-claim Policy – Personal Accident Policy – Child Welfare Policy-Employee Group Insurance – Features of Group Health Insurance – Group Availability Plan. Fire Insurance-Essentials of Fire Insurance Contracts, Types of Fire Insurance Policies, Fire Insurance Coverage. Marine Insurance-Types of Marine Insurance – Marine Insurance principles Important Clauses in Marine Insurance– Marine Insurance Policies –Marine Risks-Clauses in Marine Policy. Motor Vehicles Insurance-Need for Motor Insurance, Types of Motor Insurance, Factors to be considered for Premium Fixing. (Theory).

Module-6 Management of Insurance Companies	**7 hours**

Functions and Organization of Insurers- Types of Insurance Organization, Organizational Structure of Insurance Companies-Functions of Insurers. Underwriting-Principles of Underwriting, Underwriting in Life Insurance, Underwriting in nonlife Insurance. Claims Management-Claim Settlement in General Insurance-Claim Settlement in Life Insurance. (Theory).

Course outcomes:
At the end of the course the student will be able to:
1. Understand various types of risks.
2. Assess the process of identifying and measuring the risk.
3. Acquaint with the functioning of life Insurance in risk management.
4. Understand general insurance contract.

Practical Component:
- Should visit insurance companies and undertand the types of policies
- Undesatnd how insurance premium are fixed
- Interact with insurance agents and understand the ground reality of insurance investors.
- Undesatnd how different insurance companies settles the accident claims/death claims
- Undesatnd the functioning and organisation structure of insurances companies.
- Compile and analyse General and Life insurance policies offered by Indian insurance companies (one public sector and one private sector)
- Visit policy bazaar portal and study the different types of insurance policies offered by the Indian insurance companies.
- Analyse the Systematic and unsystematic risk of any two companies
- Analyse the types of Risk in different sectors of India due to Covid- 19 Pandemic

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X		X	X	
CO3	X	X			
CO4	X				

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Principles of Risk Management and Insurance	George E Rejda	Pearson	12/e, 2009
2	Insurance and Risk Management	P.K. Gupta	Himalaya	1/e, 2010

Reference Books

1	Principles and Practice of Insurance	P. Periasamy	Himalaya Publishing House	2/e, 2009
2	Introduction to Risk Management and Insurance	Dorfman, Mark S.	Prentice Hall India	10/e, 2008
3	Risk Management and Insurance	Scott E. Harrington, Gregory R Niehaus	TMH	2/e, 2007

FINANCIAL DERIVATIVES			
Course Code	20MBAFM402	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives

1. To understand various concepts and terminologies used in various financial derivatives.
2. To explain and critically evaluate various financial derivatives such as forwards, futures, options, financial swaps, credit derivatives etc.
3. To apply various financial derivatives in hedging risk and analyse it.

Module-1 Financial Derivatives	**5 hours**

Meaning, benefits, types (both exchange traded and OTC traded) and features of financial derivatives-Factors causing growth of derivatives-functions of derivatives market-Derivative market players (Hedgers, speculators and arbitragers)-Derivatives market in India. (Theory).

Module -2 Futures and Forwards	**7 hours**

Futures and Forwards: Meaning, features and types of futures/forwards-Futures vs Forwards-Mechanics of buying and selling futures/forwards-Hedging through futures/forwards-Marking-to-market process-contract specifications of stock, index and commodity futures–valuation of futures/forwards using cost of carry model-Arbitrage process-Interest Rate Futures & options. (Numerical problems on MTM and valuation of futures/forwards). (Theory and Problems).

Module -3 Option Contracts	**7 hours**

Option Contracts: Meaning, features and types of option contracts-Options vs futures/forwards-Mechanics of buying and selling option contracts-contract specifications of stock, index and commodity options-Option pricing-factors affecting option pricing-Valuation of option contracts using Black Scholes model and Binomial model-Put-call parity theory-Option Greeks-Option Trading strategies-Interest rate options-Exotic options. (Numerical problems on all aspects except exotic options). (Theory and Problems).

Module -4 Financial Swaps	**7 hours**

Meaning, features and advantages of financial swaps-Types of financial swaps (Interest rate swap, currency swap, equity swap and commodity swap)-Mechanics of interest rate swaps– Triangular swap (Numerical problems only on interest rate swap including triangular swap)-valuation of interest rate swaps- Only theory. (Theory and Problems).

Module -5 Commodity Derivative Market	**7 hours**

Commodity Derivative Market: Meaning of commodity derivatives-Commodity derivative exchanges (with commodities traded) in India-Trading and settlement system of commodity derivatives-SEBI Guidelines for commodity market-commodities traded. (Theory).

Module -6 Credit Derivatives and VaR	**7 hours**

Credit Derivatives-Total Return Swap (TRS)-Credit Default Swap (CDS)-Types of CDS-Asset Backed Securities (ABS)-Collateralised Debt Obligation (CDO)-Sub-Prime Crisis-2007-Credit Spread Options-Probability of Default- Forward Rate Agreement (FRA)-Interest Rate Caps/Floors/Collars-Types of Interest Rates-Zero Rate-Forward Rate-Value-at-Risk-Meaning, VaR Models-Stress testing and back testing. (Numerical problems only on VaR, Zero Rate and Forward rate). (Theory and Problems).

Course outcomes:

At the end of the course the student will be able to:

- Understand the mechanism of forwards/futures, options, financial swaps, various credit derivatives and VaR with their features, merits and demerits.
- Assess the application of forwards/futures, options, financial swaps, various credit derivatives and VaR using numerical problems.
- Application of financial derivatives in risk management.
- Critically evaluate various financial derivatives.

Practical Component:

- Visit the website of FEDAI and understand the regulations for Commodity Exchanges
- Visit the MCX/NCDEX and understand the their trading and settlement
- Visit the banks and understand the their foreign exchange transactions.
- Undesatnd how different types of qoutations helpful to the participants in Forex

- Undesatnd what is the implication of financial derivatives.
- Compile and analyze few Futures, Forward Option contract documents
- Visit MCX portal and study its trading and settlement process
- Study the different types of option and Future contracts traded on NSE

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X			X	
CO4	X			X	

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Options, Futures & Other Derivatives	John C. Hull	Pearson Education	
2	Financial Derivatives-Text and Cases	Prakash Yaragol	Vikas Publishing House Pvt. Ltd.	1/e, 2019

Reference Books

1	Options & Futures	Vohra & Bagri	TMH	2/e
2	Derivatives-Principles and Practice	Sundaram & Das	McGraw Hill	
3	Derivatives and Risk Management	Rajiv Srivastava	Oxford University	2010

	INDIRECT TAXATION		
Course Code	20MBAFM403	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives:
1. To provide an overview of GST in India
2. To provide an understanding of levy and collection of GST
3. To give an overview of customs duty in India
4. To provide an understanding of valuation for customs duty

Module-1 Introduction to Goods and Services Tax (GST)	**7 hours**

Goods and Services Tax Act & Rules, Need for GST in India, Dual GST Model - Central Goods and Services Tax Act, 2017 (CGST) State Goods and Services Tax Act, 2017 (SGST) Union Territory Goods and Services Tax Act, 2017 (UTGST) Integrated Goods and Services Tax Act, 2017 (IGST) Goods and Services Tax Network (GSTN), GST Council Guiding principle and Functions of the GST Council. (Theory).

Module -2 Levy and Collection of Tax	**7 hours**

Scope of Supply, Composite and Mixed Supplies, Levy and Collection, Composition Levy, Exemptions Person Liable to pay GST, Exemption from tax. (Simple problems on calculation of value of taxable supply and GST Levy). (Theory and Problems).

Module -3 Time and Value of Supply	**7 hours**

Time of Supply, Change in Rate of Tax in respect of Supply of Goods or Services, Place of Supply and Value of Supply. (Simple problems on Time of supply, place of supply and value of supply) (Theory and Problems).

Module -4 Input Tax Credit	**7 hours**

Introduction and Eligibility to avail Input Tax Credit (ITC). Registration under GST: Persons not liable for Registration, Compulsory Registration in Certain Cases, Procedure for Registration, Deemed Registration. Returns under GST: Furnishing of Returns, First Return, Revision of Returns and Penalty/Late Fee. (Theory).

Module -5 Customs Duty	**7 hours**

Concept, Meaning of Customs Duty, Circumstances of Levy of Customs Duties and Types of Duties and Exemption from Customs Duty. Valuation under customs: Valuation of Imported Goods and Valuation of Export Goods.. (Problems on Valuation of Imported Goods). (Theory and Problems).

Module -6 Import and Export Procedure for Customs	**5 hours**

Introduction to Baggage and General Free Allowance. Provisional Assessment of Duty, Due Dates for Payment of Duty, Penalties under Customs, Seizure of Goods, Confiscation of Goods. (Theory).

Course outcomes:
At the end of the course the student will be able to:
1. Have clarity about GST system in India
2. Understanding of levy and collection of GST in India
3. Have an overview of customs duty in India
4. Understanding of valuation for customs duty.

Practical Component:
- Compile and analyze documents pertaining to Registration under GST and Returns under GST
- How to file Online GST Returns
- How to Generate GSTR 1 & GSTR 3B, E way Bill and How to calculate and avail Input Tax Credit(ITC)
- Conduct a survey among local business community about compliance with GST regime.
- Encourage students to register for online GST Certification Course – Suggested.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X				
CO3	X				
CO4	X				X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Indirect Taxes Law and practices	V S Datey	Taxmann's	*Latest Edition*
2	GST & Customs Law (University Edition)	K.M Bansal	Taxmann's	*Latest Edition*

Reference Books

1	Principles of GST & Customs Law	V.S. Datey and Dr. Krishnan Sachdeva	Taxmann's	*Latest Edition*
2	Goods & Services Tax (GST) in India	B. Viswanathan	UBS Publishers	*Latest Edition*
3	Indirect Taxation	Raj K Agrawal & Shivangi Agrawal	Bharat Law House Pvt. Ltd	*Latest Edition*

MERGERS, ACQUISITIONS & CORPORATE RESTRUCTURING			
Course Code	20MBAFM404	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives:
1. To understand various concepts and terminologies used in mergers and acquisition.
2. To explain and critically evaluate M&A with its different classifications, strategies, theories, synergy etc.
3. To apply and analyse financial evaluation and accounting aspects of M&A.

Module-1 Mergers and Acquisitions(M & A)	5 hours

Introduction of M & A: Meaning-types of mergers–Merger Motives-Theories of Mergers-Mergers and industry life cycle, Reasons for failures of M & A-synergy-types of synergy–value creation in M&A-SWOT analysis-BCG matrix. (Theory).

Module -2 Merger Process	7 hours

Procedure for effecting M & A-Five-stage model–Due diligence–Types, process and challenges of due diligence-HR aspects of M & A–Tips for successful mergers-Process of merger integration. (Theory).

Module -3 Financial Evaluation of M & A	7 hours

Merger as a capital budgeting-Business valuation approaches-asset based, market based and income based approaches-Exchange Ratio (Swap Ratio)-Methods of determining exchange rate. (Theory and Problems).

Module -4 Accounting aspects of Amalgamation	7 hours

: Types of amalgamations (Amalgamation in the nature of merger and amalgamation in the nature of purchase)-Methods of Accounting-Pooling of interest method and Purchase method)–Calculation of purchase consideration-Journal entries in the books of transferor & transferee company-Ledger accounts in the books of transferor and transferee companies. (Theory and Problems).

Module -5 Acquisitions/Takeovers	7 hours

Meaning and types of acquisition/takeovers (Friendly and Hostile takeovers)-Anti-takeover strategies-Anti-takeover amendments-Legal aspects of M & A-Combination and Competition Act-2002Competition Commission of India (CCI)-The SEBI Substantial Acquisition of Shares and Takeover (Takeover code-2011). (Theory).

Module -6 Corporate Restructuring	7 hours

Meaning, significance and forms of restructuring–sell-off, spin-off, divestitures, demerger, Equity Carve Out (ECO), Leveraged Buy Outs (LBO), Management Buy Out (MBO), Master Limited Partnership (MLP), Limited Liability Partnership (LLP) and joint ventures. (Theory).

Course outcomes:
At the end of the course the student will be able to:
1. Understand M&A with its different classifications, strategies, theories, synergy etc.
2. Conduct financial evaluation of M&A
3. Analyse the results after evaluation
4. Critically evaluate different types of M&A, takeover and antitakeover strategies

Practical Component:
- Choose any two latest M & A deal, announced/completed in the Indian corporate sector in 2019-20; Compile complete details of the deal;
- Study the deal in the light of the following:
  1. Nature of the deal: merger, amalgamation, acquisition, takeover, OR any program of corporate restructuring Valuation/Financials involved in the deal
  2. Synergies/benefits likely to emerge from the deal
  3. Challenges/Impact/Problems-associated with the deal.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X			X	
CO4	X			X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 60 percent theory and 40 percent problems in the SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Mergers Acquisitions & Corporate Restructuring - Strategies & Practices	Rabi Narayan Kar and Minakshi	Taxmann's	3/e, 2017
2	Mergers and Acquisitions	Sheeba Kapil and Kanwal N. Kapil	Wiley	2/e, 2017
3	Mergers, Acquisitions and Corporate Restructuring: Text and Cases	Chandrashekar, Krishnamurti & Vishwanath S	Sage Publications	2/e, 2018

Reference Books

1	Mergers, Acquisitions and Takeovers	H.R.Machiraju	New Age International Publishers	1/e, 2010
2	Mergers et.al.-Issues, Implications, and Case Law in Corporate Restructuring	Ramanujam S.	Tata McGraw Hill Publishing House	2000
3	Takeovers, Restructuring and Corporate Governance	Weston, Mitchell and Mulherin	Pearson Education	4/e , 2003.

CORPORATE VALUATION			
Course Code	20MBAFM405	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives:
1. Identify the purpose of corporate valuation and to obtain an overview of the basic corporate valuation process
2. To familiarize the students with the standard techniques of corporate valuation.
3. To develop analytical skills and communication strategies for discussing corporate valuation.
4. To understand the valuation in the contexts of IPOs, M&As, Bankruptcy cases

Module -1 Corporate Valuation Overview	**7 hours**

Approaches to Valuation-Features of the valuation process: Enterprise DCF Model-Analysing historical performance-Estimating the cost of Capital-Forecasting performance-Estimating the continuing value-Calculating and interpreting the results-Other DCF models: Equity DCF Model: Dividend discount model, free cash flow to Equity (FCFE) model-Adjusted present value model-Economic profit model-Applicability and Limitations of DCF analysis (Theory and problems).

Module -2 Non-DCF Approaches to Valuation	**7 hours**

Book value approach, Adjusted book value approach, Stock and debt approach (numerical problems in each of these methods).Market efficiency and valuation. Call option based valuation (theory only because Numerical problems on Black and Scholes –Binomial methods are considered in Derivatives).Relative valuation-Steps involved in Relative valuation-Equity valuation multiples-Enterprise valuation multiples-Choice of multiple-Best practices using multiples-Assessment of relative evaluation. (Theory and problems).

Module -3 Advanced Issues in Valuation	**7 hours**

Valuation of companies of different kinds-valuation in different contexts-Loose ends of valuation-Valuation of intangible assets: Patents, trademarks, copyrights and licenses; Franchises; Brands, WACCVs Flow to equity method. (Theory and problems).

Module -4 Strategic Financing Decisions	**7 hours**

Strategic financing decisions: Valuation and financing Decisions in ideal capital markets, Capital structure and value in a perfect world, Information asymmetry, Share buyback and valuation. (Theory).

Module -5 Leverage decisions	**7 hours**

, Agency costs of Debt, financial distress, Bankruptcy. Role of Government, securities Markets and financial institutions in IPO valuations and M&As. (Theory).

Module-6 Value Based Management	**5 hours**

Value Based Management- Methods and Key premises of VBM-Marakon approach-Alcar approach-Mckinsey approach-Stern Stewart approach-BCG approach-Lessons from the experiences of VBM adopters. (Theory).

Course outcomes:
At the end of the course the student will be able to:
1. Understand corporate valuation and valuation process
2. Familiarize with the standard techniques of corporate valuation
3. Develop analytical skills relevant for corporate valuation and value based management
4. Critically evaluate IPOs, M&As, Bankruptacy cases

Practicaul Component:
- Obtain last three years' balance sheet of any TWO firms (from different sector) that has debt and equity.
- Find out the free cash flow to the firm (FCFF) and free cash flow to the equity (FCFE) for the last three years.
- Determine if there is any growth in the cash flows to the firm and to the equity holders.
- Find beta of the firm and Compute cost of equity and WACC.
- Finally find the value of the firm and interpret the findings.
- Discuss few case studies on Value-based management followed in Indian corporates.
- Study the IPO valuation by Indian financial institutions.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X				
CO3	X			X	
CO4	X			X	

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 60 percent theory and 40 percent problems in the SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Corporate Valuation and Value Creation	Prasanna Chandra	Tata McGraw Hill	2011
2	Damodaran on Valuation	Aswath Damodaran	John Wiley and Sons	2/e, 2006

Reference Books

1	Corporate Valuation: A Guide for Managers and Investors	Philip R Daves, Michael C. Ehrhardt, and Ron E. Shrieves	Cengage Learning	2003
2	Corporate Valuation	David Frykman, Jakob Tolleryd	Prentice Hall	2003
3	The Valuation Handbook: Valuation Techniques from Today's Top Practitioners	Rawley Thomas, Benton E. Gup	John Wiley & Sons	2010

INTERNATIONAL FINANCIAL MANAGEMENT			
Course Code	20MBAFM406	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives:
1. To understand the International Financial Environment and the Foreign Exchange market.
2. To learn hedging and Forex risk management.
3. To learn the Firm's Exposure to risk in International environment and various theories associated with it**.**

Module -1 International Financial Environment	7 hours

Importance, rewards & risk of international finance- Goals of MNC- International Business methods. Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Equilibrium & Disequilibrium, International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU).(Only Theory).

Module -2 Foreign Exchange Market	7 hours

Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behaviour-Cross Rates- - Bid – Ask – Spread (Theory & Problems).

Module -3 Foreign Exchange Risk Management	7 hours

Hedging against foreign exchange exposure – Forward Market- Futures Market- Options Market- Currency Swaps-Interest Rate Swap- problems on both two-way and three-way swaps. (Theory & Problems).

Module -4 International Financial Markets and Instruments	5 hours

: Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, International Financial Instruments: Foreign Bonds & Eurobonds, Global Bonds. Floating rate Notes, Zero coupon Bonds, International Money Markets, International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements. (Only Theory).

Module -5 Forecasting Foreign Exchange rate	7 hours

International Parity Relationships, Measuring exchange rate movements-Exchange rate equilibrium –Factors effecting foreign exchange rate- Forecasting foreign exchange rates. Interest Rate Parity, Purchasing Power Parity &International Fisher effects, Arbitrage, Types of Arbitrage – Locational, Triangular and Covered Interest Arbitrage. (Theory & Problems).

Module-6 Foreign Exchange exposure	7 hours

Foreign Exchange exposure: Management of Transaction exposure-Management of Translation exposure-Management of Economic exposure-Management of political Exposure- Management of Interest rate exposure. International Capital Budgeting: Concept, Evaluation of a project.
(Theory & Problems).

Course outcomes:
At the end of the course the student will be able to:
1.   The student will have an understanding of the International Financial Environment.
2.   The student will learn about the foreign exchange market, participants and transactions.
3.   The student will be able to use derivatives in foreign exchange risk management.
4.   The student will be able to evaluate the Firm's Exposure to risk in International
     environment and various theories associated with it.
Practical Components:
   - Visit the foreign exchange department of a bank, study the operations and submit a report
   - Track and analyze the rupee exchange value against Dollar and Euro in spot and forward markets for one week and record the observations.
   - Study the different types of swaps used in Foreign Exchange Market
   - Visit the foreign exchange department of a bank, study the operations and submit a report
   - Track and analyze the rupee exchange value against Dollar and Euro in spot and forward markets for one week and record the observations

CO-PO MAPPING

CO	PO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	X				
CO2	X			X	X
CO3	X			X	
CO4	X		X		X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Textbooks

Sl. No.	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	International Corporate Finance	Jeff madura	Cengage Learning	10/e 2012
2	International Finance Management	Eun & Resnick	Tata McGraw Hill	4/e, 2014
3	Financing International Trade: Banking Theories and Applications	Gargi Sanati	Sage Publication	1/e, 2017

Reference Books

	International Financial Management	Apte P. G	Tata McGraw Hill	6/e, 2011
2	International Financial Management	MadhuVij	Excel Books	2010
3	International Financial Management	Thummuluri Siddaiah	Pearson India	1/e, 2009

ORGANISATIONAL LEADERSHIP

Course Code	20MBAHR401	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives

1. The student will be able to describe and Identify the application of Leadership styles and practices followed in the Organisation
2. The student will be able to describe and explain in her/his own words, the relevance and importance of various Leadership practices and style followed in the Organisation
3. The student will be able to apply and solve the workplace problems through Leadership practices
4. The student will be able to classify and categories different Leadership practices and styles followed in the Organisation
5. The student will be able to create and reconstruct Leadership required to manage the Human Resources in the Organisation
6. The student will be able to appraise and judge the practical applicability of Leadership practices followed in the Organisation

Module-1 Introduction	**5 hours**

Concept of Leadership, Ways of Conceptualizing Leadership, Definition and Components, Leadership Described, Trait Versus Process Leadership, Assigned Versus Emergent Leadership. Leadership and Power, Leadership and Coercion, Leadership and Management.

Module -2 Model of Leadership - Part A	**7 hours**

Trait Approach
Description, Intelligence, Self-Confidence, Determination, Integrity, Sociability, Five-Factor Personality Model and Leadership, Emotional Intelligence, How Does the Trait Approach Work?
Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Skills Approach
Description, Three-Skill Approach, Technical Skill, Human Skill, Conceptual Skill, Summary of the Three-Skill Approach, Skills Model, Competencies, Individual Attributes, Leadership, Outcomes, Career Experiences, Environmental Influences, Summary of the Skills Model, How Does the Skills Approach Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Behavioral Approach
Description, The Ohio State Studies, The University of Michigan Studies, Blake and Mouton's Managerial (Leadership) Grid, Authority–Compliance (9,1), Country-Club Management (1,9) Impoverished Management (1,1), Middle-of-the-Road Management (5,5), Team Management (9,9), Paternalism/Maternalism, Opportunism, How Does the Behavioral Approach Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Situational Approach
Description, Leadership Styles, Development Levels, How Does the Situational Approach Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Module -3 Model of Leadership - Part B	**7 hours**

Path–Goal Theory
Description, Leader Behaviors, Directive Leadership, Supportive Leadership, Participative Leadership, Achievement-Oriented Leadership, Follower Characteristics, Task Characteristics How Does Path–Goal Theory Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Leader–Member Exchange Theory
Description, Early Studies, Later Studies, Leadership Making, How Does LMX Theory Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Transformational Leadership
Description, Transformational Leadership Defined, Transformational Leadership and Charisma, A Model of Transformational Leadership, Transformational Leadership Factors, Transactional Leadership Factors, Non-leadership Factor, Other Transformational Perspectives Bennis and Nanus, Kouzes and Posner, How Does the Transformational Approach Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Authentic Leadership

Description, Authentic Leadership Defined, Approaches to Authentic Leadership, Practical Approach, Theoretical Approach, How Does Authentic Leadership Theory Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Psychodynamic Approach

Description, The Clinical Paradigm, History of the Psychodynamic Approach, Key Concepts and Dynamics Within the Psychodynamic Approach,

1. Focus on the Inner Theatre
2. Focus on the Leader-Follower Relationships

Social Defense Mechanisms, Mirroring and Idealizing, Identification With the Aggressor

3. Focus on the Shadow Side of Leadership Narcissism

How Does the Psychodynamic Approach Work? Strengths, Criticisms, Application, Case Studies, Leadership Instrument

Module -4 Leadership Instrument	7 hours

Description, Culture Defined, Related Concepts, Ethnocentrism, Prejudice, Dimensions of Culture, Uncertainty Avoidance, Power Distance, Institutional Collectivism, In-Group, Collectivism, Gender Egalitarianism, Assertiveness, Future Orientation, Performance Orientation, Humane Orientation, Clusters of World Cultures, Characteristics of Clusters, Anglo, Confucian Asia, Eastern Europe, Germanic Europe, Latin America, Latin Europe, Middle East, Nordic Europe, Southern Asia, Sub-Saharan Africa, Leadership Behavior and Culture, Clusters, Eastern Europe Leadership Profile, Latin America Leadership Profile, Latin Europe Leadership Profile, Confucian Asia Leadership Profile, Nordic Europe Leadership Profile, Anglo Leadership Profile, Sub-Saharan Africa Leadership Profile, Southern Asia Leadership Profile, Germanic Europe Leadership Profile, Middle East Leadership Profile, Universally Desirable and Undesirable Leadership Attributes, Strengths, Criticisms, Application, Case Studies on Leadership Instrument

Module -5 Ethical Leadership	7 hours

Description, Ethics Defined ;Level 1. Preconventional Morality ;Level 2. Conventional Morality;
Level 3. Postconventional Morality; Ethical Theories, Centrality of Ethics to Leadership, Heifetz's Perspective on Ethical Leadership; Burns's Perspective on Ethical Leadership, The Dark Side of Leadership, Principles of Ethical Leadership, Ethical Leaders Respect Others, Ethical Leaders Serve Others, Ethical Leaders Are Just, Ethical Leaders Are Honest, Ethical Leaders Build CommModuley, Strengths, Criticisms, Application, Case Studies, Leadership Instrument.

Module – 6 Leadership Practices	7 hours

Select Case of Successful Leadership Practices; TATA Group; Reliance; Infosys; WIPRO; and Organisations which are listed as Fortune Companies. Survey Report analysis of NHRD; NIPM; CII; FICCI; Conference Board; CCL - Centre of Creative Leadership.

Course Outcomes:
1. Understand the fundamental concepts and principles, theories of Organizational Leadership.
2. Analyze the organizational leadership style, approaches and traits, its impact on the followers by using leadership theories and instruments.
3. Developing better insight in understanding the leadership traits that influence them to work effectively in group.
4. Demonstrate their ability to apply of their knowledge in organizational leadership.

Practical Components:
- Meet any Leader- Organisation or Academic and ask 10 questions related to Leadership. Than analysis the type of leadership style adopted.
- Meet 4-5 Leaders from different roles and compare - contrast the different style son leadership.
- Meet Gender specific leaders and try analysing who makes the best leader in which type of set-up.

Note: Faculty can either identify the organizations/ leaders/job profile or students can be allowed to choose the same.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X		X	X	X
CO3	X		X	X	
CO4	X		X		X

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Leadership: Theory and Practices Leadership for Organisations	Peter G. Northouse	Sage Publication	7/e, 2016
2	Management: Leading People and Organisations in the 21st Century	Gary Dessler	Prentice Hall	2001
3	Charismatic Leadership in Organisations	Jay A. Conger, Rabindra N. Kanungo	Sage Publications	1998

Reference Books

1	Leadership: Theory and Practice	Peter G. Northouse	Sage	2010
2	Management: Leading People and Organisations in the 21st Century	Gary Dessler	Prentice Hall	2001
3	The Leadership Code: Five Rules to Lead	Dave Ulrich, Norm Smallwood, Kate Sweetman	Harvard Business Pres	2008
4	Leadership for Organisations	David A. Waldman, Charles O'Reilly	Sage Publications	2019

PERSONAL GROWTH AND INTERPERSONAL EFFECTIVENESS			
Course Code	20MBAHR402	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives
1. The student will be able to describe and Identify the application of various PG and IE framework
2. The student will be able to describe and explain in her/his own words, the relevance and importance of various PG and IE to be adopted in the Organisation
3. The student will be able to apply and improve the workplace effectiveness through various PG and IE
4. The student will be able to classify and categorise different PG and IE practices and to be followed in the Organisation
5. The student will be able to create and reconstruct Leadership required to manage the Human Resources in the Organisation
6. The student will be able to appraise and judge the practical applicability of various PG and IE practices to be followed in the Organisation

Module-1 Dynamics of Personal Growth	4 hours

Dynamics of Personal Growth Meaning, nature and scope of personal growth. Self-awareness and self-esteem, life roles, social roles and organisational roles, role clarity and role boundaries. Ego states- Id, ego and super ego and defense mechanism. Developing a self-improvement plan.

Module -2 Interpersonal Trust	4 hours

Openness, confidentiality, blind spot and unknown part of personality. Self-disclosure, seeking feedback, self-reflection and practicing new behaviors. Discovering facets of interpersonal trust through Johari Window.

Module -3 Understanding Human Personality and Neuro Functioning	7 hours

Personality theories, Carl Jung's theory of personality types and Myers Briggs Type Indicator test (MBTI), Trait theories- Guilford Peogut, PF 16 and Type A and B, Emotional intelligence. **Basic functions of mind:** Creativity and innovation. Blocks to creativity. Creativity processes and tools- convergent and divergent thinking. Six thinking Hats, Neuro Linguistic Programming.

Module -4 Attitudes, Beliefs, Values and their impact on Behaviour	7 hours

Personal change meaning, nature and requisites. Social adjustments and habit formation. Locus of control. Habits of personal effectiveness. Seven habits of highly effective people.

Module -5	9 hours

Interpersonal relations and personal growth: Interpersonal needs for openness, inclusion and control. Discovering the interpersonal orientation through FIRO-B. Conflict resolution and negotiation, time management and honouring the commitments

Module – 6 Transactional Analysis	9 hours

Ego states, types of transactions and time structuring. Life position, scripts and games; T-group sensitivity training, encounter groups, appreciative enquiry and group relations conference (students may go through three days personal growth lab for experiential learning)

Course Outcomes:
1. Have in-depth understanding the various personality traits which promotes personal growth.
2. Analyze the concepts of human personality, behaviour and functioning of mind
3. Learn and apply the psychometrics tests in understanding the personality traits.
4. Develop the greater insight of self, and others through various theories and prepare the developmental plan for interpersonal effectiveness.

Practical Components:
- Students are expected to conduct an in-depth study about various personality traits & TA and submit a detailed report.
- Students must undergo psychometric test like MBTI, FIRO-B, Big Five etc, conduct SWOT analysis and prepare a personal growth plan based on the results
- Ask the individual students to seek multisource feedback about their interpersonal effectiveness from peers, teachers, and parents; understand and reflect the feedback and prepare a development plan for interpersonal

effectiveness.

- Discuss a Johari Window case in the class to identify how it can help each individual student to promote his/ her personal growth.
- Organize a workshop on MBTI for the students to know their type and to understand the type dynamics.
- Organize a Neuro linguistic programming workshop for the participation of all HR students.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X		
CO2	X		X	X	X
CO3	X	X	X		
CO4	X	X	X		X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Organisational Behaviour: Human Behaviour at work	John W. Newstrom and Keith Davis	Tata McGraw Hill	11/e, 2003
2	Human Relations in organisations	Robert N. Lussier	Mc- Graw Hill Education	6/e
3	Development of Management Skills	Whetten & Cameron	PHI	7/e
4	Competency Mapping Assessment and Growth	Naik G. P	IIHRM	2010

Reference Books

1	Understanding OB	Udai Pareek	Oxford University Press	
2	Theories of Personality	Calvin S Hall	Wiley India Pvt. Ltd	4/e
3	Seven habits of highly effective people	Stephen R Covey	Pocket Books.	
4	Training in interpersonal Skills	Stephen Robbins	Pearson Education	

INTERNATIONAL HUMAN RESOURCES MANAGEMENT			
Course Code	20MBAHR403	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives

1. The student will be able to describe and Identify the application of IHRM in managing and developing an Organisation
2. The student will be able to describe and explain in her/his own words, the relevance and importance of IHRM in managing and developing an Organisation
3. The student will be able to apply and solve the workplace problems involving International issues
4. The student will be able to classify and categorise different Laws related to IHRM
5. The student will be able to create and reconstruct HRM System to be adopted in the Organisation related to International employees
6. The student will be able to appraise and judge the practical applicability of various strategy and approaches in managing International Organisation

Module-1 Introduction	7 hours

Meaning and Definition IHRM: Evolution, Challenges, Objectives, IHRM Versus Single Nation-centric HRM IHRM: Approaches Emergence of Global HR Manager IHRM;Culture and Cross-Cultural Management-Introduction, Studies on culture in management Positivist views: 'Culture and values' Interpretive views: 'Culture and meanings' Critical views: 'Culture and power'; Comparative Human Resource Management - Globalisation and HRM, The importance of context, Differences in HRM practice; Approaches to International Human Resource Management - Review of IHRM approaches, The concept of HRM, Are IHRM models applicable to other contexts? What factors affect HRM approaches internationally? What are the implications of change for IHRM approaches?

Module -2 IHRM Policies and Practices - Part A	7 hours

Managing Knowledge in Multinational Firms: Introduction, Different types of knowledge, Factors influencing knowledge sharing How to stimulate knowledge sharing Gaining access to external knowledge, Knowledge retention From the management of knowledge to innovation

Training and Development: Developing Global Leaders and Expatriates

Training and Development: Domestic Versus International Organisations International Training Management: Basic Concepts and Models Leadership Training and Development in International Organisations Technology in International Training Management.

Module -3 IHRM Policies and Practices - Part B	7 hours

Global Performance Management

Introduction, Key components of PMSs Factors affecting PMSs Culture and PMSs, PMSs in six leading economies: China, India, Japan, South Korea, UK and USA, PMS for expatriates

Total Rewards in the International Context

Recap: differentiating between PCNs, TCNs and HCNs Introduction: the current state of total rewards Complexities faced by IHR managers, International total rewards objectives for the MNC Newer forms of international assignments, Key components of global total rewards programs. Approaches to international compensation Repatriation issues, International trends in global total rewards.

Module -4 International Assignments And Employment Practices	5 hours

Introduction Staffing policies, Motives for international transfers, Alternative forms of international assignments. The international assignment process Dimensions of international assignment success

Multinational Companies and the Host Country Environment Introduction, Varieties of host country environments, Sustainability of divergent, employment arrangements Understanding how MNCs act in diverse host country, environments Host country effects on IHRM practices of MNC subsidiaries

Module -5 Employment Practices	7 hours

Regulation and Multinational Corporations: The Changing Context of Global Employment Relations Importance of regulation and political context, Political agendas to de-regulate, Political and institutional drivers of de-regulation, Problems with de-regulation in a global context. Human Resource Management in Cross-Border Mergers and Acquisitions. Cultural differences and cross-border M&A performance, Managing cross-border integration: the HRM implications.

Module – 6 Diversity Management and CSR	7 hours

Equal opportunities, Diversity Management, Work–life balance: practices and discourses; International Culture Management: Model Organisational Culture and Innovation, Models of Culture, Hofstede's Four, Cultural Dimensions, Trompenaar's Seven Cultural Dimensions, Globe's Nine Cultural Dimensions, Edgar Schein's Model of Culture Deal and Kennedy's Culture Model, Schneider's Culture Model, Cameron and Quinn's Model of Culture Charles Handy's Model of Culture Denison's Model of Culture, Profile of Organisational Culture in International Organizations Managing International Culture. Corporate Social Responsibility and Sustainability through Ethical HRM practices. Ethics and corporate social responsibility International labour standards.

Course Outcomes:
1. Gain conceptual knowledge and practical experience in understanding the HR concepts globally.
2. Comprehend and correlate the strategic approaches to HR aspects amongst PCN's, TCN's and HCN's.
3. Develop knowledge and apply the concepts of HR in global perspective
4. Have a better insight of HR concepts, policies and practices by critically analysing the impact of contemporary issues globally.

Practical Components:
- A visit to Organisation and interact with HR Manager and list out the roles played by HR manager.
- Meet Recruitment Manager and ask- 10 questions one asks during Interview.
- Meet Training and Development Manager and list out various training given to employees; basis of training program; Need analysis.
- Visit any Service Organisation and observe HR functions; List them.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X		X
CO2	X		X		X
CO3	X	X	X		
CO4	X		X	X	X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	International Human Resource Management	Srinivas R. Kandula	Sage Publication India Pvt. Ltd.	2018
2	International Human Resource Management	Anne-Wil Harzing, Ashly H. Pinnington	Sage Publication India Pvt. Ltd.	4/e, 2015
3	Diversity at Work	Arthur P Brief	Cambridge University Press	2008

	Reference Books			
1	Strategic Human Resource Management: An International Perspective	Gary Rees, Paul E. Smith	Sage Publication India Pvt. Ltd.	2014
2	Global Talent Management: An Integrated Approach	Sonal Minocha and Dean Hristov	Sage Publication India Pvt. Ltd.	2019
3	International Human Resource Management	Anne-Wil Harzing, Ashly Pinnington	Sage Publication India Pvt. Ltd.	2011

ORGANISATIONAL CHANGE AND DEVELOPMENT			
Course Code	20MBAHR404	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives

1. The student will be able to describe and Identify the application of various OC/D framework
2. The student will be able to describe and explain in her/his own words, the relevance and importance of various OC/D intervention to be adopted in the Organisation
3. The student will be able to apply and improve the workplace effectiveness through various OC/D Intervention
4. The student will be able to classify and categorise different OC/D practices and intervention followed in the Organisation
5. The student will be able to create and reconstruct OC/D intervention and process required to manage the Organisation
6. The student will be able to appraise and judge the practical applicability of various OC/D intervention, process and practices to be followed in the Organisation

Module-1 Changing Organisations	5 hours

Nature of 21st Century Organisation, Defining Organisational Change, The Roots of Organisation Change, Environmental Forces, Driving Change Today, The Implications of Worldwide Trends for Change Management, Four Types of Organisational Change, Planned Changes and Intended Results, Organisation Change Roles, Change Initiators, Change Implementers, Change Facilitators, Change Recipients, The Requirements for Becoming a Successful Change Leader, Application of Lewin's Model of Change, OD Practitioners.

Module -2 Building and Energising the Need for Change	7 hours

Organisations as Systems, Levels and Characteristics of Organisational Change, Models of Organisational Change, Systems Theory and Social Construction Approaches, Developing a Knowledge for the Need for Change, Seek Out and Make Sense of Internal - External Data, The Organisations' Readiness for Change, Creating Awareness of the Need for Change, Factors That Block People From Recognising the Need for Change, Creating a Powerful Vision for Change, The Difference Between an Organisational Vision and a Change Vision.

Module -3 Measuring Change: Designing Effective Control Systems	7 hours

Using Control Processes to Facilitate Change, Selecting and Deploying Measures, Use Measures that Lead to Challenging but Achievable Goals, Use Measures and Controls that are Perceived as Fair and Appropriate, Ensure Accurate Data, Control Systems and Change Management, Controls During Design and Early Stages of the Change Project, Measurement Tools to use in Change Process, Strategy Maps, The Balanced Scorecard, Risk Exposure Calculator, Organisational Change Agent, Orienting Yourself to Organisation Change, Data Gathering, Diagnosis and Feedback.

Module -4 Models of Change	7 hours

Kurt Lewin's Three-step Model (1950–1952), Six-box Model of Marvin Weisbord, The McKinsey 7-S Model, Huse's Model of Planned Organizational Change, Action Research Model, David Nadler and Michael Tushman Model , Porras and Silvers Model (1991), The Burke–Litwin Causal Model, John Kotter's Eight-step Theory , Organizational Intelligence Model (2004), Managing Change with ADKAR Model, Integrated Model of Change , Comparison and Critical Analysis of Change Models Plan the Work, Selecting the Correct Path, Engage Others in Action Planning, Working the Plan Ethically and Adaptively, Developing a Communication Plan, Key Principles in Communicating for Change, Transition Management. Ensure Alignment in Your Action Planning, Action Planning Tools: 1) To-Do Lists; 2) Responsibility Charting; 3) Contingency Planning; 4) Surveys and Survey Feedback;5) Project Planning and Critical Path Methods;6) Force Field and Stakeholder Analysis; 7) Leverage Analysis and 8) Other Change-Management Tools.

Module -5 Organisation Development(OD)	7 hours

Concept of O D, History of O D, OD in India, OD Activities, Values, Beliefs and Assumptions of OD, Laboratory Training and T-Groups Action Research and Survey Feedback, Employee Involvement, Organisational Culture, Reengineering Organisational Learning, Organisational Effectiveness and Employee Engagement, Defining Values, Values Important to the OD Practitioner, Core Values of O D, Changes to OD Values, Values Statement of O D, Ethical Issues of OD.

Module – 6 OD Practitioner and Consulting Process	7 hours

Changing Workforce Demographics, Changing Nature of Work, The Consulting Relationship and Types of Consulting, Consulting Model, OD Practitioners, The Organisation Development Consulting Profession, The OD Consulting Process and Action Research, Data Gathering - Data Gathering Methods and Process, Ethical Issues With Data Gathering, Diagnosis and Feedback, assessment, Ethical Issues With Diagnosis and Giving Feedback, OD Intervention-Team Interventions, Quality, Performance Management, Communication in OD process, Coaching, Mentoring, 360 Feedback, Career Planning and Development. Merger and Acquisition, Organisational Health, OD Association in India.

Course Outcomes:
1. Gain conceptual insight of change management models, OD processes and interventions.
2. Develop the understanding of OD to apply OD aspects in private and public sectors in India.
3. Analyse the tools and techniques available to implement changes in the organization environment
4. Handle the OD interventions by analysing the role of OD consultant.

Practical Components:
- A visit to Organisation and interact with OD and Change Manager and list out the roles played by OD/C manager.
- Meet and Interact with OD and Change Manager and ask- 10 questions related to Change and Development issues
- Meet OD and Change Manager and list out various OC/D Intervention practised and how they impact the Organisational Growth
- Visit Organisation and Interact with Employees in the organisation and discuss Culture Impact on Change process and how it can be managed.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				X
CO2	X		X	X	X
CO3	X		X	X	
CO4	X		X	X	

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Change Management and Organisational Development	Ratan Raina	SAGE Texts	2018
2	Organisational Change- An Action-Oriented Toolkit	Gene Deszca, Cynthia Ingols, Tupper F. Cawsey	SAGE Publications, Inc	2019

3	Organisation Development: The process of Leading Organisational Change	Donald L. Anderson	Sage Publication India Pvt. Ltd.	2/e, 2012
Reference Books				
1	Organisation Development	Donald L. Anderson	SAGE South Asia	2013
2	Toolkit for Organisational Change	T. F. Cawsey, Gene Deszca	SAGE Text	2007
3	Organisation Development and Organisational Change	Donald L. Anderson and Tupper F. Cawsey	SAGE Publications	1/e, 2014

HUMAN RECOURSE AUDIT			
Course Code	20MBAHR405	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives

1. The student will be able to describe and Identify the application of various HR Audit methodology
2. The student will be able to describe and explain in her/his own words, the relevance and importance of various HR Audit approach adopted in the Organisation
3. The student will be able to apply and improve the workplace effectiveness through various HR Audit approach, practices and interventions
4. The student will be able to classify and categories different HR Audit approach and practices followed in the Organisation
5. The student will be able to create and reconstruct HR Audit framework and Model required to manage the Human Resources in the Organisation
6. The student will be able to appraise and judge the practical applicability of various HR Audit approach and practices to be followed in the Organisation

Module-1 Human Resource Development(HRD)	5 hours

H R D -Strategies and Systems; HR as Strategic Partner ; Need for HR Accounting and HR Auditing; Good Industrial Relation Index; Components of HRD Audit; HR Policies and Practices; Elements of good HRD; Role of HR Manager in HRD

Module -2 Human Resource(HR) Audit	7 hours

The Audit System; Need; Advantage and Challenges; Basic concepts and components; Understanding the concept of HR Audit; Identifying goal of HR Audit; Forming Audit team; Approaches to measuring HR; Audit Strategies; HR Systems; HR Competencies; Benefits of HR Audit; Process; Preparation of Audit Report; Methodology of Conducting Audit; Documents for HR Audit; Competency required for HR Audit.

Module -3 Areas for HR Audit	7 hours

Audit of HR Planning; Training and Development; Industrial Relations; Managerial compliance and Corporate strategies; Culture; Quality; Communication; Competencies; Decision Making; Engagement; Relational Audit; Task; Systems; HRIS System; Measuring impact of HR policies on the corporate goals; Creating HR Dashboard and Metric.

Module -4 HR Audit process	7 hours

Audit Methodology- Planning questions; Interview; Observation; Questionnaire; Collecting Audit data; Analysing and interpreting data; Assessing organisation ability to change; Action Plan; Audit Report; Developing Credibility of HR Dept; Internal - External Audit; Attitude Survey; Job Satisfaction Survey; Approaches to HR Audit - (i) Cooperative approach, (ii) Outside authority approach, (iii) Statistical approach, (iv) Compliance approach and (v) Management by objectives (MBO)

Module -5 HR Scorecard approach	7 hours

Measuring Business Impact; Components of HR scorecard ;How to use HR Scorecard for Audit ; Measuring HR effectiveness through HR Scorecard; Balanced scorecard; HR Research; HRD Audit as OD Intervention.

Module – 6 HR Audit for Legal Compliance	7 hours

Using scorecard approach in formulating workplace policies; Recruitment and Selection: Formulating FIR Audit for Start-up companies; HR Audit in practice: Cases in manufacturing industry, Service industry; Extracts of an Illustrative Audit Report.

Course Outcomes:
1. Gain conceptual knowledge and practical experience in understanding the HR Audit.
2. Comprehend and correlate the strategic approaches to HR Audit aspects
3. Develop knowledge and apply the concepts of HR Audit in the organisation
4. Have a better insight of HR Audit concepts, policies and practices by critically analysing the impact of contemporary issues in the organisation.

Practical Components:
- A visit to Organisation and interact with HR Manager/ list out Audit Methodology followed.
- Can design an HR Audit for an Small Scale Organisation.
- Can have Video recording of Attitude and Job Satisfaction Survey of Employees and how Audit can be improved.
- Visit any Service Organisation and observe HR Audit process; List them, and critically can give feedback for further improvement.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X		X
CO2	X		X		
CO3	X		X	X	X
CO4	X		X	X	X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	HRD Audit: Evaluating the Human Resource Function for Business Improvement	TV Rao	Sage Response	2/e, 2014
2	HR Audit	Durdana Ovais Rajni Gyanchandani	Everest Publishing House	2017
3	The HR Scorecard: Linking People, Strategy and Performance		Harvard Business Review Press	1/e, 2001

Reference Books

1	Auditing Your Human Resources Department: A Step-by-Step Guide to Assessing the Key Areas of Your Program	John Mcconnell	AMACOM	2/e, 2011
2	HRD Score Card 2500: Based on HRD Audit	TV Rao	Sage Response	1/e, 2005
3	7 Easy Steps to Conduct a Human Resources Audit and Protect Your Company!	Vanessa Nelson	Lulu Publication	2016

MANAGEMENT CONSULTING FOR BUSINESS EXCELLENCE			
Course Code	20MBAHR406	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Objectives

1. To prepare professionals for a career in Management Consulting
2. To impart basic understanding of the requirements of the profession
3. To equip professionals with knowledge, skills and attitude desirable for a career in Management Consulting
4. How to Scale the business and transform it into established firm
5. To prepare professionals working in industry, service sector, development sector and Not for Profit Organisations for Internal Consulting Roles

Module-1 Introduction	**7 hours**

Management Consultancy in India- Indian Management Consulting Scenario, Concept, Nature, Dynamics, Opportunity Modules, Challenges, Consultancy as Profession, Strategic planning process for long-term success through Consultancy; Proactive client relationships for repeat business; Organisational Study and Consultancy-Align organisational vision and strategy; Changing Business Models and Business Strategy; Consultancy Agenda; Economics of Consulting; Client development, Client engagement, Basic and Advanced tools, techniques and frameworks used by management consultants- simulation analysis, decomposition analysis, feasibility analysis and sensitivity analysis/ rankings, scenario analysis, representative element analysis, decision tree, Theory of constraints, Critical chain; issue tree, bottom-up approach, top-down approach, backward reasoning, 80/20 rule, benchmarking, cost drivers, opportunity tree; Ethics of Consulting; Pre requisite needed for Consultancy as Profession.

Module -2 Consultancy Areas - Part A	**5 hours**

Corporate Governance: Role of Management Consultants Play; Consulting Experience in Brand Management; Experience in M and A Consulting; E-Governance and its Relevance to India; Information Technology Consulting: Bytes of Reality; Management Consultancy in Infrastructure Projects; Implications for Management Consultants.

Module -3 Consultancy Areas - Part B	**7 hours**

Project Finance: New Investment, Diversification and Growth; Mentoring In Entrepreneurship; Strengthening Contribution of NGOs in Social Development: Consultancy in Communication Research; Developing strategy for financial restructuring; Management consulting in investment banking, legal, real estate, accounting, financial services, advertising, IT consulting, engineering consulting, HR consulting, R&D, education, architecture, AI, Block chain; Customer relations' management.

Module -4 Consulting Services	**7 hours**

Consulting Services to design and implement policies, systems and processes in functional and cross-functional areas of business. Project Feasibility studies and appraisal; Performance measurement and evaluation of public and corporate sectors; Designing project planning, monitoring and control systems; Designing and implementing manufacturing execution system; Designing and implementing supply chain models; Total quality management; System analysis and design; Enterprise Resource Planning (ERP); Information Technology strategies and architectures; Business Process Reengineering (BPR); E-Governance; Strategic restructuring through alliances and Joint ventures.

Module -5 Careers and Firms in Consultancy	**7 hours**

Career in Consulting - Future Jobs; Top consulting firms McKinsey, BCG, Bain and AT Kearney, PwC, EY, Accenture, Career Growth for Management Consultants area like- Strategy Consulting; Operations Consulting; Financial Advisory Consulting; Risk & Compliance Consulting; Business Coach; Industry-Specific Consulting like steel, FMCG, supply-chain, public sector, etc.; Legal Management Consultancy; Skills and Competency- Research and analysis, Industry analysis, Project preparation, Strategic and design thinking, Technology, Communication skills, Presentation, Business negotiations, ability to think logically and structure, current affairs in the industry and general news around the world, problem solving, business-analytics skills, writing proposals, managing projects, prising strategy, initiating relationship, growing client organisation relationship, corporate valuation and integration, sharp knowledge and strong networking skills, global culture.

Module – 6 HR Consultancy	7 hours

Creating Winning People Strategy; Strategy Maps; Structure, Process and Governance; HR Service Delivery Design; Consulting in Executive Search and Building a Management Team; HR Audit; HR Annual Survey; HR Systems Design; HR Process Re-engineering; Creating HPWS- High Performance Work System and Culture; Developing leadership, Succession, Empowering line managers to take on HR role, 360 degree feedback, Assessment and development Centre's, Value and culture building, Human potential utilisation, Manpower planning; Development and Improvement of performance appraisal system; talent management, Organisational restructuring, Developing heterogeneous HR policies, Managing Gen Y and Gen Z employees, Attrition control and employee retention management, Work-life balance, Executive coaching, Performance management, Employee engagement, Integration and assimilation of new recruits, Expectation management, T and D, Stress management, healthy living and building future.

Course Outcomes:
1. Gain the practical insight of various principles and practices of Consultant and Consultancy
2. Acquire knowledge of latest conceptual framework used by Consultant and Consultancy process and procedure applied in various sectors
3. Illustrate the application of Consultant and Consultancy tools and techniques in various sectors.
4. Develop a greater understanding about strategies adopted/undertaken by Consultant and Consultancy.

Practical Components:
- Visit management consulting firm and identify opportunities and challenges of the firm.
- Help consulting firm to increase profitability by making an SWOT analysis.
- Design strategies for Lifetime Fitness to enter foreign markets.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X		X		X
CO2	X		X		
CO3	X		X		X
CO4	X		X	X	X

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Texbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Management Consulting in India- Practice and Experiences for Business Excellence	U. K. Srivastava; Pramila Srivastava	SAGE Response	2012
2	An Introduction to Management Consultancy	Marc Baaij	SAGE Publications Ltd	2013
3	Management Consultancy Insights and Real Consultancy Projects	Book by Graham Manville	Routledge	2018

Reference Books			
1	The McKinsey way	Ethan M. Rasiel	KOBO	1999
2	The Boston Consulting Group on Strategy: Classic Concepts and New Perspectives	Carl W. Stern, Michael S. Deimler	John WILEY and Sons	2006
3	Competitive Strategy: Techniques for Analyzing Industries and Competitors	Michael E. Porter	The Free Press	1980

RUBRICS FOR CONTINUOUS INTERNAL EVALUATION (CIE) FOR 40 MARKS

Particulars	Marks	Procedure
Internal Assessment Test	50+50= 100/4=25	Average of two best performances out of three internal assessments tests shall be considered.
Seminar/Presentation	05	Document for the same must be maintained
Subject Viva-Voce/ Oral Examination	05	Document for the same must be maintained
Assignment/ Quiz	05	Document for the same must be maintained
Note: Course Instructor may introduce/use any activity other than the above three activities to award 15 marks. The activities used by the course instructor must be measurable and documented for inspection by VTU.		

QUESTION PAPER PATTERN FOR SEE

Q.No.1 to7 PART -A	Marks
a	3 marks
b.	7 marks
c.	10 marks
Total (4/7) 4X20	80 marks
PART-B Case-Compulsory	20 marks

Note: For III Sem SEE 20% marks allocated to application oriented questions from practical Components.

GUIDELINES FOR 6 WEEK PROJECT WORK 20MBAPR407
(BETWEEN 3RD AND 4TH SEMESTER MBA)

PROJECT REPORT			
Course Code	20MBAPR407	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:0:12	SEE Marks	60
Credits	06	Exam Hours	00

Objective

To expose the students to understand the working of the organization/company / industry and take up an in-depth study of an issue / problem in the area of specialization.

General Guidelines

- The project work shall be for a period of 6 weeks immediately after the completion of 3rd SEE but before the commencement of the 4th semester classes.

- The Course code of the project report shall be 20MBAPR407 and shall be compulsory for all the students opting for all specializations.

- The University shall receive 2 copies of project reports prior to the commencement of the 4th semester examination. Copies of the project report should be sent to the concerned Regional Office with intimation to the Registrar (Evaluation).

- By keeping the business trend in the present scenario, university has given an option to the students to select the research problem either from business organization or they can carry out the project on freelance basis subject to the approval of department committee.

- It is the total responsibility of the internal guide to monitor the freelance project.

- In case, business problem selected from a Company, no two students of an institute shall work on the same problem in the same organization.

- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance.

- On completion of the project work, student shall prepare a report with the following format.

- The Project report shall be prepared using word processor viz. MS Word with New Times Roman, 12 font size.

- All the reports shall be printed in the A4 size 1" margin on all the sides.

- The report shall be hard bound facing sheet of royal blue color indicating the title of college and month & year of admission (spiral binding not permitted).

- A certificate by the guide, HOD and Head of the institution indicating the bonafide performance of the project by the student to be enclosed.

- An undertaking by the student to the effect that the work is independently carried out by him/her.

- The certificate from the organization if applicable (if its Freelance project, certificate is not required and Internal guide can issue a certificate for successful completion).

- Acknowledgement

- Executive Summary .

Schedule to be followed before commencement of Project

Activity	Timeline	Remarks
Identifying the organization Problem identification	First week	Student individually identifies an organization OR identifies problem for his/her study, according to his/her interest.
Problem statement Research Design	Second week	His/ Her interests are discussed with project guides. Discussion with Internal Guide to decide on suitable design for the research
Synopsis Preparation	Third week	Preparation of Synopsis* & formulating the objectives
Presentation of Synopsis	Fourth Week	The student will present the synopsis with the detailed execution plan to the Internal Guide and HOD who will review and may: a. Approve b. Approve with modification or c. Reject for fresh synopsis
Approval Status	Fifth & Sixth week	The approval status is submitted to HOD who will officially give concurrence for the execution of the Project

Synopsis: Three page hard copy to be submitted to the HOD with the signatures of the Guide and the student

Page 1	Title, Contact Address of student- with details of Internal and External Guide (if applicable).
Page 2	Short introduction with objectives and summary (300 words). Review of Articles / Literature about the topic with source of information.
Page 3	Time Activity Chart.

Schedule to be followed during Project work

Activity	Time Line	Remarks
Understanding Structure, Culture and functions of the organization /identifying of business problem from the Industry from the literature study	First week of Project	Student should understand products/services and the problems of the organization.
Preparation of Research design and Research instrument for data collection	2nd week of Project	Discussion with the guide for finalization of research design and instrument in his/her domain and present the same to the guide. (First Presentation).
Data collection	3rd week of Project	Date collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. (Second Presentation).
Analysis and finalization of report	4th & 5th week of project	Students must use appropriate and latest statistical tools and techniques for analyzing the data. (It is must to use of Statistical Package whose result should be shown in the report) (Third Presentation).
Submission of Report	6th week of Project	Final Report should be submitted to the University before one week of the commencement of theory examination.

Project Report Evaluation:

- Internal evaluation will be done by the internal guide.
- External valuation shall be done by a faculty member of other institute drawn from VTU affiliated institute with minimum of 10 years experience.
- Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective Institution where a student is expected to give a presentation of his/ her work.
- The viva –voce examination will be conducted by the respective HOD / Senior Professor of the department and an expert drawn from the VTU affiliated institutes with minimum of 10 years of experience as appointed by the University.
- Project work carries 100 marks consisting of 40 marks for internal marks by the internal guide, average of 30 marks from both internal and external evaluation and 30 marks for viva-voce examination. Minimum passing marks of the Project work is 50% in each of the components such as Internal Marks, report evaluation and viva-voce examination.
- Format of the project report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1inch margin all sides (1.5inch on left side) and 1.5 line spacing. The Project report shall not exceed 100 pages.
- Submission of Report: Students should submit the Project Report in electronic data form only, in PDF file (Un-editable Format) to the Institute. The Institute in turn shall submit all the CD's of their students along with a consolidated master list as per specialization containing USN, Name of the student, and Title of the Report to Registrar Evaluation) one week before the commencement of the Theory Examinations or as per notification given for this purpose.
- Plagiarism: Plagiarism is considered as academically fraudulent, and an offence against University academic discipline. The University considers plagiarism to be a major offence, and subject to the corrective procedures. It is compulsory for the student to get the plagiarism check done before submission of the project report. Plagiarism of up to 25% is allowed in the project work and report should consist 75% of original content/work.
- Publication of Research Findings: Students are expected to present their research findings in Seminars/ Conferences/ Technical/ Management Fests or publish their research work in Journals in association with their Internal Guide. Appropriate Weightage should be given to this in the internal evaluation as well as in the viva voce examination of the project report.

Contents of the Project Report

- Cover page
- Certificate from the Organization (scanned copy if applicable)
- Certificate from the guide, HOD and Head of the Institution (scanned copy) indicating bonafide performance of Project by the student
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive summary

Chapter 1: Introduction

Introduction, Industry profile and company profile: Promoters, vision, Mission & Quality Policy. Products / services profile areas of operation, infrastructure facilities, competitor's information, SWOT Analysis, Future growth and prospects and Financial Statement

Chapter 2: Conceptual background and Literature review

Theoretical background of the study, Literature review with research gap (with minimum 20 literature reviews).

Chapter 3: Research Design

Statement of the problem, Need for the study, Objectives, Scope of the study, Research methodology, Hypotheses, Limitations, Chapter scheme.

Chapter 4: Analysis and Interpretation

Analysis and interpretation of the data- collected with relevant tables and graphs. Results obtained by the using statistical tools must be included.

Chapter 5: Findings, Conclusion and Suggestions

Summary of findings, Conclusion and Suggestions / Recommendations

Bibliography: Books, Articles names, etc. to be mentioned as per APA style.

Annexures: Relevant to the project such as figures, graphs, photographs etc.,

Rubrics for Project Work (Common to core and Dual Specializations)

Sl.No	Particulars	Marks Allotted
1	Internal Assessment by the Guide- Based on three Presentations by Students	**40**
2	Report Evaluation by the Guide & External Examiner Average of the marks awarded by the two Examiners shall be the final evaluation marks for the Dissertation.	**30**
3	Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/ Institute (Joint Evaluation)	**30**
	Total	**100**

Rubrics for Project Evaluation and Viva voce Examination

A. Internal Assessment by the Guide- Based on three Presentations by Students

SL No	Aspects	Marks Allotted
1	First Presentation	5
2	Second Presentation	5
3	Third Presentation	5
4	Introduction and Methodology	5
5	Industry and Company Profile	5
6	Theoretical background of study	5
7	Data analysis and interpretation	5
8	Summary of findings, suggestions and conclusion	5
	Total	40

B. Report Evaluation by the Guide & External Examiner. Average of the marks awarded by the two Examiners shall be the final evaluation marks for the Dissertation.

SL No	Aspects	Marks Allotted
1	Introduction & Relevance of the project	5
2	Conceptual background and literature review	5
3	Research design	5
4	Analysis and interpretation	10
5	Summary of findings, suggestions and conclusion	5
	Total	**30**

C. Viva-Voce Examination to be conducted by the HOD/ Guide and an External examiner from the Industry/ Institute (Joint Evaluation)

SL No	Aspects	Marks Allotted
1	Presentation skills	5
2	Communication skills	5
3	Subject knowledge	5
4	Objectives of the study and Methodology	5
5	Analysis using statistical tools and statistical packages	5
6	Findings and appropriate suggestions	5
	Total	**30**

Formats for Project Report and Evaluation
- Format of Cover Page
- Format of certificate by Company/Institution or from both
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography
- Format for Internal Evaluation, External Evaluation and Viva voce

(Title of the Report)

Submitted by

(Student Name)
(USN)

Submitted to
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAVI
In partial fulfillment of the requirements for the award of the degree of

MASTER OF BUSINESS ADMINISTRATION

Under the guidance of

INTERNAL GUIDE   **EXTERNAL GUIDE**
(Name & Designation)   **(Name & Designation)**

(Institute Logo)

Department of MBA
(Institute Name with Address)
(Month & Year of submission)

CERTIFICATE

This is to certify that (Name of the Student) bearing USN (xxxx), is a bonafide student of Master of Business Administration course of the Institute (Batch), affiliated to Visvesvaraya Technological University, Belgaum. Project report on "(Title of Report)"is prepared by Him/her under the guidance of (Name of the Guide), in partial fulfillment of the requirements for the award of the degree of Master of Business Administration of Visvesvaraya Technological University, Belagavi Karnataka.

Signature of Internal Guide   **Signature of HOD**   **Signature of Principal**

DECLARATION

I, (Student Name), hereby declare that the Project report entitled "(Title)" with reference to —(Organization with place) prepared by me under the guidance of (Guide Name), faculty of M.B.A Department, (Institute name) and external assistance by (External Guide Name, Designation and Organization). I also declare that this Project work is towards the partial fulfillment of the university Regulations for the award of degree of Master of Business Administration by Visvesvaraya Technological University, Belgaum. I have undergone a summer project for a period of Twelve weeks. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Place: **Signature of the Student**

Date:

Table of Contents

Sl.No	Contents	Page No's.
Executive Summary		
Chapter-1	Introduction	**XXXXXXXXXXX**
Chapter-2	Industry and Company profile	**XXXXXXXXXXX**
Chapter-3	Theoretical Background of the Study	**XXXXXXXXXXX**
Chapter-4	Data Analysis and interpretation	**XXXXXXXXXXX**
Chapter-5	Summary of Findings, suggestions and Conclusion	**XXXXXXXXXXX**
Bibliography		
Annexures		

List of Tables

Sl.No	Particulars	Page No's.
1	Table showing ABC Analysis	XXXXX
2	Table showing FSN Analysis	XXXXX
3	Table showing EOQ	XXXXX
4	Table showing stock of Raw materials	XXXXX

List of Figures/ Charts/ Graphs

Sl.No	Particulars	Page No's.
1	Graph showing ABC Analysis	XXXXX
2	Graph showing FSN Analysis	XXXXX
3	Graph showing EOQ	XXXXX
4	Graph showing stock of Raw materials	XXXXX

BIBLIOGRAPHY

BOOKS:
Name of the Author, Title of the Book, Name of the Publisher, Edition, year of Publication.
ARTICLES:
Name of the Author, Title of the article, Name of the Journal, Volume/Issue Number, Year, Page Number (pp).
WEBLIOGRAPHY
Name of the Author, Title of the article. Retrieved on dd/mm/yyyy from URL.

MARKS SHEET FORMATS
1. Internal Assessment by the Guide- Based on three Presentations by Students
Visvesvaraya Technological University
Marks Sheet for MBA Project Work (20MBAPR407)

Name of the College: **College Code:**
Internal Marks Allocation for Project Work (20MBAPR407)

SL No	Aspects	Marks Allotted
1	First Presentation	5
2	Second Presentation	5
3	Third Presentation	5
4	Introduction and Methodology	5
5	Industry and Company Profile	5
6	Theoretical background of study	5
7	Data analysis and interpretation	5
8	Summary of findings, suggestions and conclusion	5
	Total	**40**

Marks Sheet

Sl. No	USN	1	2	3	4	5	6	7	8	Total
1										
2										
3										
4										
5										

Signature of the Internal Guide with Name, Address & Date

Note:

1. Total Internal Evaluation Marks of the Project report should be sent along with the other subject internal marks and the above marks sheet should be maintained by the Department/Institution for verification on demand.
2. Total Internal Evaluation Marks of the Project report should be uploaded to VTU by the Internal guide after thorough evaluation of the project report and the copy of the mark sheet downloaded after the entry must be maintained in the department as well as sent to VTU along with the remuneration bill.

2. Report Evaluation by the Guide & External Examiner. Average of the marks awarded by the two Examiners shall be the final evaluation marks for the Dissertation.

Visvesvaraya Technological University
Marks Sheet for MBA Project Work (20MBAPR407)

Name of the College: **College Code:**
External Evaluation Marks Allocation for Project Work (20MBAPR407)

SL No	Aspects	Marks Allotted
1	Introduction & Relevance of the project	5
2	Conceptual background and literature review	5
3	Research design	5
4	Analysis and interpretation	10
5	Summary of findings, suggestions and conclusion	5
	Total	**30**

Marks Sheet

Sl. No	USN	1	2	3	4	5	Total
1							
2							
3							
4							
5							

Signature of External Examiner with affiliation

Note:
1. Total External Evaluation Marks of the Project report should be uploaded to VTU by the External examiner appointed by VTU after thorough evaluation of the project report and the copy of the mark sheet downloaded after the entry must be sent to VTU along with the remuneration bill.
3. Viva-Voce Examination to be conducted by the HOD/ Guide and an External examiner from the Industry/ Institute (Joint Evaluation)

<p style="text-align:center"><u>Visvesvaraya Technological University</u>
<u>Marks Sheet for MBA Project Work (20MBAPR407)</u></p>

Name of the College: **College Code:**

Viva voce Marks Allocation for Project Work (20MBAPR407)

<p style="text-align:center">(Viva voce conducted by HOD/Internal Guide and an Expert from VTU.)</p>

SL No	Aspects	Marks Allotted
1	Presentation skills	5
2	Communication skills	5
3	Subject knowledge	5
4	Objectives of the study and Methodology	5
5	Analysis using statistical tools and statistical packages	5
6	Findings and appropriate suggestions	5
	Total	**30**

Marks Sheet

Sl. No	USN	1	2	3	4	5	6	Total
1								
2								
3								
4								
5								

Signature of Internal Exam   **Signature of External Examiner with affiliation**

Note: Marks may be finalized based on the joint evaluation by internal examiner and External examiner.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.

Scheme of Teaching and Examinations and Syllabus
Master of Computer Applications (MCA)
(Effective from Academic year 2020 - 21)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
Scheme of Teaching and Examination

Master of Computer Applications

Under Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme

SEMESTER-I

S.No	Course Type	Course Code	Title	Teaching Hours/ Week			Examination				Credits
				L	P	T/S DA	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	PCC	20MCA11	Data Structures with Algorithms	04	-	-	03	60	40	100	04
2	PCC	20MCA12	Operating System with Unix	04	-	-	03	60	40	100	04
3	PCC	20MCA13	Computer Networks	04	-	-	03	60	40	100	04
4	PCC	20MCA14	Mathematical Foundation for Computer Applications	03	-	02	03	60	40	100	04
5	PCC	20MCA15	Research Methodology & IPR	02	-	02	03	60	40	100	02
6	PCC	**20MCA16**	**Data Structures with Algorithms Lab**	-	04		03	60	40	100	02
7	PCC	20MCA17	Unix Programming Lab	-	04		03	60	40	100	02
8	PCC	**20MCA18**	**Computer Networks Lab**	-	04		03	60	40	100	02
9	BC	20MCA19-BC*	Basics of Programming & CO	02	-	02	03	60	40	100	-
			Total	**17**	**12**	**06**	**27**	**540**	**360**	**900**	**24**

*Only for non-computer science students

Note: PCC- Professional Core Course; PCE- Professional Elective Course
Each Course (PCC/PCE) shall have case study discussion and may be considered as a part of assignment.
Theory courses internal assessment (CIE) shall be based on internal test (50% weightage), 50% weightage may be given to other continues assessment carried out during the teaching learning processes. Course coordinator may select suitable assessment techniques/tools for continues evaluation such as weekly Multiple Choice Questions (MCQ) quiz, higher order cognitive level questions as assignment, and case study questions/

any other assignment useful for learning with a minimum cognitive level at the application level. Average marks of three internal tests have to be considered for CIE along with other continues evaluations.

Laboratory courses internal assessment shall be based on internal test (**50**% weightage), remaining 50% weightage shall be given to continues evaluation of practical execution during regular laboratory hours. During regular laboratory hours students may be asked to solve the extended versions of the laboratory program/problem, and demonstrate higher order cognitive level such as analysis and design programming assignment. During the laboratory hours after the program execution, technical quiz may be conducted. Wherever laboratory is also having project work students may be asked to solve novel problems in their projects work.

Skill development activities (SDA):

Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills.

The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem.

The students shall

1) Gain confidence in modelling of systems and algorithms.
2) Work on different software/s (tools) to Simulate, analyse and authenticate the output to interpret and conclude. Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations, etc.
3) Handle advanced instruments to enhance technical talent.
4) Involve in case studies and field visits/ field work.
5) Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Tutorial:

Tutorial sessions may be conducted using cooperative Learning techniques. Tutorial sheets maintained should indicate date, problem (statement) addressed, and cooperative learning technique employed, solution to the problem. Course coordinator shall maintain document in specific format for tutorial / SDA.

In order to promote reinforcement of TLP, course coordinator to analyze the performance of the student after the execution of particular test and conduct remedial/ tutorial classes. It is recommended to make changes in delivery methods wherever required and give appropriate assignments/ study materials to fast/slow learners.

Note:

1) Four credit courses are designed for 50 hours of teaching and learning process

2) Three credit courses are designed for 40hours Teaching – Learning process.

3) Two credit courses are designed for 30hours Teaching – Learning process.

Research/Technical Seminar:

As a part of the course Research Methodology & IPR, presenting the seminar is mandatory. The CIE marks awarded for Resaerch/Technical Seminar shall be based on the evaluation of Seminar Report, Presentation skills and performance in Question and Answer session in the ratio 50:25:25. Seminar is to be considered for **20 marks. Remaining 20 marks is for internal tests.**

Students shall do the literature survey of existing work on contemporary topics and present. Student shall highlight on the research gap and propose solution. Seminar presentation and report have to be evaluated using rubrics.

Bridge course: 20MCA19-BC

20MCA19-BC: Bridge course is a non-credit course introduced to the students who admits into MCA program from non-computer science background. Students have to secure eligibility by scoring 50% marks in aggregate (CIE and SEE).

Master of Computer Applications

Under Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme

SEMESTER-II

S.No.	Course Type	Course Code	Title	Teaching Hours/Week			Examination				Credits
				L	P	T/SDA	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	PCC	20MCA21	Database Management System	03	-	-	03	60	40	100	03
2	PCC	20MCA22	Object Oriented Programming with Java	03	-	-	03	60	40	100	03
3	PCC	20MCA23	Web Technologies	04	-	-	03	60	40	100	04
4	PCC	20MCA24	Software Engineering	03	-	02	03	60	40	100	04
5	PEC	20MCA25X	Elective-1	03	-	-	03	60	40	100	03
6	PEC	20MCA26X	Elective-2	03	-	-	03	60	40	100	03
7	PCC	20MCA27	DBMS Lab	-	04	-	03	60	40	100	02
8	PCC	20MCA28	Java Programming Lab.	-	04	-	03	60	40	100	02
9	PCC	20MCA29	Web Technologies Lab with Mini-project	-	04	-	03	60	40	100	02
Total				**19**	**12**	**02**	**27**	**540**	**360**	**900**	**26**

Elective-I		Elective-II	
20MCA251	Cybersecurity	20MCA261	Cryptography and Network Security
20MCA252	Data Mining and Business Intelligence	20MCA262	Artificial Intelligence
20MCA253	Enterprise Resource Planning	20MCA263	Mobile Application Development
20MCA254	User Interface Design	20MCA264	Distributed operating System
20MCA255	Optimization Techniques	20MCA265	Natural Language Processing

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Under Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme

SEMESTER-III

S.No	Course Type	Course Code	Title	Teaching Hours/Week			Examination				Credits
				L	P	T/SDA	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	**PCC**	**20MCA31**	**Data Analytics using Python**	**04**	**-**	**-**	**03**	**60**	**40**	**100**	**04**
2	PCC	20MCA32	IoT	04	-	-	03	60	40	100	04
3	PCC	20MCA33	Advances in Java	04	-	-	03	60	40	100	04
4	PEC	20MCA34X	Elective-II	03	-	-	03	60	40	100	03
5	PEC	20MCA35X	Elective-III	03	-	-	03	60	40	100	03
6	PCC	20MCA36	Data Analytics Lab with Mini-project	-	04		03	60	40	100	02
7	PCC	20MCA37	IoT Lab with Mini Project	-	04		03	60	40	100	02
8	PCC	20MCA38	Advances in Java Lab	-	04		03	60	40	100	02
			Total	**18**	**12**	**-**	**24**	**480**	**320**	**800**	**24**

Elective-III		Elective-IV	
20MCA341	Block chain Technology	20MCA351	Deep Learning
20MCA342	Cloud Computing	20MCA352	Big data Analytics
20MCA343	Digital Marketing	20MCA353	Wireless Ad Hoc Networks
20MCA344	Software Testing	20MCA354	Software Project Management
20MCA345	NOSQL	20MCA355	Software Defined Networks

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SEMESTER-IV

S.No	Course Type	Course Code	Title	Teaching Hours/Week			Examination					Credits
				Lecture(L)	Tutorial(T)	Practical(P)\Seminar	Duration in hours	SEE Marks	CIE Marks	Total Marks		
1	PCC	20MCA41	Advances in Web Technologies	02	02		3	60	40	100		02
2	PCC	20MCA42	Programming using C#	02	02	-	03	60	40	100		02
3	PCC	20MCA43	Industry Internship (4 weeks in vacation of 3rd sem.)	-	-	-	-	-	100	100		02
4	PCC	20MCA44	Project work Phase 2 (During 4th Semester- min. of 4 Months)			02	03	60	40	100		20
			Total	**4**	**4**	**02**	**09**	**180**	**220**	**400**		**26**

Internship:

All the students have to undergo mandatory internship of 4 weeks during the vacation of III semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent semester. After satisfying the internship requirements the degree will be awarded. However, student can carry out 4th semester project without completing the internship.

Project:

The candidate should carry out the project in any industry or R&D institution or educational institution under a guide/co-guide. The candidate has to present the work carried out before the examiners during the University examination. The work out carried out should be free from plagiarism. The

literature study may be clearly written which may be summary of existing project and highlight of what are the functionalities that are proposed to this project. Student shall indicate the different research papers, documents refereed as a part of the literature study. It is recommended to do prior art search as part of literature survey before submitting the synopsis for the projects.

This is an individual project for a duration of minimum of 4 months or duration of the semester. Rubrics have to be used for evaluation of projects which makes the evaluation transparent and valid. Paper publication in an indexed journal/conference is compulsory as part of the project work.

Project work evaluation

There shall be three project presentations each to be considered for 5 marks (5X3= 15 marks) and a final presentation for 15 marks. Presentation may be given using Power point presentation/demonstrations of the work. Synopsis submitted in a proper format is to be evaluated for 10 marks. Student has to publish a research paper in indexed journal / conference. Publications follow the Thesis. 10% weightage is given in SEE. Project report organization/contents can be similar to project report contents of 2018 scheme/syllabus .

Data Structures with Algorithms Choice Based Credit System

Semester:	I	CIE Marks:	40
Course Code:	20MCA11	SEE Marks:	60
Contact Hours (L:T:P):	4:0:0	Exam Hours:	03

Course Outcomes: At the end of the course students will be able to

1. CO1: Demonstrate different data structures, its operations using C programming.
2. CO2: Analyse the performance of Stack, Queue, Lists, Trees, Hashing, Searching and Sorting techniques.
3. CO3: Implement some applications of data structures in a high-level language such as C/C++
4. CO4: Design and apply appropriate data structures for solving computing problems.
5. CO5: Compute the efficiency of algorithms in terms of asymptotic notations for the given problem.

Module-1

Classification of Data Structures: Primitive and Non- Primitive, Linear and Nonlinear; Data structure Operations, Stack: Definition, Representation, Operations and Applications: Polish and reverse polish expressions, Infix to postfix conversion, evaluation of postfix expression, infix to prefix, postfix to infix conversion.

Module-2

Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi. Queue: Definition, Representation, Queue Variants: Circular Queue, Priority Queue, Double Ended Queue; Applications of Queues. Programming Examples.

Module-3

Linked List:Limitations of array implementation, Memory Management: Static (Stack) and Dynamic (Heap) Memory Allocation, Memory management functions. Definition, Representation, Operations: getnode() and Freenode() operations, Types: Singly Linked List. Linked list as a data Structure, Inserting and removing nodes from a list, Linked implementations of stacks, Header nodes, Array implementation of lists.

Module-4

Introduction, Fundamentals of the Analysis of Algorithm Efficiency Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms.

Module-5

Brute Force: Selection Sort and Bubble Sort, Sequential Search, Exhaustive search and String Matching. Divide-and-Conquer Mergesort, Quicksort, Binary Search, Binary tree Traversals and related properties. Decrease-and-Conquer Insertion Sort, Depth First and Breadth First Search, Topological sorting. Greedy Technique Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.

Question Paper Pattern:
• The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Textbooks
1. Introduction to the Design and Analysis of Algorithms. AnanyLevitin, Pearson Education, 2nd Edition. 2. Programming in ANSI C, Balaguruswamy, McGraw Hill Education . 3. Data Structures Using C and C++ by YedidyahLangsam and Moshe J. Augenstein and Aaron M Tenanbanum, 2nd Edition, Pearson Education Asia, 2002. 4. Introduction to Data Structure and Algorithms with C++ by Glenn W. Rowe.

Operating System with UNIX			
Semester: I	**I**	**CIE Marks:**	**40**
Course Code:	**20MCA12**	**SEE Marks:**	**60**
Contact Periods (L:T:P):	**4-0-0**	**Exam Hours:**	**3**

Course Outcomes:

1. CO1:Analyse the basic Operating System Structure and concept of Process Management
2. CO2: Analyse the given Synchronization/ Deadlock problem to solve and arrive at valid conclusions.
3. CO3: Analyse OS management techniques and identify the possible modifications for the given problem context.
4. CO4:Demonstrate the working of basic commands of Unix environment including file processing
5. CO5: : Demonstrate the usage of different shell commands, variable and AWK filtering to the given problem

Module-1

Introduction to Operating Systems, Computer System Architecture; Operating System Operations; ; Operating System Structure: Operating System Services; System Calls; Types of System Calls; System Programs;; Virtual Machines; System boot.

Process Management Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling. Process Synchronization

Module-2
Deadlocks: System model; Deadlock Characterization, Methods for handling deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from deadlock. Memory Management: Memory Management Strategies: Background, Swapping; Contiguous Memory Allocation; Paging; Segmentation; Virtual Memory Management; Demand Paging; Page Replacement; Allocation of Frames; Thrashing.
Module-3
The File System: The File, What's in a File name? The Parent-Child Relationship, The HOME Variable: The Home Directory, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The Unix File System. The vi Editor: vi Basics, Input Mode, ex Mode and Command Mode.
Basic File Attributes: ls options, File Ownership, File Permissions, chmod, Directory Permissions, Changing the File Ownership More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links, The Directory, umask, Modification and Access Times, find. **The Shell:** The Shell's Interpretive Cycle, Shell Offerings, Pattern Matching-The Wild-cards, Escaping and Quoting, Redirection: The Three Standard Files, Two Special Files: /dev/null and /dev/tty, pipes, tee: Creating a Tee, Command Substitution**.**
Module-4
The Process: Process Basics, ps: Process Status, System Processes, Mechanism of Process Creation, Internal and External Commands, Running Jobs in Background, Killing Processes with Signals, Job Control, at and batch, cron.
Essential Shell Programming: Shell Variables, Environment Variables, Shell Scripts, read, Using Command Line Arguments, exit and exit status of command, The Logical Operators, The if Conditional, using test and [] to Evaluate Expression, The case Conditional, expr, while: looping, for: looping with a list, set and shift, trap, Debugging Shell Scripts with set – x.
Module-5
AWK and Advanced Shell Programming
Simple AWK Filtering, Splitting a Line into Fields, printf, the Logical and Relational Operators, Number Processing, Variables, The –f option, BEGIN and END positional Parameters, getline, Built-invariables, Arrays, Functions, Interface with the Shell, Control Flow. The sh command, export Command, Conditional Parameter Substitution, Merging Streams, Shell Functions, eval, Exec Statement and Examples
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Text books

1. Sumitabha Das: UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 8th Edition, Wiley – India.

References

1. UNIX: The Complete Reference: Kenneth Roson et al, Osborne/McGraw Hill, 2000.
2. Using UNIX: Steve Montsugu, 2ndEdition, Prentice Hall India, 1999.
3. UNIX and Shell Programming: M G Venkateshmurthy, Pearson Education Asia, 2005
4. Behrouz A Forouzan and Richard F Gilberg
5. 4.D M Dhamdhere: Operating Systems – A Concept Based Approach, 2nd Edition, Tata McGraw – Hill, 2002.
6. P C P Bhatt: Operating Systems, 2ndEdition, PHI, 2006.
7. 6. Harvey M Deital: Operating Systems, 3rdEdition, Addison Wesley, 1990.

Computer Networks Choice Based Credit System

Semester: I	CIE Marks:40
Course code:20MCA13	SEE Marks:60
Contact Hours (L: T:P):4-0-0	Exam Hours:03

Course Outcomes: At the end of the course, the student will be able to

1. CO1: Apply the basic concepts of networking and to analyse different parameters such as bandwidth, delay, throughput of the networks for the given problem.
2. CO2: Apply different techniques to ensure the reliable and secured communication in wired and wireless communication
3. CO3: Analyse the networking concepts of TCP/IP for wired and wireless components
4. CO4: Identify the issues of Transport layer to analyse the congestion control mechanism
5. CO5: Design network topology with different protocols and analyse the performance using NS2

Module-1

Applications, Requirements, Network Architecture, Implementing Network Software, Performance.

Module-2

Perspectives on Connecting, Encoding (NRZ, NRZI, Manchester, 4B/5B), Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks (802.3), Wireless.

Module-3

Internetworking and Advanced Internetworking Switching and Bridging, Basic Internetworking (IP), Routing, The Global Internet, Routing among Mobile Devices.

Module-4

End-to-End Protocols and Congestion Control Simple Demultiplexer (UDP), Reliable Byte Stream (TCP), Queuing Disciplines, TCP Congestion Control, Congestion-Avoidance Mechanisms.

Module-5
Network Security and Applications   Cryptographic Building Blocks, Key Pre-distribution, Firewalls, Traditional Applications, Infrastructure Services.

Question Paper Pattern:
• The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Text books
1. " Computer Networks A Systems Approach" by Larry L Peterson and Bruce S Davie, 5th Edition, MKP – 2012 – (1, 2 ,3.1,3.2,3.3, 3.4,4.1, 5.1,5.2 , 6.2,6.36.4, 8.1,8.2,8.5, 9.1,9.3)
References
1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009. 2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010. 3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011. 4. Behrouz A. Forouzan, "Data Communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

Mathematical Foundation for Computer Applications	
Choice Based Credit System	
Semester: I	CIE Marks:40
Course Code:20MCA14	SEE Marks:60
Contact Hours(L: T:P)::3-2-0	Exam Hours:03
Course Outcomes: At the end of the course student will be to 1. CO1: Apply the fundamentals of set theory and matrices for the given problem. 2. CO2: Apply the types of distribution, evaluate the mean and variance for the given case study/ problem. 3. CO3: solve the given problem by applying the Mathematical logic concepts 4. CO4: Model the given problem by applying the concepts of graph theory. 5. CO5: Design strategy using gaming theory concepts for the given problem. 6. CO6: Identify and list the different applications of discrete mathematical concepts in computer science.	
Module-1	
Set Theory and Matrices	

Sets, Operations on sets, Cardinality of sets, inclusion-exclusion principle, pigeonhole principle, matrices, finding Eigen values and Eigen vectors.
Module-2
Mathematical Logic Propositional Logic, Applications of Propositional Logic, Propositional Equivalences Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs
Module-3
Relations Relations and Their Properties, n-ary Relations and Their Application, Representing Relations, Closures of Relations,Equivalence Relations, Partial Orderings
Module-4
Random variable and probability distribution Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and co-variance and co-variance of random variables. Binomial and normal distribution, Exponential and normal distribution with mean and variables and problems
Module-5
Graph Theory Graphs and Graphs models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Text book
1. Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill publications, 7th edition. (Chapters 2.1,2.2,2.5, 2.6,6.2,8.5,8.6,10.1 to 10.8) 2. Wolpole Myers Ye "Probability and Statistics for engineers and Scientist" Pearson Education, 8th edition.
References
1. 1.Richard A Johnson and C.B Gupta "Probability and statistics for engineers" Pearson Education. 2. 2.J.K Sharma "Discrete Mathematics", Mac Millian Publishers India, 3rd edition,2011.

Research Methodology and IPR Choice Based Credit System	
Semester: I	CIE Marks:40
Course Code:20MCA15	SEE Marks:60
Contact Hours (L: T:P):2:2:0	Exam Hours:03

Course Outcomes: At the end of the course students will be able to

1. CO1: Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem.
2. CO2: Carry out literature survey, define the problem statement and suggest suitable solution for the given problem and present in the format of the research paper (IEEE).
3. CO3: Analyse the problem and conduct experimental design with the samplings.
4. CO4:Perform the data collection from various sources segregate the primary and secondary data
5. CO5: Apply some concepts/section of Copy Right Act /Patent Act /Cyber Law/ Trademark to the given case and develop –conclusions

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Module-2

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Module-3

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs

Module-4

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of

Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Module-5

Intellectual Property (IP) Acts:Introduction to IP: Introduction to Intellectual Property (IP), different types of IPs and its importance in the present scenario, Patent Acts: Indian patent acts 1970.Design Act: Industrial Design act 2000. Copy right acts: Copyright Act 1957. Trade Mark Act, 1999

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Text books

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.
2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011 Study Material.
3. Intelectual property, Debirag E. Bouchoux, Cengage learning, 2013.

References

1. 1.Research Methods: the concise knowledge base   Trochim, Atomic Dog Publishing, 2005.
2. 2.Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.

Data Structures with Algorithms Lab

Semester: II	CIE Marks: 40
Course Code:20MCA16	SEE Marks:60
Contact Hours (L:T:P): 0:0:4	Exam Hours:03

Course Outcomes: At the end of the course, Students will be able to

1. CO1: Implement sorting / searching techniques, and validate input/output for the given problem.
2. CO2: Implement data structures (namely Stacks, Queues, Circular Queues, Linked Lists, and Trees), its operations and algorithms.
3. CO3: Implement the algorithm to find whether the given graph is connected or not and conclude on the performance of the technique implemented.
4. CO4: Design and apply appropriate data structures for solving computing problems
5. CO5: Implement the techniques for evaluating the given expression.

1.	Write a C program to Implement the following searching techniques a. Linear Search b. Binary Search.
2.	Write a C program to implement the following sorting algorithms using user defined functions: a. Bubble sort (Ascending order) b. Selection sort (Descending order).
3.	Write a C Program implement STACK with the following operations a. Push an Element on to Stack b. Pop an Element from Stack
4.	Implement a Program in C for converting an Infix Expression to Postfix Expression.
5.	Implement a Program in C for evaluating an Postfix Expression.
6.	Write a C program to simulate the working of a singly linked list providing the following operations: a. Display & Insert b. Delete from the beginning/end c. Delete a given element
7.	Obtain the Topological ordering of vertices in a given graph with the help of a c programming.
8.	Check whether a given graph is connected or not using DFS method using C programming.
9.	From a given vertex in a weighted connected graph, find shortest paths to other vertices Using Dijkstra's algorithm (C programming)
10.	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm (C programming)

Unix Programming Lab	
Choice Based Credit System	
Semester:I	CIE Marks:40
Course Code: 20MCA17	SEE Marks:60
Contact Hours (L: T:P): 0:0:4	Exam Hours:03

Course Outcomes: At the end of the course students will be able to

1. CO1:Demonstrate the working of basic commands of Unix environment including file processing
2. CO2: Apply Regular expression to perform pattern matching using utilities like grep,sed and awk.
3. CO3: Implement unix commands/ system calls to demonstrate process management
4. CO4: Demonstrate the usage of different shell commands, variable and AWK filtering to the given problem.
5. CO5:Develop shell scripts for developing the simple applications to the given problem.

Laboratory Experiments:

(a) Explore Unix Environment.
(b) Explore vi- editor with Vim tutor. Perform the following operations using vi editor, but not limited to:
1. Insert character, delete character, replace character.
2. Save File and continue working.
3. Save File and exit editor.
4. Quit the editor.
5. Quit without saving the file.
6. Rename a file.
7. Insert lines, delete line.
8. Setline numbers.
9. Search for a pattern.
10. 10. Move forward and backward.

1a. Write a shell script that takes a valid directory name as a argument recursively descend all the sub-directors, find the maximum length of any file in that hierarchy and writ the maximum value to the standard output.

1b. Write a shell script that accepts a path name and creates all the components in that path name as directories. For example, if the script is named as mpc, then the command mpc a/b/c/d should create sub-directories a, a/b, a/b/c, a/b/c/d.

2a. Write a shell script that accepts two filenames as arguments, checks if the permissions for these files are identical and if the permissions are identical, output common permissions otherwise output each filename followed by its permissions.

2b. Write a shell script which accepts valid log-in names as arguments and prints their

corresponding home directories, if no arguments are specified, print a suitable error message.

3a. Create a script file called file properties that reads a filename entered and outputs it properties.

3b. Write a shell script to implement terminal locking (Similar to the lock command). It should prompt for the user for a password. After accepting the password entered by the user, it must prompt again for the matching password as confirmation and if match occurs, it must lock the keyword until a matching password is entered again by the user. Note the Script must be written to disregard BREAK, control-D. No time limit need be implemented for the lock duration.

4a. Write a shell script that accept one or more file names as argument and convert all of them to uppercase, provided they exists in current directory.

4b. Write a shell script that displays all the links to a file specified as the first argument to the script. The second argument, which is optional, can be used to specify in which the search is to begin. If this second argument is not present, the search is to begin in the current working directory. In either case, the starting directory as well as its subdirectories at all levels must be searched. The script need not include error checking.

5a. Write a shell script that accepts filename as argument and display its creation time if file exist and if does not send output error message.

5b. Write a shell script to display the calendar for the current month with current date replaced by * or ** depending whether the date is one digit or two digit.

6a. Write s a shell script to find a file/s that matches a pattern given as command line argument in the home directory, display the contents of the file and copy the file into the directory ~/mydir.

6b. Write a shell script to list all the files in a directory whose filename is at least 10 characters. (use expr command to check the length).

7a. Write a shell script that gets executed and displays the message either "Good Morning" or "Good Afternoon" or "Good Evening" depending upon time at which the user logs in.

7b. Write a shell script that accepts a list of filenames as its argument, count and report occurrence of each word that is present in the first argument file on other argument files.

8a. Write a shell script that determine the period for which as specified user is working on a system and display appropriate message.

8b. Write a shell script that reports the logging on of as specified user within one minute after he/she login. The script automatically terminates if specified user does not login during

specified in period of time.

9a. Write a shell script that accepts the filename, starting and ending line number as an argument and display all the lines between the given line number.

9b. Write a shell script that folds long lines into 40 columns. Thus any line that exceeds 40 characters must be broken after 40th, a "/" is to be appended as the indication of folding and processing is to be continued with the residue. The input is to be supplied through a text file created by the user.

10a. Write an awkscript that accepts date argument in the form of dd-mm-yy and display it in the form month, day and year. The script should check the validity of the argument and in the case of error, display a suitable message.

10b. Write an awkscript to delete duplicated line from a text file. The order of the original lines must remain unchanged.

11a. Write an awk script to find out total number of books sold in each discipline as well as total book sold using associate array down table as given below.

Electrical   34

Mechanical   67

Electrical   80

Computer Science 43

Civil   98

Mechanical   65

Computer Science 64

11b. Write an awkscript to compute gross salary of an employee accordingly to rule given below.

If basic salary < 10000 then HRA=15% of basic & DA=45% of basic.

If basic salary is >=1000 then HRA=20% of basic & DA=50% of basic.

Computer Networks Lab	
Choice Based Credit System	
Semester:I	CIE Marks:40
Course Code:**20MCA18**	SEE Marks:60
Contact Hours(L:T:P):0:0:4	Exam Hours:03

Course Outcomes: At the end of the course, the students will be able to

1. CO1: Apply the basic concepts of networking and to analyse different parameters such as bandwidth, delay, throughput of the networks for the given problem.
2. CO2:Apply different techniques to ensure the reliable and secured communication in wired and wireless communication
3. CO3:Analyse the networking concepts of TCP/IP for wired and wireless components
4. CO4:Identify the issues of Transport layer to analyse the congestion control mechanism
5. CO5:Design network topology with different protocols and analyse the performance using any simulator

PART-A

Implement the following Computer Networks concepts using C/C++

1. Write a program for distance vector algorithm to find suitable path for transmission.

2. Using TCP/IP sockets, write a client-server program to make the client send the file name and to make the server send back the contents of the requested file if present.

3. Write a program for Hamming code generation for error detection and correction.

4. Write a program for congestion control using leaky bucket algorithm.

PART-B

(Simulate the following Computer Networks concepts using any network simulators)

1. Simulate a three nodes point — to — point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.

2. Simulate the network with five nodes n0, n1, n2, n3, n4, forming a star topology. The node n4 is at the centre. Node n0 is a TCP source, which transmits packets to node n3 (a TCP sink) through the node n4. Node n1 is another traffic source, and sends UDP packets to node n2 through n4. The duration of the simulation time is 10 seconds.

3. Simulate to study transmission of packets over Ethernet LAN and determine the number of packets drop destination.

4. **Simulate working of multicasting routing protocol and analyse the throughput of the network/protocol.**

5. Simulate the different types of internet traffic such as FTP and TELNET over a wired network and analyze the packet drop and packet delivery ratio in the network.

Note 1: In the practical exam student has to execute one program from part-A and one from part-B(equal weightage of marks). For simulation of Part B problems any network simulator (either Graphical user interface or script based)can be used.

Bridge Course: Basics of Programming and Computer Organisation

Choice Based Credit System

Semester: I	CIE Marks:40
Course Code: 20MCA19-BC	SEE Marks:60
Contact Hours(L:T:P): 2: 2:0	Exam Hours:03

Course Outcomes: At the end of the course students will be able to
1. CO1: Demonstrate the key concepts introduced in C programming by writing and executing the programs.
2. CO2: Demonstrate the concepts of structures and pointers for the given application/problem.
3. CO3: Implement the single/multi-dimensional array for the given problem.
4. CO4: Demonstrate the application of logic gates in solving some societal/industrial problems.
5. CO5: Analyse how memory organization, operations, instruction sequencing and interrupts are useful in executing the given program.

Module-1

C Programming: decision making, control structures and arrays

C Structure, Data Types, Input-Output Statements, Decision making with if statement, simple if statement, the if..else statement, nesting of if..else statements, the else.if ladder, the switch statement, the ?: operator, the goto statement, the break statement, programming examples. The while statement, the do...while statement, the for statement, nested loops, jumps in loops, the continue statement, programming examples. One dimensional and two dimensional arrays, declaration and initialization of arrays, reading, writing and manipulation of above types of arrays.

Module-2

Structures

Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, operations on individual members, array of structures, structures within structures, structures and functions, Unions, size of structures.

Module-3

Pointers

Pointers in C, Declaring and accessing pointers in C, Pointer arithmetic, Functions , Call by value, Call by reference, Pointer as function arguments, recursion, Passing arrays to functions, passing strings to functions, Functions returning pointers, Pointers to functions, Programming Examples

Module-4

Binary Systems and Combinational Logic

Digital Computers and Digital Systems, Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers, subtraction using r's and r-1 complements, Binary Code, Binary Storage and Registers, Binary Logic, Integrated Circuits, Digital Logic Gates

Module-5

Basic Structure of Computer Hardware and Software

Computer Types, Functional Units, Basic Operational Concepts, Bus structure, Software, Performance, Multiprocessing and Multi computers, Machine Instruction: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Interrupts.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1. Programming in ANSI C,Balaguruswamy, 7th Edition, McGraw Hill Education

2.C : The Complete Reference, Herbert Schild,4th Edition, McGraw Hill Education

3. Let us C, YashwantKanetkar, BPB Publications

4.M.Morris Mano, "Digital Logic and Computer Design", Pearson, 2012.

5.Carl Hamacher, ZvonkoVranesicSafwatZaky, "Computer Organization", 5th edition, Tata McGraw-Hill, 2011

Database Management System	
Choice Based Credit System	
Semester: II	CIE Marks:40
Course Code: 20MCA21	SEE Marks: 60
Contact Hours(L:T:P): 3:0:0	Exam Hours:03
Course Outcomes: At the end of the course students will be able to 1. CO1: Apply the basic concepts of database management in designing the database for the given problem. 2. CO2: Design entity-relationship diagrams to the given problem to develop database application with appropriate fields and validations. 3. CO3: Implement a database schema for the given problem domain.	

4. CO4: Formulate and execute SQL queries to the given problem. 5. CO5: Apply normalization techniques to improve the database design to the given problem.

Module-1
Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, A Brief History of Database Applications, Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, the database system environment, Centralized and client-server architectures, Classification of Database Management systems.

Module-2
Structure of Relational Databases, Database Schema, Keys, Relational Query Languages, Relational Operations. Entity-Relationship Model: Conceptual Database using high level conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets Attributes and Keys Relationship types, Relationship Sets Functional Dependencies, Normal Forms based on Primary

Module-3
SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, Insert, update and delete statements in SQL, aggregate functions in SQL, group by and having clauses.

Module-4
Introduction to triggers in SQL, views in SQL, schema change statements in SQL, stored procedures and functions.

Module-5
Introduction to transaction processing, transaction and system concepts, desirable properties of transactions, transaction support in SQL. Concurrency control techniques: two-phase locking techniques, concurrency control based on timestamp ordering, multiversion concurrency control techniques, validation concurrency control techniques. Recovery techniques: recovery concepts, recovery in multidatabase systems, database backup and recovery from catastrophic failures.

Question Paper Pattern:
    • The Question paper will have TEN questions
    • Each full question will be for 20 marks
    • There will be 02 full questions (with maximum of four sub questions) from each module.
    • Each full question will have sub questions covering all the topics under a module.
    • The students will have to answer FIVE full questions, selecting one full question from

each module.	

Text Books

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Addison -Wesley, 2011.
2. Silberschatz, Korth and Sudharshan Data base System Concepts, 6th Edition, Tata McGraw Hill, 2011.

References

1. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson education, 2009.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

Object Oriented Programming with Java

Choice Based Credit System(CBCS)

Semester: I	**CIE Marks:40**
Course Code:20MCA22	**SEE Marks:60**
Contact Periods (L:T:P):3-0-0	**Exam Hours:03**

Course Outcomes:

1. CO1: Demonstrate the basic programming constructs of Java and OOP concepts to develop Java programs for a given scenario.
2. CO2: Illustrate the concepts of generalization and run time polymorphism applications to develop reusable components.
3. CO3: Demonstrate the usage of Packages, Interfaces, Exceptions and Multithreading in building given applications.
4. CO4: Apply Enumerations, Wrappers, Auto boxing, Collection framework and I/O operations for effective coding to the given problem.
5. CO5: Implement the concepts of Applets, and networking using Java network classes for developing the distributed applications to the given problem.

Module-1

Java Programming Fundamentals

The Java Language, The Key Attributes of Object-Oriented Programming, The Java Development Kit, A First Simple Program, The Java Keywords, Identifies in Java, The Java Class Libraries.

Introducing Data Types and Operators

Java's Primitive Types, Literals, A Closer Look at Variables, The Scope and Lifetime of Variables, operators, Shorthand Assignments, Type conversion in Assignments, Using Cast.

Program Control Statements

Input characters from the Keyword, if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Use break,

Use continue, Nested Loops.

Introducing Classes, Objects and Methods

Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, Parameterized Constructors, The new operator Revisited, Garbage Collection and Finalizers, The this Keyword.

More Data Types and Operators

Arrays, Multidimensional Arrays, Alternative Array Declaration Syntax, Assigning Array References, Using the Length Member, The For-Each Style for Loop, Strings,

String Handling

String Fundamentals, The String Constructors, Three String-Related Language Features, The Length() Method, Obtaining the characters within a string, String comparison, using indexOf() and lastIndexOf(), Changing the case of characters within a string, StringBuffer and String Builder.

Module-2

A Closer Look at Methods and Classes:

Controlling Access to Class Members, Pass Objects to Methods, How Arguments are passed, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, Varargs: Variable-Length Arguments.

Inheritance:

Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When are Constructors Executed, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why Overridden Methods, Using Abstract Classes, Using final, The Object Class.

Module-3

Interfaces

InterfaceFundamentals,CreatinganInterface,Implementingan Interface,Using InterfaceReferences,ImplementingMultipleInterfaces,Constantsin Interfaces, Interfacescanbeextended,NestedInterfaces,FinalThoughtsonInterfaces.

Packages

Package Fundamentals, Packages andMember Access, Importing Packages, Static Import

ExceptionHandling

TheExceptionHierarchy,ExceptionHandlingFundamentals,The Consequencesof an Uncaught Exception, Exceptions Enable you to handle errors gracefully, using Multiple catch clauses, Catching subclass Exceptions, try blocks can be nested, ThrowinganException,A

CloserlookatThrowable,usingfinally,usingthrows,Java's Built-inExceptions,NewExceptionfeaturesaddedbyJDK7, CreatingException Subclasses.	

Module-4

MultithreadedProgramming

Multithreadingfundamentals,The ThreadClassandRunnableInterface,Creating Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities,Synchronization,using SynchronizationMethods,TheSynchronized Statement,ThreadCommunicationusingnotify(),wait()and notifyAll(),suspending, ResumingandstoppingThreads.

Enumerations,AutoboxingandAnnotations

Enumerations, Java Enumeration are class types, The Values() and Valueof() Methods,Constructors,methods,instancevariablesand enumerations,Autoboxing, Annotations(metadata)

Module-5

NetworkingwithJava.net

Networkingfundamentals, TheNetworkingclassesandInterfaces,TheInetAddressclass,The SocketClass,TheURLclass,TheURLConnectionClass,The HttpURLConnectionClass.

The collections Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1.JavaFundamentals,AcomprehensiveIntroductionbyHerbertSchildt,DaleSkrien.TataMcGrawHill Edition2013.(Chapters:1,2,3,4,5,6,7,8,9,10,11,12,13,15,22,23,24,25,26)

2. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. (Chapter 17)

References

1.JavaProgrammingbyHariMohanPandey,PearsonEducation,2012.

2.Java6 Programming,BlackBook,KoGenT, DreamtechPress,2012.

3.Java2Essentials,CayHortsmann,secondedition,Wiley

Web Technologies

Choice Based Credit System

Semester: II	CIE Marks:40
Course Code:20MCA23	SEE Marks:60
Contact Hours(L:T:P): 4:0:0	Exam Hours:03

Course outcomes

1. CO1: Apply the features JQuery for the given web based problem.
2. CO2: Demonstrate the development of XHTML documents using JavaScript and CSS.
3. CO3: Illustrate the use of CGI and Perl programs for different types of server side applications.
4. CO4: Design and implement user interactive dynamic web based applications.
5. CO5:Demonsrtae applications of Angular JS and JQuery for the given problem

Module-1

Web browsers, web servers, MIME, URL, HTTP Introduction to XHTML5 tags, Basic syntax and structure, text markups, images, lists, tables,progress, Media tags-audio and video ,forms, frames.

Module-2

Introduction to CSS, Levels of CSS, Selectors, Font, color and Text Properties, BOX Model, Span and Div tags. Introduction to Javascript, controls statements, Arrays and functions, pattern matching, Element Access, Event Handling.

Module-3

Introduction to Bootstrap, First example, containers, Bootstrap elements: colors, tables, images, buttons, button groups, progress bars, Forms, utilities, Classes, alerts, custom forms, Grid System.

Module-4

Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS.

Module-5

Introduction to Angular JS, Directives, Expressions, Directives, Controllers, Filters, Services, Events, Forms, Validations, Examples.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks

- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1. **Web Programming By Chris Bates , Wiley Publications**
2. **HTML5 Black Book by Dreamtech**
3. **Angular JS By Krishna Rungta**
4. **Bootstrap essentials by Snig by Packt-open source**

Software Engineering

Choice Based Credit System

Semester:II	CIE Marks:40
Course Code:20MCA24	SEE Marks:60
Contact Hours(L:T:P): 3:2:0	Exam Hours:03

Course Outcomes: Students will be able to

CO1: Identify and define different requirements for the given problem and present in the IEEE format.

CO2: Use modern tool to create dynamic diagrams to represent the design for the given problem.

CO3: Draw class diagram , analyse the different types of association that exists as per the given problem and represent them using UML notations.

CO4: Analyse the given system to identify actors, use cases to design use case diagrams for the given problem using RSA/open source tool.

CO5: Design the static/dynamic models to meet application requirements of the given system and generate code (skeleton) using the modern tool.

Module-1

Introduction: Professional Software Development Attributes of good software, software engineering diversity, IEEE/ACM code of software engineering ethics, case studies.

Software Process and Agile Software Development

Software Process models: waterfall, incremental development, reuses oriented, Process activities; coping with change, The Rational Unified Process. Agile Methods, Plan-Driven and Agile Development, Extreme Programming, Agile Project Management, scaling agile

methods.

Module-2

Requirement Engineering: Functional and non-functional requirements, The Software requirements document, Requirements specification, Requirements engineering processes, Requirement elicitation and analysis, Requirement validation, Requirement management.

Module-3

What is object orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modelling history, modeling as design Technique: Modelling; abstraction; the three models. Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips. Advanced objects and class concepts; Associations ends; N-array association; Aggregation, Abstract class; Multiple inheritance; Metadata; Reification; Constraints; Derived data; packages; practical tips.

Module-4

State modelling: Events, States, Transitions and Conditions; State Diagram; State diagram behaviour; Practical tips. Advanced State Modeling: Nested state diagram; Nested states; Signal generalization; Concurrency; A sample state model, Relation of class and state models; practical. Interaction modelling: Use Case models, Sequence models, Activity models, Use case relationships; Procedural sequence models, special constructs for activity models.

Module-5

Project Design and planning:

Process planning, Effort estimation, project scheduling and staffing, Software configuration Management plan, Quality plan, Risk Management, Project Monitoring plan Design: Design concepts, Function oriented design, detailed design, verification, Metrics.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education Ltd, 2011

2. Pankaj Jalote, Software Engineering, Wiley India Pvt Ltd (2010) Paul C Jorgensen Software Testing A CraftMan's Approach, 2nd edition, CRC Press.

3. MichelBlaha, James Rumbaugh: Object-Oriented Modelling and Design with UML, 2nd edition, Pearson, 2007.

References
1. Stephan R. Schach, "Object oriented software engineering", Tata McGrawHill,2008
2. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education,2005.

Cyber Security
Choice Based Credit System

Semester:II	CIE Marks:40
Course Code:20MCA251	SEE Marks:60
Contact Hours(L:T:P):3:0:0	Exam Hours:03

Course Outcomes: At the end of the course students will be able to

CO1: Apply IT ACT (Cyber law) to the given case/problem and infer from the given case and analyze the gap if exists.

CO2: Analyze the working of cyber security principles in designing the system.

CO3: Analyze the given problem (cybercrime, vulnerability, threat), develop a strategy (physical, logical or administrative controls) to mitigate the problem and articulate consequences on Society and National Economy.

CO4: Examine relevant network defence / web application tool to solve given cyber security problem and evaluate its suitability.

CO5: Evaluate provisions available in Indian cyber law to handle infringement of intellectual property rights that happens on the cyber platform.

Module-1
Introduction to Cybercrime and Laws
Introduction, Cybercrime: Definition and Origins of the word, Cybercrime and information Security, Who are Cybercriminals? Classifications of Cybercrimes. How Criminals Plan Them – Introduction, How Criminals Plan the Attacks, Cybercafé and Cybercrimes, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.
Module-2
Tools and Methods used in Cybercrime
Introduction, Proxy Server and Anonymizers, Password Cracking, Key loggers and
Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQLinjection, Buffer Overflow.
Module-3

Phishing and Identity Theft

Introduction, Phishing – Methods of Phishing, Phishing Techniques, Phishing Toolkits andSpy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Module-4

Cybercrime: Mobile and Wireless devices, Introduction, proliferation of mobile and wireless devices, Trends in Mobility, credit card frauds in Mobile and wireless computing, Attacks on Mobile/cell phones.

Module-5

Network Defense tools and block chain technology

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Intrusion Detection System, introduction to block chain technology (definition, tools used for implementation) and its applications.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

Text Books:
1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill. (Chapters: 2, 7, 8, 11)
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina
Godbole and SunitBelpure, Publication Wiley. (Chapters: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.5, 2.6, 2.7, 6.4,
5.2.1, 5.2.2, 5.2.5, 5.3.1, 5.3.2, 5.3.3, 4.2,
4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11)

References

1. Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
2. Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cyber securityCRCPress
3. Bill Nelson, Amelia Phillips, Christopher Steuart - Guide to Computer Forensics and InvestigationsCengage Learning

DataMining with Business Intelligence	
Choice Based Credit System	
Semester:II	CIE Marks:40
Course Code:20MCA252	SEE Marks:60
Contact Hours(L:T:P):3:0:0	Exam Hours:03

Course Outcomes: At the end of the course, students will be able to

CO1: Analyse the concept of data warehouse, Business Intelligence and OLAP

CO2: Demonstrate data pre-processing techniques and application of association rule mining algorithms

CO3: Apply various classification algorithms and evaluation of classifiers for the given problem

CO4: Analyse data mining for various business intelligence applications for the given problem

CO5: Apply classification and regression techniques for the given problem.

Module-1

Overview and concepts Data Warehousing and Business Intelligence:

Why reporting and Analysing data, Raw data to valuable information-Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing.

The Architecture of BI and DW

BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations.

Module-2

Introduction to data mining (DM):

Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process

Data Pre-processing:Why to pre-process data? - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.

Module-3
Concept Description and Association Rule Mining
What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm – Incremental ARM – Associative Classification – Rule Mining.
Module-4
Classification and prediction:
What is classification and prediction? – Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression. Introduction of tools such as DB Miner /WEKA/DTREG DM Tools.
Module-5
Data Mining for Business Intelligence Applications:
Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., Data Analytics Life Cycle: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.
Question Paper Pattern: - The Question paper will have TEN questions   - Each full question will be for 20 marks   - There will be 02 full questions (with maximum of four sub questions) from each module.   - Each full question will have sub questions covering all the topics under a module.   - The students will have to answer FIVE full questions, selecting one full question from each module.
Textbook
1. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 2. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc. 3. PaulrajPonnian, "Data Warehousing Fundamentals", John Willey. 4. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education. 5. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", Wiley India

Enterprise Resource Planning	
Choice Based Credit System	
Semester: II	CIE Marks:40
Course Code:20MCA253	SEE Marks:60
Contact Hours (L: T:P): 3:0:0	Exam Hours:03

Course Outcomes: At the end of the course students will be able to

CO1: Analyse the essentials of supply chain management in ERP.

CO2: Analyse the implementation of ERP in the context of business of the different organization.

CO3: Analyse and apply ERP for different business modules for the given problem.

CO4: Analyse the given case study of ERP marketing.

CO5: Analyse the design of ERP with future E-commerce and internet.

Module-1

Introduction to Supply Chain Management: Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing – pricing.

Module-2

ERP Implementation: Implementation of Life Cycle, Implementation Methodology, Hidden Costs, Organizing Implementation, Vendors, Consultants and Users, Contracts, Project Management and Monitoring

Module-3

Business Modules: Business Modules in an ERP Package, Finance, Manufacturing, Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution

Module-4

ERP Market: ERP Market Place, SAP AG, People Soft, Baan Company, JD Edwards World Solutions Company, Oracle Corporation, QAD, System Software Associates.

Module-5

ERP–Present And Future: Turbo Charge the ERP System, EIA, ERP and E–Commerce, ERP and Internet, Future Directions in ERP.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1. Sunil Chopra and Peter Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson/PHI, 3rd Edition, 2007

2. Alexis Leon, "ERP Demystified", Tata McGraw Hill, 1999.

3. Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, "Concepts in Enterprise Resource Planning", Thomson Learning, 2001.

Reference

1.Vinod Kumar Garg and N.K .Venkata Krishnan, "Enterprise Resource Planning   concepts and Planning", Prentice Hall, 1998.

2. Jose Antonio Fernandz, " The SAP R /3 Hand book", Tata McGraw Hill

User Interface Design **Choice Based Credit System**	
Semester: II	CIE Marks:40
Course code:20MCA254	SEE Marks:60
Contact Hours (L:T:P): 3:0:0	Exam Hours:3
Course Outcomes: At the end of the course, students will be able to CO1:Analyse the new technologies that provide interactive devices and interfaces. CO2: Apply the guidelines to develop the UID and evaluate for the given problem. CO3: Apply the development methodologies with an analysis of the social impact and legal issuesUnderstand Direct Manipulation and Virtual Environment CO4: Discuss the command, natural languages and issues in design for maintaining QoS CO5: Demonstrate techniques for information search and visualization for the given problem.	
Module-1	

Introduction Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Goals for our profession. Guideline, principles, and theories: Introduction, Guidelines, principles, Theories.
Module-2
Development Processes Managing Design Processes: Introduction, Organizational Design to support Usability, The Four Pillars of Design, Development methodologies: Ethnographic Observation, Participatory Design, Scenario Development, Social Impact statement for Early Design Review, Legal Issues.   **Evaluating Interface Design** Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments
Module-3
Direct Manipulation and Virtual Environments: Introduction, Examples of Direct Manipulation, Discussion of direct manipulation, 3D Interfaces, Tele-operation, Virtual and Augmented Reality Menu Selection, Form Filling and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry With Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays
Module-4
Command and Natural Languages Introduction, Command-organization functionality strategies and structure, Naming and Abbreviations, Natural Language in computing. Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory interfaces, Displays-Small and Large   **Design Issues** Quality of Service: Introduction, Models of Response-Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response time, Frustrating Experiences Balancing Function and Fashion: Introduction, Error Messages, Nonanthropomorphic Design, Display design, web page design, Window Design, Color
Module-5

User Documentation and Online Help :

Introduction, Online versus paper documentation, Reading from paper versus Displays, Shaping the content of the Manuals, Accessing the Documentation, Online Tutorials and animated demonstrations, Online Communities for User Assistance, The Development Process.

Information Search and Visualization

Introduction, Search in Textual Documents and Database Querying, Multimedia document searches, Advanced filtering and Search Interfaces, Information Visualization: Introduction, Data tyoe by task taxonomy, Challenges for information visualization.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1.BenShneiderman, Plaisant, Cohen, Jacobs: Designing the User Interface, 5th Edition, Pearson ,Education, 2010.

References

1 Alan Dix, Janet Finalay, Gregory D AbiwdmRusselBealel: Human-Computer Interaction, III Edition, Pearson , Education, 2008.
2 Eberts: User Interface Design, Prentice Hall, 1994
3 Wilber O Galitz: The Essential Guide to User Interface Design- An Introduction to GUI Design, Principles and Techniques, Wiley-Dreamtech India Pvt Ltd, 2011

Optimization Techniques	
Choice Based Credit System	
Semester: II	CIE Marks:40
Course Code: 20MCA255	SEE Marks:60
Contact Hours (L:T:P):3:0:0	Exam Hours:03
Course Outcomes: At the end of the course, students will be able to	

CO1: Apply problem solving techniques through OR approaches.

CO2: Formulate the problem using linear programming technique.

CO3: Analyze the optimal solution for the given problem by applying Transportation problems.

CO4: Analyze the strategies with different players through game theory approach.

CO5: Analyze the sequence of jobs to be executed by machines for the given problem.

Module-1
Linear programming problem(LPP): introduction, structure of linear programming model, advantages, general model of Linear programming problem(LPP), examples of LP formulation, graphical solutions of LP problem and Solution of LPP by simplex method:
Module-2
Linear programming problem(LPP):Artificial variables-two-phase method, Big M method. Duality in linear programming, formulation of dual linear programming and examples.
Module-3
Transportation and Assignment Problems: Mathematical model of transportation problem, methods of finding initial solution (Northwest corner rule, Least cost method, Vogel's approximation method), test for optimality in TP using MODI Method. Mathematical model of assignment problem, Hungarian method for solving assignment problem.
Module-4
Theory of games: introduction, two-person zero sum games, pure strategies (MinMax and MaxMin principles), mixed strategies. The rules of principles of dominance, algebraic method to solve games without saddle point, graphical methods to solve games.
Module-5
Network Analysis: PERT and CPM, Network construction anddetermination of critical path, Calculation of ES, EF, LS, LF, TF, FFand IF, Crashing of a project, Scheduling of a project and resourcelevelling.
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Text books
1. Operations Theory and Applications, J.K. Sharma, 5th edition, MacMillan publisher India(Chapter 1,2,3,4,5,910,11,12,20).

2. Operations Research S.D Sharma, Kedarnath, Ramnath and Co, 2002.	
References	
1. Operations Research – An Introduction Taha H A- Low price edition 7th edition,2006. 2. Introduction to operation Research, Hiller and Liberman, Mc GRawHill , 5th edition ,2001. 3. Operation Research, Prem Kumar Gupta, D S Heera, S Chand Pub., New Delhi, 2007.	

Cryptography and Network Security

Choice Based Credit System

Semester: II	CIE Marks:40
Course Code:20MCA261	SEE Marks:60
Contact Hours(L:T:P): 3:0:0	Exam Hours:03

Course Outcomes: At the of the course students will be able to

CO1: Apply encryption techniques for the given problem and analyse the results.

CO2: Design the Cipher technique and analyse the functioning of Cipher for the given problem.

CO3: Implement the Public and Private key based cryptography algorithms and investigate the results of algorithm based on output.

CO4: Design and implement the cryptographic algorithms using programming languages/ tools for the given problem/context.

CO5: Design the security planning for the given case study for data classification, access control and propose technical solution, and submit the detailed report with plagiarism check.

Module-1

Introduction:OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, model for Network Security.

Classical Encryption Technique: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Module-2

Data Encryption and advanced encryption techniques:

Block Ciphers, Data Encryption Standard and Advanced Encryption Standard

Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles and Modes of operation, Evaluation Criteria for AES, AES Cipher-Encryption and Decryption, Data Structure, Encryption Round.

Public Key Cryptography and Key Management: Principles of Public Key Cryptosystem, RSA algorithm, Key management, Diffie Hellman Key exchange.
Module-3
Message Authentication and Hash Function: Authentication Requirement, Authentication Functions, Message Authentication Code, Hash Functions, Digital Signatures, Digital Signature Standard. **Authentication Applications:** Kerberos, X.509 Authentication Service
Module-4
Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME **IP Security:**IP Security Overview;IP Security Architecture; Authentication Header; Encapsulating SecurityPayload; Combining Security Associations; Key Management.
Module-5
Web Security: Web security Considerations; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET). **System Security:**Intruders, Intrusion Detection, Firewall Design Principles- Characteristics, Types of Firewall and Firewall Configuration.
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Text books
1. William Stallings, "Cryptography and Network Security – Principles and Practices", 4th Edition, Pearson Education, 2009. (Chapters: 1, 2.1-2.3, 3.1,3.2,3.5, 5.1,5.2, 6.2, 9.1,9.2, 10.1,10.2, 11.1- 11.4, 13.1, 13.3, 14.1, 4.2, 15.1, 15.2, 16.1-16.6, 17.1-17.3, 18.1, 18.2, 20.1; Exclude the topic not mentioned in the syllabus)
References
1. Behrouz A. Forouzan and DebdeepMukhopadhyay: "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill, 2010. 2. AtulKahate, "Cryptography and Network Security" 2nd Edition TMH.

Artificial Intelligence

Choice Based Credit System

Semester: II	CIE Marks:40
Course Code:20MCA262	SEE Marks:60
Contact Hours (L: T:P): 3:0:0	Exam Hours:03

Course Outcomes: at the end of the course students will be able to:

CO1: Identify problems that are amenable to solution by AI methods.

CO2: Identify appropriate AI methods to solve a given problem.

CO3: Formalize a given problem in the language/framework of different AI methods.

CO4: Implement basic AI algorithms for the given problem.

CO5: Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.

Module-1

INTRODUCTION TO Al AND PRODUCTION SYSTEMS

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized productions system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.

Module-2

REPRESENTATION OF KNOWLEDGE

Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

Module-3

KNOWLEDGE INFERENCE

Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory.

Module-4

PLANNING AND MACHINE LEARNING

Basic plan generation systems – Strips -Advanced plan generation systems – K strips -

Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

Module-5

EXPERT SYSTEMS

Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Text books

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill- 2008. (Units-I,II,VI & V)

2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007. (Unit-III).

Reference books

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.

3. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.

4. http://nptel.ac.in

Mobile Applications Development	
Choice Based Credit System	
Semester: II	CIE Marks:40
Course Code:20MCA263	SEE Marks:60
Contact Hours(L:T:P):3:0:0	Exam Hours:03
Course Outcomes:	
CO1: Develop effective user interfaces that leverage evolving mobile devices	

CO2: Develop applications using software development kits (SDKs), frameworks and toolkits.
CO3: Implement suitable methods to integrate database and server-side technologies
CO4: Design and develop open source software based mobile application to the given problem.
CO5:Build and deploy competent mobile application to solve the societal/industrial problems.
Module-1
Introduction : Preliminary Considerations – Cost of Development – Importance of Mobile Strategies in the Business World – Effective use of Screen Real Estate – Understanding Mobile Applications: Understanding Mobile Applications Users – Understanding Mobile Information Design – Understanding Mobile Platforms – Using the Tools of Mobile Interface Design.
Module-2
Getting Started with Android Programming **What is Android – Obtaining the required tools– Anatomy of an Android Application – Components of Android Applications – Activities – Fragments – Utilizing the Action Bar**
Module-3
Android UI Design and Location Based Services **Views and View Groups – Basic Views – Fragments – Displaying Maps – Getting Location Data – Publishing for Publishing – Deploying APK Files**
Module-4
Android Messaging and Networking **SMS Messaging – Sending Email – Networking – Downloading Binary Data, Text files – Accessing Web Services – Performing Asynchronous Call – Creating your own services – Communicating between a service and an activity – Binding activities to services**
Module-5
Feedback and Oscillator Circuits **iOS – Obtaining the tools and SDK – Components of XCODE – Architecture of iOS – Building Derby App in iOS – Other useful iOS things – Windows Phone: Getting the tools you need – Windows Phone 7 Project** **Building Derby App in Windows Phone 7 – Distribution – Other useful Windows Phone Thing**
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each

	module.
	• Each full question will have sub questions covering all the topics under a module.
	• The students will have to answer FIVE full questions, selecting one full question from each module.

Text books
1. **Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", 1st Edition, 2012, ISBN: 978-1-118-20390-3**
2. **Wei-Meng Lee, "Beginning Android Application Development", Wiley 2011.**

References
1. Reto Meier, " Professional Android 4 Application Development ", Wrox Publications 2012.

Distributed Operating System
Choice Based Credit System

Semester: II	CIE Marks:40
Course Code:20MCA264	SEE Marks:60
Contact Hours(L:T:P):3:0:0	Exam Hours:03

Course Outcomes: At the end of the course, students will be able to:
CO1: Analyse design issues and different message passing techniques in DOS, distributed systems
CO2: Analyse RPC implementation and its performance in DOS
CO3: Analyse the major security issues associated with distributed systems and evaluate techniques available for increasing system security
CO3: Apply the concepts of distributed shared memory and resource management for the given problem/ case study.
CO4: Analyse distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors
CO5:Apply modification to the existing algorithms to improve the performance of DOS.

Module-1
Fundamentals: What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed

ComputingEnvironment(DCE).**Message Passing:** Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.
Module-2
Remote Procedure Calls: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC.
Module-3
Distributed Shared Memory: Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms
Module-4
Resource Management: Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach **Process Management:** Introduction, Process Migration, Threads.
Module-5
Distributed File Systems: Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Text books
1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.
References
1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013. 2. Ajay D. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008 3. SunitaMahajan, Seema Shan, " Distributed Computing", Oxford University

Press,2015

Natural Language Processing
Choice Based Credit System

Semester:II	CIE Marks:40
Course Code:20MCA265	SEE Marks:60
Contact Hours(L:T:P):3:0:0	Exam Hours:03

Course Outcomes:

CO1: Apply parsing technique to the given problem and verify the output and give valid conclusions

CO1: Illustrate the approaches to syntax and semantics in NLP.

CO3: Formulate solutions for a range of natural language components using existing algorithms, techniques and frameworks, including part-of-speech tagging, language modelling, parsing and semantic role labelling.

CO4. Evaluate NLP solutions of the given problem and arrive at valid conclusions.

CO5: Illustrate information retrieval techniques.

Module-1
Introduction, Morphology: Knowledge in Speech & Lang Processing, Ambiguity, Models & Algorithms, Language, Thought & Understanding, Some Brief History, The State of the Art & Near-Term Future, Summary Morphology and Finite State Transducers: Survey of English Morphology, Finite state Morphological Parsing, Lexicon-Free FST: The Porter Stemmer, Human Morphological Parsing, Summary, Combining FST Lexicon and Rules.

Module-2
N-Grams: Counting Words in Corpora, Simple N-Grams, Smoothing, Back off, Deleted Interpolation, N-Grams for Spelling and Pronunciation, Entropy, Summary. Word Classes and Part-of- Speech Tagging: English Word Classes, Tag sets for English, Part-of-Speech Tagging.

Module-3
Context-Free Grammars and Predicate Calculus for English: Constituency, Context-Free Rules and Trees, Sentence Level Constructions, Coordination, Agreement, The Verb Phrase Sub Categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence and Normal Form, Finite –State and Context- Free Grammars, Grammars and Human Processing, The Early Algorithm, Finite-State Parsing Method, Summary Representing Meaning:

Module-4
Semantic Analysis: Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Earley Parser, Idioms and Compositionality,

Robust Semantic Analysis, Summary. Lexical Semantics: Relations Among Lexemes and Their Senses, WordNet: A Database of Lexical Relations, The Internal Structure of Words, Creativity and the Lexicon, Summary Word Sense Disambiguation and Information

Module-5

Retrieval: Selection Restriction Based Disambiguation, Robust Word Sense Disambiguation, Information Retrieval, Other Retrieval Tasks, and Summary. Case Study of Simple Text Recognition or Content Based Text Extraction System. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Text books

1.DanielJurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2009.

References

1. Christopher D.Manning and HinrichSchutze, "Foundations of Statistical Natural LanguageProcessing", MIT Press, 1999.

2.TanveerSiddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

3.Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer Verlag London Limited 2007.

DataBase Management Systems Laboratory	
Choice Based Credit System	
Semester: II	CIE Marks:40
Course Code:20MCA27	SEE Marks :60
Contact Hours (L:T:P):0:0:4	Exam Hours:03

Course Outcomes: at the end of the course students will be able to

CO1: Design entity-relationship diagrams to solve given database applications

CO2: Implement a database schema for a given problem.

CO3: Formulate SQL queries in Oracle for the given problem.

CO4: Apply normalization techniques to improve the database design for the given problem.

CO5: Build database and verify for its appropriate normalization for any given problem

Instructions for the Exercises:

1. Draw ER diagram based on given scenario with various Constraints.

2. Create Relational Database Schema based on the scenario using Mapping Rules.

3. Perform the given queries using any RDBMS Environment.

4. Suitable tuples have to be entered so that queries are executed correctly.

5. The results of the queries may be displayed directly.

1. Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries.

BRANCH (Branchid, Branchname, HOD)

STUDENT (USN, Name, Address, Branchid, sem)

BOOK (Bookid, Bookname, Authorid, Publisher, Branchid)

AUTHOR (Authorid, Authorname, Country, age)

BORROW (USN, Bookid, Borrowed_Date)

Execute the following Queries:

i.List the details of Students who are all studying in 2nd sem MCA.

ii.List the students who are not borrowed any books.

iii.Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_Date of 2nd sem MCA Students who borrowed books.

iv.Display the number of books written by each Author.

v.Display the student details who borrowed more than two books.

vi.Display the student details who borrowed books of more than one Author.

vii.Display the Book names in descending order of their names.

viii.List the details of students who borrowed the books which are all published by the same publisher.

2. Consider the following schema:

STUDENT (USN, name, date_of_birth, branch, mark1, mark2, mark3, total, GPA)

Execute the following queries:

i. Update the column total by adding the columns mark1, mark2, mark3.

ii. Find the GPA score of all the students.

iii. Find the students who born on a particular year of birth from the date_of_birth column.

iv. List the students who are studying in a particular branch of study.

v. Find the maximum GPA score of the student branch-wise.

vi. Find the students whose name starts with the alphabet "S".

vii. Find the students whose name ends with the alphabets "AR".

viii. Delete the student details whose USN is given as 1001.

3. Design an ER-diagram for the following scenario, Convert the same into a relational model and then solve the following queries.

Consider a Cricket Tournament "ABC CUP" organized by an organization. In the tournament there are many teams are contesting each having a Teamid,Team_Name, City, a coach. Each team is uniquely identified by using Teamid. A team can have many Players and a captain. Each player is uniquely identified by Playerid, having a Name, and multiple phone numbers,age. A player represents only one team. There are many Stadiums to conduct matches. Each stadium is identified using Stadiumid, having a stadium_name,Address (involves city,area_name,pincode). A team can play many matches. Each match played between the two teams in the scheduled date and time in the predefined Stadium. Each match is identified uniquely by using Matchid. Each match won by any of the one team that also wants to record in the database. For each match man_of_the match award given to a player.

Execute the following Queries:

i. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.

ii. List the details of the stadium where the maximum number of matches were played.

iii. List the details of the player who is not a captain but got the man_of _match award at least in two matches.

iv. Display the Team details who won the maximum matches.

v. Display the team name where all its won matches played in the same stadium.

4. Design an ER-diagram for the following scenario, Convert the same into a relational model, normalize Relations into a suitable Normal form and then solve the following queries. A country can have many Tourist places . Each Tourist place is identified by using tourist_place_id, having a name, belongs to a state, Number of kilometers away from the

capital city of that state,history. There are many Tourists visits tourist places every year. Each tourist is identified uniquely by using Tourist_id, having a Name, age, Country and multiple emailids. A tourist visits many Tourist places, it is also required to record the visted_date in the database. A tourist can visit a Tourist place many times at different dates. A Tourist place can be visited by many tourists either in the same date or at different dates.

Queries:

i. List the state name which is having maximum number of tourist places.

ii. List details of Tourist place where maximum number of tourists visited.

iii. List the details of tourists visited all tourist places of the state "KARNATAKA".

iv. Display the details of the tourists visited at least one tourist place of the state, but visited all states tourist places.

v. Display the details of the tourist place visited by the tourists of all country.

5. A country wants to conduct an election for the parliament. A country having many constituencies. Each constituency is identified uniquely by Constituency_id, having the Name, belongs to a state,Number_of_voters. A constituency can have many voters. Each voter is uniquely identified by using Voter_id, having the Name, age, address (involves Houseno,city,state,pincode). Each voter belongs to only one constituency. There are many candidates contesting in the election. Each candidates are uniquely identified by using candidate_id, having Name, phone_no, age, state. A candidate belongs to only one party.Thereare many parties. Each party is uniquely identified by using Party_id, having Party_Name,Party_symbol. A candidate can contest from many constituencies under a same party. A party can have many candidates contesting from different constituencies. No constituency having the candidates from the same party. A constituency can have many contesting candidates belongs to different parties. Each voter votes only one candidate of his/her constituencty.

Queries:

i. List the details of the candidates who are contesting from more than one constituencies

which are belongs to different states.

ii. Display the state name having maximum number of constituencies.

iii. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter msg" .

iv. Create a stored procedure to display the number_of_voters in the specified constituency. Where the constituency name is passed as an argument to the stored procedure.

v. Create a TRIGGER to UPDATE the count of " Number_of_voters" of the respective

constituency in "CONSTITUENCY" table , AFTER inserting a tuple into the "VOTERS" table.

Java Programming Lab	
Choice Based Credit System	
Semester:II	CIE Marks:40
Course Code:20MCA28	SEE Marks:60
Contact Hours (L: T:P):0:0:4	Exam Hours:03

Course Outcomes: at the end of the course the students will be able to

CO1: Demonstrate the fundamental data types and constructs of Java Programming by writing executable/interpretable programs.

CO2: Illustrate the object oriented principles with the help of java programs.

CO3: Develop reusable and efficient applications using inheritance and multi-threading concepts of java.

CO4: Apply client-side programming and networking concepts to develop distributed applications.

CO5: Write java programs to demonstrate the concepts of interfaces, inner classes and I/O streams.

1. Write a JAVA program to demonstrate Constructor Overloading and Method Overloading.

2. Write a JAVA program to implement Inner class and demonstrate its Access protection.

3. Write a program in Java for String handling which performs the following:
   a. Checks the capacity of String Buffer objects.
   b. Reverses the contents of a string given on console and converts the resultant string in upper case.
   c. Reads a string from console and appends it to the resultant string of (ii).

4. Write a JAVA program to demonstrate Inheritance.
Simple Program on Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.

5. Write a JAVA program which has:
   a. A Class called Account that creates account with Rs. 500 minimum balance, a deposit() method to deposit amount, a withdraw() method to withdraw amount and also throws LessBalanceException if an account holder tries to withdraw money which makes the balance become less than Rs. 500.
   b. A Class called Less_Balance_Exception which returns the statement that says withdraw amount (Rs.) is not valid.
   c. A Class which creates 2 accounts, both account deposit money and one account tries to withdraw more money which generates a Less Balance Exception take appropriate action for the same.

6. Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept.

7. Write a JAVA program to implement a Queue using user defined Exception Handling (also make use of throw, throws).
   a. Complete the following:
   b. Create a package named shape.
   c. Create some classes in the package representing some common shapes like Square, Triangle, and Circle.
   d. Import and compile these classes in other program.

8. Write a JAVA program to create an enumeration Day of Week with seven values SUNDAY through SATURDAY. Add a method isWorkday() to the DayofWeek class that returns true if the value on which it is called is MONDAY through FRIDAY. For example, the call DayOfWeek.SUNDAY.isWorkDay () returns false.

9. Write a JAVA program which has:
   a. An Interface class for Stack Operations
   b. A Class that implements the Stack Interface and creates a fixed length Stack.
   c. A Class that implements the Stack Interface and creates a Dynamic length Stack.
   d. A Class that uses both the above Stacks through Interface reference and does the Stack
   e. Operations that demonstrates the runtime binding.

10. Write a JAVA program which uses FileInputStream / FileOutPutStream Classes.
11. Write JAVA programs which demonstrate utilities of Linked List Class.

Web Technologies Laboratory	
Choice Based Credit System	
Semester: II	CIE Marks:40
Course Code:20MCA29	SEE Mark :60
Contact Hours(L:T:P) 0:0:4	Exam Hours:03
Course Outcomes: at the end of the course students will be able to CO1: Apply the concept and usages web based programming techniques. CO2: Learning and Developing XHTML documents using JavaScript and CSS. CO3: To be familiar in the use of CGI and Perl programs for different types of server side applications. CO4: Design and implement user interactive dynamic web based applications.	

CO5: Evaluate the given wed application and enhance it using latest web technologies.

Part - A

1.Create an XHTML page that provides information about your department. Your XHTML page must use the following tags:

a) Text Formatting tags

b) Horizontal rule

c) Meta element

d) Links

e) Images

f) Tables (Use of additional tags encouraged).

2.Develop and demonstrate the usage of inline, external and internal style sheet using CSS. Use XHTML page that contains at least three paragraphs of text, listed elements and a table with four rows and four columns.

3.Develop and demonstrate a XHTML file that includes Javascript script for the following problems: a) Input : A number n obtained using prompt Output : The first n Fibonacci numbers b) Input : A number n obtained using prompt Output : A table of numbers from 1 to n and their squares using alert

4.Develop, test and validate an XHTML document that has checkboxes for apple (59 cents each), orange (49 cents each), and banana (39 cents each) along with submit button. Each check boxes should have its own onclick event handler. These handlers must add the cost of their fruit to a total cost. An event handler for the submit button must produce an alert window with the message 'your total cost is $xxx', where xxx is the total cost of the chose fruit, including 5 percent sales tax. This handler must return 'false' (to avoid actual submission of the form data). Modify the document to accept quantity for each item using textboxes.

5. a) Develop and demonstrate, a HTML document that collects the USN (the valid format is : A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by three upper-case characters followed by two digits; (no embedded spaces are allowed) from the user. Use JavaScript that validate the content of the document. Suitable messages should be display in the alert if errors are detected in the input data. Use CSS and event handlers to make your document appealing.b) Modify the above program to get the current semester also(restricted to be a number from 1 to 6)

6. Develop and demonstrate a HTML file which includes JavaScript that uses functions for the following problems:

a. Parameter: A string Output: The position in the string of the left-most vowel. b. Parameter: A number Output: The number with its digits in the reverse order.

7.Develop and demonstrate a HTML5 page which contains

a) Dynamic Progressive bar.

b) Display Video file using HTML5 video tag.

8.Develop and demonstrate, using JavaScript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. Modify the above document so that when a text is moved from the top stacking position, it returns to its original position rather than to the bottom.

9.Develop a simple calculator to perform arithmetic (addition, subtraction, multiplication and division) operations on given two numbers. Use an HTML tag that allows the user to input two numbers and to display the result of arithmetic operation. Write suitable HTML and JavaScript and CSS to your simple calculator. The following figure show sample document display.

A SIMPLE CALCULATOR

Number 1 = 56

Number 2 = 47

Result = 2632

ADD   SUB   MUL   DIV   CLEAR

10.Develop and demonstrate using jQuery to solve the following:

a) Limit character input in the text area including count.

b) Based on check box, disable/enable the form submit button.

11.Develop and demonstrate using jQuery to solve the following:

a) Fade in and fade out all division elements.

b) Animate an element, by changing its height and width.

Part-B

Develop a web application (mini-project) using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. Database connection needs to be implemented.

Note:

1. A team of two students must develop the mini project. However during the examination, each student must demonstrate the project individually.

2. Each students has to execute one program picked from Part-A during the semester end examination.

3. The team must submit a brief project report (20-25 pages) that must include the following

   a. Introduction b. Requirement Analysis c Software Requirement Specification

   d. Analysis and Design, e. Implementation f. Testing

4. Brief synopsis not more than two pages to be submitted by the team as per the format given. It was recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects.

5. Rubrics may be used to evaluate the Mini-Project.

Data Analytics using Python	
Semester: III	CIE Marks:40
Subject Code:20MCA31	SEE Marks:60
Contact Hours(L:P:T):4-0-0	Exam Hours:03

Course Outcomes:•

CO1: Demonstrate basic data analytics principles and techniques

CO**2**: Apply control structures to the given problems

CO3: Apply the concepts of inheritance and overloading for a given problem.

CO4: Demonstrate the concepts of learning and decision trees for a given problem.

CO5: Demonstrate the concepts of neural networks and genetic algorithms for a given problem.

Module 1

Python Basic Concepts and Programming

 Interpreter – Program Execution – Statements – Expressions – Flow Controls – Functions - Numeric Types – Sequences - Strings,

Parts of Python Programming Language, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type( ) Function and Is Operator, Control Flow Statements, The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Module 2

Python Collection Objects, Classes

Strings- Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists-Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods. Sets, Tuples and Dictionaries. Files: reading and writing files. Class Definition – Constructors – Inheritance – Overloading

Module 3

 Data Pre-processing and Data Wrangling

Acquiring Data with Python: Loading from CSV files, Accessing SQL databases. Cleansing Data with Python: Stripping out extraneous information, Normalizing data AND Formatting data. Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String Manipulation, Regular Expressions.

Module 4

Web ScrapingAnd Numerical Analysis

Data Acquisition by Scraping web applications –Submitting a form - Fetching web pages – Downloading web pages through form submission – CSS Selectors. NumPyEssentials:TheNumPy array, N-dimensional array operations and manipulations, Memory mapped files.

Module 5

Data Visualization with NumPy Arrays, Matplotlib, and Seaborn

Data Visualization: Matplotlib package – Plotting Graphs – Controlling Graph – Adding Text – More Graph Types – Getting and setting values – Patches. Advanced data visualization with Seaborn.- Time series analysis with Pandas.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Text Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition,Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised andupdated for Python 3.2, Network Theory Ltd., 2011.

3. Jake Vander plas, "Python Data Science Handbook: Essential tools for working with data", O'Reilly Publishers, I Edition.

References:

1.   Mark Lutz, "Programming Python", O'Reilly Media, 4th edition, 2010.
2.   Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, 1st edition, 2009.
3.   Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress, Second Edition, 2005.
4.   Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014. 6. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012

Internet of Things

Choice Based Credit System

Semester: III	CIE Marks:40
Subject Code:20MCA32	SEE Marks:60
Contact Hours(L:T:P):4:0:0	Exam Hours:03

CO**1:** Analyse the IoT architecture and design along with functional/compute stack and data management.

CO**2:** Apply IOT architecture for a given problem

CO**3:** Analyse the application protocol, transport layer methods for the given business case.

CO**4:** Analyse the application of data analytics for IOT for a given

CO5: Analyse the architecture and develop programming using modern tools for the given use case

Module-1

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack

Module-2

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

Module-3

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Module-4

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment

Module-5

IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming.   IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming

RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture,Smart City Security Architecture, Smart City Use-Case Examples.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1.David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the 2. Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 9789386873743) 2. Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017

References

1.Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014. (ISBN: 978-8173719547)

2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Advances in Java

Choice Based Credit System

Semester: III	CIE Marks:40
Subject Code:20MCA33	SEE Exam:60
Contact Hours(L:T:P):4:0:0	Exam Hours:03

Course Outcomes:

CO1: Apply the concept of Servlet and its life cycle to create web application.

CO2: Apply JSP tags and its services to web application.

CO3: Create packages and interfaces in the web application context.

CO4: Build Database connection for the web applications.

CO5: Develop enterprise applications using Java Beans concepts for the given problem.

Module-1

Servlet Structure, Servlet packaging, HTML Building utilities, Lifecycle, Single Thread Model Interface, Handling Client request: Form Data, HTTP Request Headers.
Generating Server Response: HTTP Status Codes, HTTP Response Headers, Handling Cookies, Session Tracking.

Module-2
Introduction to JSP:
Overview of JSP: JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic Syntax, Invoking Java code with JSP Scripting Elements, Creating Template Text, Invoking Java Code form JSP, Limiting Java Code in JSP, Using JSP Expressions, Comparing Servlets And JSP, Writing Scriptlets. For Example: Using Scriplets to make parts of JSP Conditional, Using declarations, Declaration Examples.

Module-3
Controlling the structure, Structure of generated Servlets and Java Beans, Controlling the structure of generated Servlets: The JSP Page directive, Import Attribute, Session Attribute, isElignore attribute, Buffer and Autoflush Attribute, Info Attribute, errorPage, and iserrorPage Attributes, isThreadSafe Attribute, extends Attribute, language Attribute, Including Files and Applets in JSP Pages using Java Beans components in JSP documents.
JAR File, Manifest file, Working with Java Beans. Introspection, Customisers, Bean Properties: Simple properties, Design pattern events, Creating bound properties, Bean Methods, Beaninfo class, Persistence.

Module-4
Annotations and JDBC
Annotations: Built-in Annotations with examples, Custom Annotation. Talking to Database, Immediate Solutions, Essentials JDBC program, using prepared statement object, and Interactive SQL tool. JDBC in Action Result sets, Batch updates, Mapping, Basic JDBC data types, Advanced JDBC data types, immediate solutions.

Module-5
EJB and Server Side Components Models
Introduction to EJB: The Problem domain, Breakup responsibilities, Code Smart not hard, the enterprise java bean specification, Components Types.
Server Side Component Types: session Beans, MessageDriven Beans, Entity Beans, The Java Persistence Model. Container services: Dependency Injection, Concurrency, Instance pooling n caching, Transactions, security, Timers, Naming and object stores, Interoperability, Life Cycle Callbacks, Interceptors, platform integration. Developing your first EJB, Models: The Stateless Session Bean, The Stateful Session Bean, the Singleton Session Bean, Message-Driven Beans. EJB and Persistence. Persistence Entity Manager Mapping persistence objects, Entity Relationships.

Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module.

• Each full question will have sub questions covering all the topics under a module.
• The students will have to answer FIVE full questions, selecting one full question from each module.

TextBooks
1. Marty Hall,Larry Brown Core Servlets and Java server pages. Vol 1: Core Technologies. 2nd Edition. (Chapter 3,4,5,6,7,8,9,10,11,12,13,14)
2. Java 6 Programming Black Book, Dreamtech press 2012(Chapter 17,18,19,20,21,22,27,28,29,30)
3. Andrew LeeRubinger, Bill Burke. Development Enterprise Java Components. Enterprise JavaBeans 3.1. O'reilly (Chapters 1,2,3,4,5,6,7,8,9,10,11)

References
1. Michel Siklora, EJB 3 Developer Guide, A Practical Guide For Developers And Architects to the Enterprise Java Beans Standard,Shroff Publishers and Distributers Private Limited July2008.
2. Herbert Schildt The Java Complete Reference, 8th Edition, Comprehensive coverage of the Java Language, Tata Mc Graw Hill Edition

Block Chain Technology
Choice Based Credit System(CBCS)

Semester: III	CIE Marks:40
Course Code:20MCA341	SEE Marks:60
Contact Periods (L:T:P):3-0-0	Exam Hours:03

Course Out Comes:
CO1: Demonstrate the basics of Block chain concepts using modern tools/technologies.
CO2: Analyze the role of block chain applications in different domains including cybersecurity.
CO3: Evaluate the usage of Block chain implementation/features for the given problem.
CO4: Exemplify the usage of bitcoins and its impact on the economy.
CO5: Analyze the application of specific block chain architecture for a given problem
Module-1
Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin.
Module-2
Blockchain :Architecture , versions ,variants , use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.
Module-3
Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy , payment verification , Resolving Conflicts , Creation of Blocks

Module-4
Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency.
Module-5
Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle , Law and Regulations. Case Study.
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Textbooks
1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by ArshdeepBikramaditya Signal, GautamDhameja (PriyansuSekhar Panda., APress. 2. Blockchain Applications: A Hands-On Approach by Bahga, Vijay Madisetti 3. Blockchain by Melanie Swan, OReilly
References
1. Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, princton 2. Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu.T Books.

Cloud Computing
Choice Based Credit System(CBCS)

Semester: III	CIE Marks:40
Course Code:20MCA342	SEE Marks:60
Contact Periods (L:T:P):3-0-0	Exam Hours:03

Course Outcomes:

CO1: Demonstrate the system & software models and mechanisms that support cloud computing

CO2: Classify various cloud services and their providers

CO3: Compare various cloud deployment models

CO4: Differentiate various types of computing environments

CO5: Identify enabling technologies of cloud computing.

Module-1
Introduction to Cloud Computing: Eras of computing, The vision of Cloud Computing, Defining a cloud, A closer look, Cloud computing reference model, Historical developments: Distributed systems, Virtualization, Web 2.0; Service oriented computing; Utility oriented computing.
Module-2
Architectures for parallel and distributed computing: Parallel Vs Distributed computing, Elements of distributed computing, Technologies for distributed computing.
Module-3
Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples: Xen: Para virtualization, VmWare: Full virtualization, Microsoft Hyper – V.
Module-4
Cloud computing architecture: Introduction, Cloud reference model: Architecture, IaaS, PaaS, SaaS, Types of Clouds: Public, Private, Hybrid and Community clouds, Economics of the cloud, Open challenges.
Module-5
Cloud Tools and Applications: Aneka PaaS; Open stack: Introduction to open stack; Components of open stack; Amazon web services; Google AppEngine; Microsoft Azure; Scientific applications: Healthcare; Biology; Geo-Science, Business and Consumer applications: ARM & ERP; Productivity; Social networking.
Question Paper Pattern: • The Question paper will have TEN questions   • Each full question will be for 20 marks   • There will be 02 full questions (with maximum of four sub questions) from each module.   • Each full question will have sub questions covering all the topics under a module.   • The students will have to answer FIVE full questions, selecting one full question from each module.
Textbooks
1. RjkumarBuyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013.
References
1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition)   2. Cloud Computing: A Practical Approach by J.Vette, Toby J. Vette, Robert Elsenpeter (Tata McGraw Hill)

Digital Marketing	
Choice Based Credit System(CBCS)	
Semester: III	CIE Marks:40
Course Code:20MCA343	SEE Marks:60
Contact Periods (L:T:P):3-0-0	Exam Hours:03

Course Outcomes:

CO1: Demonstrate the key concepts related to e-marketing for the given case.

CO2: Demonstrate the use of different electronic media for designing marketing activities.

CO3: Analyze the role of search engine in improving digital marketing

CO4: Analyze role of social media marketing for the given problem

CO5: Analyze technical solutions to overcome social media threats

Module-1

Introduction to Digital Marketing Evolution of Digital Marketing from traditional to modern era, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.

Module-2

Internet Marketing and Digital Marketing Mix – Internet Marketing, opportunities and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC; Search Engine Advertising: - Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation Display marketing: - Types of Display Ads - Buying Models - Programmable Digital Marketing - Analytical Tools - YouTube marketing.

Module-3

Social Media Marketing – Role of Influencer Marketing, Tools & Plan– Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy Facebook Marketing: - Business through Facebook Marketing, Creating Advertising Campaigns, Adverts, Facebook Marketing Tools Linkedin Marketing: - Introduction and Importance of Linkedin Marketing, Framing Linkedin Strategy, Lead Generation through Linkedin, Content Strategy, Analytics and Targeting Twitter Marketing: - Introduction to Twitter Marketing, how twitter Marketing is different than other forms of digital marketing, framing content strategy, Twitter Advertising Campaigns Instagram and Snapchat: - Digital Marketing Strategies through Instagram and Snapchat Mobile Marketing: - Mobile Advertising, Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising Analytics Introduction to social media metrics

Module-4

Introduction to SEO, SEM, Web Analytics, Mobile Marketing, Trends in Digital Advertising– - Introduction and need for SEO, How to use internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics - Introduction to SEM Web Analytics: - Google Analytics & Google AdWords; data collection for web analytics, multichannel attribution, Universal analytics, Tracking code Trends in digital advertising

Module-5

Social Media Channels: Introduction, Key terms and concepts, Traditional media vs Social media. Social media channels: Social networking. Content creation, Bookmarking & aggregating and

Location & social media. Tracking social media campaigns. Social media marketing: Rules of engagement. Advantages and challenges.

Social Media Strategy: Introduction, Key terms and concepts. Using social media to solve business challenges. Step-by-step guide to creating a social media strategy. Documents and processes. Dealing with opportunities and threats. Step-by-step guide for recovering from an online brand attack. Social media risks and challenges

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks
1. Seema Gupta "Digital Marketing" Mc-Graw Hill 1st Edition – 2017

References
1. Ian Dodson "The Art of Digital Marketing" Wiley Latest Edition
2. Puneet Singh Bhatia "Fundamentals of Digital Marketing" Pearson 1st Edition – 2017
3. Prof. Nitin C. Kamat, Mr.Chinmay Nitin Kamat Digital Social Media Marketing Himalaya Publishing House Pvt. Ltd. Latest Edition

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Software Testing
Choice Based Credit System(CBCS)

Semester: III	**CIE Marks:40**
Course Code:20MCA344	**SEE Marks:60**
Contact Periods (L:T:P):3-0-0	**Exam Hours:03**

Course Outcomes:

CO1: Acquire knowledge of basic principles and knowledge of software testing and debugging and test cases.

CO2: Will be able to understand the perceptions on testing like levels of testing, generalized pseudo code and with related examples.

CO3: To study the various types of testing.

CO4: Differentiate between functional testing and structural testing.

CO5: Analyze the performance of fault based testing, planning and Monitoring the process, Documentation testing.

Module-1

Basics of Software Testing, Basic Principles, Test case selection and Adequacy

Humans, Errors and Testing, Software Quality; Requirements, Behavior and Correctness, Correctness Vs Reliability; Testing and Debugging; Test Metrics; Software and Hardware Testing; Testing and Verification; Defect Management; Execution History; Test Generation Strategies; Static Testing; Test Generation from Predicates. Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback, Test Specification and cases, Adequacy Criteria, Comparing

Criteria
Module-2
A perspective on Testing
Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Level of testing, Examples: Generalized pseudo code, The triangle problem, the Next Date function, The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter, Saturn windshield wiper
Module-3
Boundary value testing, Equivalence class testing, Decision table based testing
Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for triangle problem, Next Date function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem
Module-4
Path Testing, Data flow testing, Levels of Testing, Integration Testing
DD Paths, Test coverage metrics, Basis path testing, guidelines and observations, Definition Use testing, Slice based testing, Guidelines and observations. Traditional view of testing levels, Alternative life cycle models, the SATM systems, separating integration and system testing, Guidelines and observations.
Module-5
Fault Based Testing, Planning and Monitoring the Process, Documenting Analysis and Test
Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis; From Test case specification to Test Cases, Scaffolding, Generic vs. specific Scaffolding, Test Oracles, Self checks as oracles, Capture and Replay. Quality and Process, Test and Analysis strategies and plans, Risk Planning, Monitoring the Process, Improving the process, The quality team, Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.
Question Paper Pattern:
• The Question paper will have TEN questions   • Each full question will be for 20 marks   • There will be 02 full questions (with maximum of four sub questions) from each module.   • Each full question will have sub questions covering all the topics under a module.   • The students will have to answer FIVE full questions, selecting one full question from each module.
Textbooks
1. AdithyaP.Mathur " Foundations of Software Testing – Fundamental Algorithms and Techniques", Pearson Education India, 2011   2. Mauro Pezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques, Wiley India, 2012   3. Paul C Jorgensen, "Software Testing A Craftsman's Approach", Auerbach publications, 3rd edition, 2011.
References
1. KshirasagaraNaik, PriyadarshiTripathy: Software Testing and Quality Assurance, Wiley India

2012
2. M.G.Limaye: Software Testing-Principles, Techniques and Tools – McGraw Hill, 2009

NOSQL	
Choice Based Credit System(CBCS)	
Semester: III	**CIE Marks:40**
Course Code:20MCA345	**SEE Marks:60**
Contact Periods (L:T:P):3-0-0	**Exam Hours:03**

Course outcomes: The students will be able to:

CO1: Demonstrate the concepts of unstructured data

CO2: Analyse and Manage the Data using CRUD operations

CO3: Develop the applications using NoSQL

CO4: Realize the concept of Map Reduce its applicability in the real world application development

CO5: Analyze the framework of NOSQL

Module-1
Introduction to NoSQL Definition of NoSQL, History of NoSQL and Different NoSQL products. Exploring NoSQL Exploring Mongo DB Java/Ruby/Python, Interfacing and Interacting with NoSQL.
Module-2
NoSQL Basics :NoSQL Storage Architecture, CRUD operations with Mongo DB, Querying, Modifying and Managing. Data Storage in NoSQL: NoSQL Data Stores, Indexing and ordering datasets (MongoDB/CouchDB/Cassandra)
Module-3
Advanced NoSQL, NoSQL in Cloud, Parallel Processing with Map Reduce, Big Data with Hive.
Module-4
Working with NoSQL, Surveying Database Internals, Migrating from RDBMS to NoSQL, Web Frameworks and NoSQL, using MySQL as a NoSQL.
Module-5
Developing Web Application with NOSQL and NOSQL Administration Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP.
Question Paper Pattern: •   The Question paper will have TEN questions

• Each full question will be for 20 marks
• There will be 02 full questions (with maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module.
• The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks
1.Professional NOSQL Shashank Tiwari   WROX Press

References
2. The Definitive Guide to Mongo DB, The NOSQL Database for cloud and Desktop Computing EelcoPlugge, Peter Membreyand Tim Hawkins   APress

Deep Learning
Choice Based Credit System(CBCS)

Semester: III	CIE Marks:40
Course Code:20MCA351	SEE Marks:60
Contact Periods (L:T:P):3-0-0	Exam Hours:03

Course Outcomes:
1. Demonstrate the basics of deep learning for a given context.

2. Implement various deep learningmodels for the given problem
3. Realign high dimensional data using reductiontechniques for the given problem
4. Analyze optimization and generalization techniques of deeplearning for the given problem.
5. Evaluate the given deep learningapplication and enhance by applying latest techniques.

Module-1
Introduction to machine learning- Linear models (SVMs and Perceptron's, logistic regression)-Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

Module-2
DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning-Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow NetworksConvolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

Module-3
DIMENTIONALITY REDUCTION : Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

Module-4
OPTIMIZATION AND GENERALIZATION Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks-Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network

Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience
Module-5
CASE STUDY AND APPLICATIONS Imagenet- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection BioInformatics- Face Recognition- Scene Understanding-Gathering Image Captions
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Textbooks : 1.   CosmaRohillaShalizi, Advanced Data Analysis from an Elementary Point of View,2015.

References:
        1.   Deng & Yu, Deep Learning: Methods and Applications, Now Publishers,2013.
        2.   Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press,2016.
Michael Nielsen, Neural Networks and Deep Learning, Determination Press,2015.

Big data Analytics	
Choice Based Credit System(CBCS)	
Semester: III	CIE Marks:40
Course Code:20MCA352	SEE Marks:60
Contact Periods (L:T:P):3-0-0	Exam Hours:03
Course Outcomes: CO1: Identify the business problem for a given context and frame the objectives to solve it through data analytics tools. CO2: Apply various algorithms for handling large volumes of data. CO3: Illustrate the architecture of HDFS and explain functioning of HDFS clusters. CO4: Analyse the usage of Map-Reduce techniques for solving big data problems. CO5: Conduct experiment with various datasets for analysis / visualization and arrive at valid conclusions.	
Module-1	
Big Data and Analytics Example Applications, Basic Nomenclature, Analysis Process Model, Analytical Model Requirements , Types of Data Sources, Sampling, Types of Data Elements, Data Exploration, Exploratory Statistical Analysis, Missing Values, Outlier Detection and Treatment, Standardizing Data Labels, Categorization	
Module-2	
Big Data Technology Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, Cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing	

Analytics, Inter- and Trans-Firewall Analytics.
Module-3
Meet Hadoop Data, Data Storage and Analysis, Comparison with Other Systems, RDBMS, Grid Computing, Volunteer Computing, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem Hadoop Releases Response.
Module-4
The Hadoop Distributed File system The Design of HDFS, HDFS Concepts, Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, Hadoop Filesystems Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the Filesystem, Deleting Data, Data Flow Anatomy of a File Read, Anatomy of a File Write, Coherency Model, Parallel Copying with distcp Keeping an HDFS Cluster Balanced, Hadoop Archives.
Module-5
A Weather Dataset ,Data Format, Analysing the Data with Unix Tools, Analyzing the Data with Hadoop, Map and Reduce, Java MapReduce, Scaling Out, Data Flow, Combiner functions, Running a Distributed MapReduce Job, Hadoop Streaming, Hadoop Pipes, Compiling and Running, Developing a MapReduce Application, The Configuration API, Combining Resources, Variable Expansion, Configuring the Development Environment, Managing Configuration, GenericOptionsParser, Tool and ToolRunner, Writing a Unit Test, Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging, Launching a Job, The MapReduce Web UI, Retrieving the Results, Debugging a Job, Hadoop Logs, Remote Debugging.
Question Paper Pattern: • The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.
Textbooks
1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications" Wiley. 2. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, Michael Minelli, Michele Chambers, AmbigaDhiraj, Wiley CIO Series, 2013. 3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.
References
1.Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015. 2. Chris Eaton, Dirk deroos et al., "Understanding Big data", McGraw Hill, 2012. 3. Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013. 4. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014.

<table>
<tr><td colspan="2" align="center">Choice Based Credit System (CBCS) and Outcome Based Education(OBE)
SEMESTER – III
Wireless Ad Hoc Networks</td></tr>
</table>

Course Code : 20MCA353	CIE Marks : 40
Contact Periods (L:T:P): 3:0:0	SEE Marks : 60
Credits : 03	Exam Hours : 03

Course outcomes
CO1: Analyze the issues of ad-hoc wirelessnetwork
 CO2 : Evaluate the existing network and improve its quality ofservice
 CO3 : Choose appropriate protocol for variousapplications and design the architecture
 CO4: Examine security measures present at differentlevels and identify the
       possible improvements for the latest version of the ad hoc network IEEE standard
CO5 : Analyze energy consumption andmanagement in ad-hoc wirelessnetworks

Module-1

Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention- Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based
Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.

Module -2

Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical
Routing Protocols and Power-Aware Routing Protocols.

Module – 3

Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based
Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.

Module-4

Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challengesin
Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.

Module-5

Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission
Management Schemes, System Power Management Schemes.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbook

1. Ad-hoc Wireless Networks, C. Siva Ram Murthy& B. S. Manoj, Pearson Education, 2nd Edition, 2011

Reference Books

1. Ad-hoc Wireless Networks, Ozan K. Tonguz and John Wiley, 2007 ,Gianguigi Ferrari

2. Ad-hoc Wireless Networking. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic Publishers, 2004

3. Ad-hoc Mobile Wireless Networks- Protocols and Systems, C.K. Toh, Pearson Education, 2002

Software Project Management	
Choice Based Credit System(CBCS)	
Semester: III	**CIE Marks:40**
Course Code:20MCA354	**SEE Marks:60**
Contact Periods (L:T:P):3-0-0	**Exam Hours:03**

Course Out Comes:
CO1:Apply thepracticesandmethodsforsuccessfulsoftwareprojectmanagement
CO2:Identifytechniquesforrequirements,policiesanddecisionmakingforeffectiveresource management
CO3:Illustratetheevaluationtechniquesforestimatingcost,benefits,scheduleandrisk
CO4:Deviseaframeworkforsoftwareprojectmanagementplanforactivities,risk,monitoring andcontrol
CO5:Designaframeworktomanagepeople

Module-1

INTRODUCTIONTOSOFTWAREPROJECTMANAGEMENT
Introduction,WhyisSoftwareProjectManagementimportant?Whatisa Project?, ContractManagement,ActivitiesCoveredbySoftwareProjectManagement, Plans, MethodsandMethodologies,Somewaysof categorizingsoftwareprojects, Stakeholders,SettingObjectives,BusinessCase,ProjectSuccessandFailure,Whatis Management? Management Control, Traditional versus Modern Project ManagementPractices

Module-2

PROJECTEVALUATION&FINANCE

Evaluationof IndividualProjects,CostBenefitEvaluationTechniques,RiskEvaluation, ProgrammeManagement,Managingallocationof ResourceswithinProgrammes, FinancialAccounting–Anoverview– Accountingconcepts,Principles&Standards, Ledgerposting,Trialbalance,ProfitandLossaccountBalancesheet

Module-3
ACTIVITYPLANNING ObjectivesofActivityPlanning,Whento Plan,ProjectSchedules,Sequencingand SchedulingActivities,NetworkPlanningModels,ForwardPass– BackwardPass, Identifyingcriticalpath,ActivityFloat,ShorteningProjectDuration,Activityon Arrow Networks RiskManagement,NatureofRisk,CategoriesofRisk,Aframeworkfordealingwith Risk, Risk Identification, Risk analysis and prioritization, risk planning and risk monitoring

Module-4
MONITORINGANDCONTROL CreatingtheFramework,CollectingtheData,Review,ProjectTerminationReview, VisualizingProgress,CostMonitoring,EarnedValueAnalysis,PrioritizingMonitoring, GettingProjectBackToTarget,ChangeControl,SoftwareConfiguration Management

Module-5
MANAGINGPEOPLEANDWORKINGINTEAMS Introduction,UnderstandingBehavior,OrganizationalBehavior:A Background, SelectingtheRightPersonfortheJob,InstructionintheBestMethods,Motivation, TheOldham–HackmanJobCharacteristicsModel,Stress–HealthandSafety WorkingInTeams,BecomingaTeam,DecisionMaking,Leadership.

Question Paper Pattern:
• The Question paper will have TEN questions • Each full question will be for 20 marks • There will be 02 full questions (with maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks
1.BobHughes, MikeCotterell, RajibMall, "Software Project Management", Fifth Edition,TataMcGrawHill,2011. 2."AccountingforManagement"JawaharLal,5th Edition,WheelerPublications,Delhi.

References
1.JackMarchewka," Information Technology-Project Management", Wiley Student Version,4th Edition,2013. 2.JamesPLewis,"ProjectPlanning,Scheduling&Control",McGrawHill,5th Edition, 2011. 3.Pankaj Jalote," Software Project Management in Practise", Pearson Education, 2002.

Software Defined Networks	
Choice Based Credit System(CBCS)	
Semester: III	**CIE Marks:40**
Course Code:20MCA355	**SEE Marks:60**
Contact Periods (L:T:P):3-0-0	**Exam Hours:03**

Course Outcomes:
CO1: Apply the fundamentals of Software Defined Networks for the given problem
CO2: Illustrate the basics of Software Defined Networks Operations and Data flow
CO3: Apply different Software Defined Network Operations and Data Flow
CO4: Analyse alternative definitions of Software Defined Networks
CO5: Apply different Software Defined Network Operations in real world problem

Module-1
Introduction to SDN
Understanding the SDN, Understanding the SDN technology, Control Plane, Data Plane, Moving information between planes, separation of the control and data planes, Distributed control planes, Load Balancing, Creating the MPLS Overlay, Centralized control planes.

Module-2
Working of SDN
Evaluation of Switches and Control planes, SDN Implications, Data centre Needs, Forerunner of SDN, Software Defines Networks is Born, Sustain SDN interoperability, Open source contribution, Fundamental Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Applications, Alternate SDN methods.

Module-3
The Open Flow Specifications
Open Flow Overview, Open Flow Basics, Open Flow 1.0 additions, Open Flow 1.1 additions, Open Flow 1.2 additions, Open Flow 1.3 additions, Open Flow limitations.

Module-4
SDN via APIS, SDN via Hypervisor-Based Overlays, SDN via Opening up the device, Network function virtualization, Alternative Overlap and Ranking.

Module-5
Data centres definition, Data centres demand, tunnelling technologies for Data centres Path technologies in data centres, Ethernet fabrics in Data centres, SDN use case in Data centres.

Question Paper Pattern:
• The Question paper will have TEN questions
• Each full question will be for 20 marks
• There will be 02 full questions (with maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module.
• The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks
1. Software Defined Networking by Thomas D Nadeau and Ken Gray.
2. Software Define Networks, A Comprehensive Approach, Paul Goransson, Chuck Black. MK Publications.

References
1. Software Defined Networking for Dummies brought you by cisco, Brian Underdahl and Gary Kinghorn.

Data Analytics Lab
Choice Based Credit System

Semester:III	CIE Marks:40
Subject Code:20MCA36	SEE Marks:60
Contact Hours(L:T:P):0:0:4	Exam Hours:03

Course Outcomes:
1.Develop python program to perform search/sort on a given data set
2.Demonstrate object oriented principles
3. Demonstrate data visualization using Numpy for a given problem
4. Demonstrate regression model for a given problem
5.Deign and develop an application for the given problem

1.Write a Python program to perform linear search
2.Write a Python program to insert an element into a sorted list
3.Write a python program using object oriented programming to demonstrate encapsulation, overloading and inheritance
4.Implement a python program to demonstrate 1) Importing Datasets 2) Cleaning the Data 3) Data frame manipulation using Numpy
5.Implement a python program to demonstrate the following using NumPy a) Array manipulation, Searching, Sorting and splitting. b) broadcasting and Plotting NumPy arrays
6. Implement a python program to demonstrate Data visualization with various Types of Graphs using Numpy
7.Write a Python program that creates a mxn integer arrayand Prints its attributes using matplotlib
8.Write a Python program to demonstrate the generation of linear regression models.
9.Write a Python program to demonstrate the generation of logistic regression models using Python.
10.Write a Python program to demonstrate Timeseries analysis with Pandas.
11.Write a Python program to demonstrate Data Visualization using Seaborn.

Part-B

6. Students shall carry out a mini project using python/pandas to demonstrate the data analysis.
7. A team of two students must develop the mini project. However during the examination, each student must demonstrate the project individually.
8. The team must submit a brief project report (20-25 pages) that must include the following

a. Introduction   b. Requirement Analysis c Software Requirement Specification
          d. Analysis and Design,   e. Implementation f. Testing
9. Brief synopsis not more than two pages to be submitted by the team as per the format given. It is recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects.
10. Rubrics may be used to evaluate the Mini-Project

Each students has to execute one program picked from Part-A during the semester end examination. In SEE   Part-A and Part-B shall be given 50% weightage each.

Mini project with IOT Lab	
Choice Based Credit System	
Semester :III	CIE Marks:40
Subject Code:20MCA37	SEE Exam:60
Contact Hours(L:T:P)0:0:4	Exam Hours:03
Course Outcomes: CO**1:** Demonstrate theIoT architecture design for a given problem CO**2:** Apply IOT techniques for a given problem CO**3:** Analyse the application protocol, transport layer methods for the given business case. CO**4:** .Design and develop an application for the given problem for the societal/industrial problems CO5: Develop python program by applying suitable feature for the given problem and verify the output	
1.Run some python programs on Pi like: Read your name and print Hello message with name Read two numbers and print their sum, difference, product and division.Word and character count of a given string Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input Print a name 'n' times, where name and n are read from standard input, using for and while loops. Handle Divided by Zero Exception. Print current time for 10 times with an interval of 10 seconds. Read a file line by line and print the word count of each line.	
2.Get input from two switches and switch on corresponding LEDs	
3.Flash an LED at a given on time and off time cycle, where the two times are taken from a file.	
4.Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.	
5.Access an image through a Pi web cam	
6.Control a light source using web page.	
7.Implement an intruder system that sends an alert to the given email.	

8.Get the status of a bulb at a remote place (on the LAN) through web.
9.Get an alarm from a remote area (through LAN) if smoke is detected. The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.
Part-B

1. A team of two students must develop the mini project. However during the examination, each student must demonstrate the project individually. 2. The team must submit a brief project report (20-25 pages) that must include the following
 	
  a. Introduction   b. Requirement Analysis c Software Requirement Specification
 	
  d. Analysis and Design,   e. Implementation f. Testing
 	
3. Brief synopsis not more than two pages to be submitted by the team as per the format given. It is recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects. 4. Rubrics may be used to evaluate the Mini-Project
 	
Each students has to execute one program picked from Part-A during the semester end examination. In SEE   Part-A and Part-B shall be given 50% weightage each.

Advances in Java Lab Choice Based Credit System	
Semester: III	CIE Marks:40
Subject Code:20MCA38	SEE Marks:60
Contact Hours(L:T:P):0:0:4	Exam Hours:03
Course Outcomes: at the end of the course students will be able to CO1: Apply the concept of Servlet and its life cycle to create web application. CO2: Apply JSP tags and its services to web application. CO3: Create packages and interfaces in the web application context. CO4: Build Database connection for the web applications. CO5: Develop application programs using beans concept.	
1.Write a JAVA Servlet Program to implement a dynamic HTML using Servlet (user name and	

Password should be accepted using HTML and displayed using a Servlet).
2.Write a JAVA Servlet Program to Auto Web Page Refresh (Consider a webpage which is displaying Date and time or stock market status. For all such type of pages, you would need to refresh your web page regularly; Java Servlet makes this job easy by providing refresh automatically after a given interval).
3.Write a JAVA Servlet Program to implement and demonstrate GET and POST methods (Using HTTP Servlet Class).
4.Write a JAVA Servlet Program using cookies to remember user preferences.
5.Write a JAVA Servlet program to track HttpSession by accepting user name and password using HTML and display the profile page on successful login.
6.Write a JSP Program which uses jsp:include and jsp:forward action to display a Webpage.
7.Write a JSP Program which uses tag to run an applet
8.Write a JSP Program to get student information through a HTML and create a JAVA Bean class, populate Bean and display the same informationthrough another JSP
9. Write a JSP program to implement all the attributes of page directive tag.
10.Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries (For example update, delete, search etc…).
11.An EJB application that demonstrates Session Bean (with appropriate business logic).
12.An EJB application that demonstrates MDB (with appropriate business logic).
13. An EJB application that demonstrates persistence (with appropriate business logic).

Semester-IV

Sl. No.	Course Type	Course Code	Title	Tutorial (T)	Lecture (L)	Practical (P) / Seminar (S)	Duration (in Hrs.)	CIE Marks	SEE Marks	Total Marks	Credits
				Teaching Hours/Week			**Examination**				
1.	PCC	20MCA41	Advances in web technologies	2	2	-	3	40	60	100	2
2.	PCC	20MCA42	Programming using C#	2	2	-	3	40	60	100	2
	PCC	20MCA43	Industry Internship (4 weeks)	-	-	-	-	100	-	100	2
3.	PCC	20MCA44	Project Work (16 Weeks)	-	-	2*	3	40	60	100	20
			TOTAL	4	4	2	-	220	180	400	26

* Two hours per week is allocated to the faculty members in order to review the progress of the students' projects. The students will present the progress to the faculty member or discuss about the further direction of project work during the allocated hours. Students shall maintain diary where in he/she records the weekly work done duly signed by internal/external guides.

Advances in Web Technologies	
Choice Based Credit System	
Semester: IV	CIE Marks:40
Course Code:20MCA41	SEE Marks:60
Contact Hours (L:T:P): 2:2:0	Exam Hours:03

Course Outcomes: At the end students will be able to
CO1: Build the Web Applications using JQuery, PHP, XML for the given problem
CO2: Design the Web Pages using AJAX for the given problem.
CO3: Analyse the advances in Web2.0 and demonstrate its usage for the problem considered.
CO4 Analyse the web services and demonstrate its usage for the problem considered.
CO5: Design responsive web applications using Bootstrap for the given problem.

Module-1

Module 1:
Introduction to PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations andexpressions, Output, Control statements, Arrays, Functions, Pattern matching.
Building Web applications with PHP:

Form handling, Files, Tracking users, cookies, sessions, Using databases, Handling XML.

Module-2

Introduction to Ruby and Introduction to Rails:
Origins and uses of Ruby, Scalar types and their operations ,Simple input and output, Controlstatements, Arrays, Hashes, Methods, Classes, Codeblocks and iterates, Pattern matching.
Overview of Rails, Document requests, Processing forms, Layouts. Rails applications with Databases.

Module-3

Rich Internet Applications With Ajax: Limitations of Classic Web application model, AJAX principles,Technologies behind AJAX, Examples of usage of AJAX; Asynchronous communication and AJAXapplication model.
Ajax with XMLHTTP object: Part 1
Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creatingand opening the XMLHttpRequest object, Data download, Displaying the fetched data, Connecting tothe server, Adding Server-side programming, Sending data to the server using GET and POST.

Module-4

Ajax with XMLHTTP object: Part 2
Handling multiple XMLHttpRequest objects in the same page, Using two XMLHttpRequest objects, Usingan array of XMLHttpRequestobjects,AJAX Patterns – Predictive Fetch, Multi-stage download, PeriodicRefresh and Fallback patterns, Submission throttling.

Module-5

Introduction to Bootstrap:
What Is Bootstrap? Bootstrap File Structure, Basic HTML Template, Global Styles, Default Grid System,Basic Grid HTML, Offsetting Columns, Nesting Columns, Fluid Grid System, Container Layouts,Responsive Design. Typography, Emphasis Classes, Lists, Code, Tables, Optional Table Classes, Table RowClasses, Forms, Buttons, Images, Icons.

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1. RobertW.Sebesta: Programming the Worldwide Web, 4thEdn, Pearson, 2012
2. Professional AJAX – Nicholas C Zakas et al, Wrox publications, 2008.
3. Steven Holzner: Ajax: A Beginner's Guide, Tata McGraw Hill, 2014.
4. Jake Spurlock: "Bootstrap: Responsive Web Development", O'Reilly Media, 2014.

Reference books

1. Thomas A. Powel: Ajax The Complete reference, McGraw Hill,2008.
2. AravindShenoy, Ulrich Sossou: Learning Bootstrap, Packt, Dec 2014.
3. Dana Moore, Raymond Budd, Edward Benson: Professional Rich Internet Applications: AJAX andBeyond, Wiley 2012.

Programming using C#	
Choice Based Credit System(CBCS)	
Semester: IV	CIE Marks:40
Course Code:20MCA42	SEE Marks:60
Contact Periods (L:T:P): 2:2:0	Exam Hours:03

Course Out Comes:
CO1:Analyse C#andclient-serverconceptsusing.NetFrameWork Components.
CO2:Applydelegates,eventandexceptionhandlingtoincorporatewithASP,WinForm, ADO.NET.
CO3:Analyzetheuseof.NetComponentsdependingontheproblemstatement.
CO4:Implement&developawebbasedandConsolebasedapplicationwithDatabase connectivity
CO5: Implement & develop a web based application with Databaseconnectivity

Module-1

Gettingstartedwith.NETFramework4.0andC#
Understanding PreviousTechnologies, Benefitsof.NETFramework,Architecture of.NETFramework 4.0,.NET Execution Engine, Components of.NET Framework 4.0: CLR,CTS,MetadataandAssemblies,.NETFrameworkClassLibrary,WindowsForms,
ASP.NETand ASP.NETAJAX,ADO.NET,WindowsworkflowFoundation,Windows PresentationFoundation,WindowsCommunicationFoundation,WidowsCardSpace andLINQ.
IntroducingC#
Creating aSimple C# Console Application, Identifiers and Keywords. System DataTypes,Variablesand Constants:ValueTypes,ReferenceTypes,UnderstandingType Conversions,BoxingandUnBoxing.Namespaces,TheSystemnamespace,.NETArray Types.

Module-2

Classes,ObjectsandObjectOrientedProgramming
Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, CreatinganArrayofObjects,UsingtheNestedClasses,DefiningPartialClassesand
Method,ReturningaValuefroma MethodandDescribingAccessModifiers.Static Classes and StaticMembers, Properties: Read-only Property, Static Property, Indexers,Structs:SyntaxofastructandAccessModifiersforstructs,System.ObjectClass
Encapsulation: Encapsulation using accessors and mutators, Encapsulation using
Properties. Inheritance: Inheritanceand Constructors, Sealed Classes and Sealed Methods,Extensionmethods.
Polymorphism:Compiletime Polymorphism/Overloading,RuntimePolymorphism/ Overriding.Abstraction:Abstractclasses,Abstract methods.Interfaces:Syntaxof Interfaces,ImplementationofInterfacesandInheritance.

Module-3

Delegates,Events,ExceptionHandlingandADO.NET
Delegates:CreatingandusingDelegates,MuticastingwithDelegates. Events:Event Sources,EventHandlers,EventsandDelegates,MultipleEventHandlers.
Exception Handling: The try/catch/throw/finally statement, Custom Exception.System.Exception, HandlingMultipleException.\
DataAccesswithADO.NET:UnderstandingADO.NET:DescribingtheArchitectureof ADO.NET,ADO.NET,ADO.NETEntityFramework.CreatingConnectionStrings:Syntax forConnectionStrings.Creatinga Connectiontoa Database:SQLServerDatabase,

OLEDBDatabase,ODBCDataSource.Creatinga CommandObject.Workingwith DataAdapters:CreatingDataSetfromDataAdapter.	
Module-4	
GraphicalUserInterfacewithWindowsFormsandWPF WindowsForms:Introduction,WindowsForms,EventHandling:A SimpleEvent- Driven GUI, Control Properties and Layout, Labels, TextBoxesand Buttons, GroupBoxesand Panels,CheckBoxesand RadioButtons,ToolTips,Mouse-Event Handling, Keyboard-Event Handling. Menus, Month Calendar Control, LinkLabelControl,ListBoxControl, ComboBoxControl,TreeViewControl,ListViewControl, TabControlandMultipleDocumentInterface(MDI)Windows. WPF:New WPF Controls,WPF Architecture:PresentationFramework,Presentation Core, WindowsBase, MILorMilcore,Working withWPFWindows: UsingXAMLin WPF4.0Applications: Contentsof XAMLandWPFApplications:XAMLElements NamespaceandXAML,XAMLPropertySyntax,MarkupExtensions.	
Module-5	
WebAppDevelopmentandDataAccessusingADO.NET Introduction,WebBasics,MultitierApplicationArchitecture,Your First Web Application: Building Web-Time Application, Examining Web-Time.aspx'sCode-BehindFile,UnderstandingMasterpages, StandardWebControls:DesigningaForm, Validation Controls, GridViewControl, DropDownList, Session Tracking, ASP.NET AJAX:ExploringAJAX,NeedforAJAX,AJAXand otherTechnologies,AJAXServer Controls,ScriptManagercontrol, UpdatePanel, UpdateProgressControl,Creating SimpleApplicationusingAJAXServerControls	

Question Paper Pattern:
- The Question paper will have TEN questions
- Each full question will be for 20 marks
- There will be 02 full questions (with maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Textbooks

1. .NET4.0Programming(6-in-1),BlackBook,KogentLearningSolutionsInc.,Wiley-DreamTechPress.(Chapters:1,10,11,12,13,14and19).
2. PaulDeitelandHarveyDeitel:C#2010forProgrammers,4thEdition,PearsonEducation.(Chapters:14,15,19and27.3)

References

1.AndrewTrolsen:ProC#5.0andthe.NET4.5Framework,6thEdition,Wiley-Appress.
2.BartDeSmet:C#4.0Unleashed,PearsonEducation-SAMSSeries.
3.HerbertSchildt:CompleteReferenceC#4.0,TataMcGrawHill,2010.

Industry Internship	
Choice Based Credit System	
Semester: IV	CIE Marks: 100
Course Code: 20MCA43	SEE Marks:---
Contact Hours (L:T:P/S): 0:0:0	Exam Hours:-

Course outcomes:
CO1: Analyse the real-time industry/research work environment with emphasis on organizational structure/job process/different departments and functions / tools /technology.
CO2: Develop applications using modern tools and technologies.
CO3: Demonstrate self-learning capabilities with an effective report and detailed presentation.

General Rules
1) All the students have to undergo mandatory internship of 4 weeks during the vacation of 3rd semester to take up individual project in companies/respective Colleges at higher than the mini project standards already taken up during previous semesters.
2) Internship shall be considered as a head of passing and shall be considered for the award of degree.
3) Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent semester.
4) After satisfying the internship requirements the degree will be awarded.
5) However, student can carry out 4thsemester project without completing the internship.
6) The student can present the progress about the internship to the committee at the department level.
7) CIE marks shall be evaluated with a weightage of Internship presentation for 50 marks and reports for 50 marks . The marks can be awarded to the student based on the criteria/rubrics formulated by the department.
8) The student has to submit a report about the outcome of the internship at the end of the semester along with the project report.
9) The internship report submitted by the studenthas to be evaluated by the guide concerned / a committee constituted by the head of the department.
10) The report shall be preserved at the department for future reference.

Project Work	
Choice Based Credit System	
Semester: IV	CIE Marks:40
Course Code:20MCA44	SEE Marks:60
Contact Hours (L:T:P/S): 0:0:0/2	Exam Hours:03
Course outcomes:	

Course outcomes: At the end of this course, the students will be able to
CO1: Identify a suitable problem making use of the technical and engineering knowledgegained from previous courses with the awareness of impact of technology on the societyand their ethical responsibilities.
CO2: Work as an individual and team to segregate work and execute/implement

projects using appropriate tools.

CO3: Develop skills to disseminate technical and general information by means of oral aswell as written presentation and professional skills.

CO4: To conduct testing of application using appropriate techniques and tools.

CO5: To enhance interpersonal skills and group cohesion among the peers during the project work

General Rules

- The candidate should carry out the project individually in any industry or R&D institution or educational institution under a guide/co-guide.
- The candidate has to present the work carried out before the examiners during the University examination.
- The work out carried out should be free from plagiarism as per the guideline provided by the university.
- The literature study may be clearly written which may be summary of existing project and highlight of what are the functionalities that are proposed to this project.
- Student shall indicate the different research papers, documents refereed as a part of the literature study. It is recommended to do prior art search as part of literature survey before submitting the synopsis for the projects.
- This is an individual project for a duration of minimum of 4 months or duration of the semester.
- Regular project work weekly diary should be maintained by the students, signed by the external guide and internal guide in order to verify the regularity of the student.
- Project work may be application/testing or research-oriented and accordingly the project report contents may vary.
- The presentation should be given at various levels such as Synopsis, SRS, Design and Project implementation/ completion levels.
- Student has to publish a paper in conference or journal of either National or International level
- Paper publication in an indexed journal/conference is compulsory as part of the project work.
- Publications follow the Thesis. 10% weightage is given in SEE.
- There shall be three project presentations each to be considered for 5 marks (5X3= 15 marks) and a final presentation for 15 marks. Presentation may be given using Power point presentation/demonstrations of the work. Synopsis submitted in a proper format is to be evaluated for 10 marks.
- The students are informed to strictly follow the report format as prescribed by the University. However as per the title/domain of the project with a suitable justification guide/department can make the minor changes.
- If the project report is not as per the format, internal guide / external examiner will have every right to reject the project.
- The Students are encouraged and appreciated to show their project demo along

with their power pointduring their viva-voce exams as an added advantage.

- In case of the paper publication could not be completed before the submission of the report, or acceptance received from the organiser of the conference / journal authorities should be included while uploading/submitting the report to the university.

Rubrics / Scheme of Evaluation:

Course Code	Title	Internal (CIE)					External (SEE)			Total Marks
		Review-1	Review-2	Review-3	Final Review	Synopsis	Dissertation evaluation	Paper Publication	Viva-Voce	
20MCA44	Project Work	5	05	05	15	10	24	6	30	100

Each Faculty member shall be allocated to supervise individual internship/project work as an internal guide and review the internship/ project work carried out on weekly basis for a minimum of one hour duration. The review carried out shall be recorded week-wise in a dairy maintained for it.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELAGAVI

Internship Report on

<INTERNSHIP TOPIC>

Submitted in partial fulfillment of the requirements of the 4th Semester in

MASTER OF COMPUTER APPLICATIONS

BY

<<STUDENT NAME>>

<<USN>>

Under the Guidance of

<<Guide1Name1>>

<<Designation>>

<<Guide**2** Name**2**>>

<<Designation>>

<<Affiliated College Logo>>

<< College Name and Address>>

2021-22 Even Semester

<< College name and Address.>

<<College Logo>>

INTERNSHIP CERTIFICATE

This is to certify that <<**Student Name**>> bearing <<**USN**>> has satisfactorily completed the Internship – 20MCA43entitled **<<Topic>>** in the academic year **2021-22**as prescribed by VTU for IV Semester of Master of Computer Applications.

Signature of the internal/external Guide   **Signature of the HOD**

ACKNOWLEDGEMENT

<College name Address>>

<<College Logo>>

VISION

MISSION

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1

Develop innovative IT applications to meet industrial and societal needs

PEO 2

Adapt themselves to changing IT requirements through life-long learning

PEO 3

Exhibit leadership skills and advance in their chosen career

PROGRAM OUTCOMES

PO1: Apply knowledge of computing fundamentals, computing specialization, mathematics and domain knowledge to provide IT solutions

PO2: Identify, analyse and solve IT problems using fundamental principles of mathematics and computing sciences

PO3: Design, Develop and evaluate software solutions to meet societal and environmental concerns

PO4: Conduct investigations of complex problems using research based knowledge and methods to provide valid conclusions.

PO5: Select and apply appropriate techniques and modern tools for complex computing activities

PO6: Practice and follow professional ethics and cyber regulations

PO7: Involve in life-long learning for continual development as an IT professional.

PO8: Apply and demonstrate computing and management principles to manage projects in multidisciplinary environments by involving in different roles

PO9: Comprehend& write effective reports and make quality presentations.

PO10: Understand and assess the impact of IT solutions on socio-environmental issues

PO11: Work collaboratively as a member or leader in multidisciplinary teams.

PO12: Identify potential business opportunities and innovate to create value to the society and seize that opportunity

Internship (20MCA43)

Course Outcomes

1. Analyse the real-time industry/research work environment with emphasis on organizational structure/job process/different departments and functions / tools /technology.
2. Develop applications using modern tools and technologies.
3. Demonstrate self-learning capabilities with an effective report and detailed presentation.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3		3					2		
CO2			3	3	3						2	
CO3						3	3		3			

Rubrics for Internship Presentation Assessment

	Excellent (10)	V. Good (8)	Good (6)	Satisfactory (4)	Poor (2)	Final Score
Knowledge on Industry experience /Research work	Demonstrates in depth knowledge about Industry / Research processes; answered all questions with elaboration	Adequate knowledge on most of the industry/ Research processes. Answered all questions but failed to elaborate	Knowledge to a limited extent on major processes. Able to answer most of the questions though not elaborate	Superficial knowledge of topic; only able to answer basic questions	Does not have any knowledge; Unable to answer questions	
Organization of the presentation	Presented in logical sequence; introduction and background given in proper context; key points and conclusions are clear and well presented with citations and references	Most information presented in logical sequence; clear introduction; adequate background; some irrelevant information. Some References are overlooked	Organized in a presentable manner though lacks details of some of the topics. Or very less references and citations.	Problems with sequencing, lacks clear transitions; incomplete or overly detailed introduction, emphasis given to less important information	Little or no organization, difficult to follow; missing or ineffective introduction; confusing background; key points unclear	
Usage of Modern tools and technologies	Effectively utilized appropriate tools and technologies for implementation.	Involved sufficiently in developing applications by	Developed applications, though not very effectively. Fair	Sufficient for understanding but not clearly elaborated about usage of tools	Too brief or insufficient for understanding or too detailed	

		utilizing modern tools and technologies	enough.	and technologies		
Presentation Skills	Clear articulation about tools/technology, steady delivery rate, good posture and eye contact, confident and appropriately dressed	Clear articulation about tools/technology but not very polished. Able to recover from minor mistakes. Appropriately dressed	Good articulation about tools/technology and not very polished. Not able to realize minor mistakes. Presentable attire	Refers to slides to make points, occasional eye contact, incorrect pronunciations, and Voice fluctuation.	No clarity in sentence, Inaudible or too loud, no eye contact, delivery rate is too slow or too fast, not in formal attire	
Visuals	Visually pleasing and easy to read; good use of white space, colour, backgrounds; images and Graphics support.	Adequate layout, but with some fonts, colours, backgrounds difficult to read	Good visuals but can be improved largely.	Difficult to read, cluttered appearance; images improperly sized; some distracting graphics or animations	Confusing layout, text extremely difficult to read; many graphics, sounds, animations distract from the presentation	
Total Score						

Rubrics for Internship Report Assessment

	Excellent (10)	V. Good (8)	Good(6)	Satisfactory (4)	Poor (2)	Final Score
Purpose and Objective of Internship	The purpose and objective of the Internship report is made clear, and the report addresses the objective(s) in a focused and logical manner.	The purpose and objective of the Internship report is made clear, and the report addresses the objective(s).	Documented well but with slight ambiguity in analyzing the problems	Purpose and objectives are stated ambiguously	The report does not clearly address the objective(s) of Internship.	
Documenting the essence of Tools/Technology used, Grammar & Spelling	Complete information is provided about tools/technology, Very few spelling errors, correct punctuation, grammatically correct, complete sentences.	Information is provided about tools/technology, Occasional lapses in spelling, punctuation, grammar, but not enough to seriously distract the reader.	Average technical details on tools/technology usage, Grammatical mistakes not corrected.	Less technical details, sentences are not framed properly and with a few spelling mistakes	No details about tools/technology, Numerous spelling errors, non-existent or incorrect punctuation, and/or severe errors in grammar that interfere with understanding.	
Code Development / self learning	Design and Code is self-developed wherever applicable.	Design and Code is self-developed wherever applicable. Code snippets are partially cited	Design and Code is not partially self-developed wherever applicable	Major part of the implementation is copied.	No details about design and development	
Report Format	All required elements of the report are present	All required elements of the report are present	All required elements are	All required elements are	Key elements of the report are not	

	and completed efficiently.	and completed to a satisfactory standard.	present but some of them are not given completely	provided but in a haphazard way	provided. Overall presentation of the document is not to a professional standard.	
Plagiarism Check	Uniqueness 90% and above	Uniqueness 85% to 89%	Uniqueness 80% to 85%	Uniqueness between 75% to 79%	Uniqueness less than 75%	
Total Score						

Rubrics for Internship Presentation and Question/ Answer

(Knowledge on Industry experience /Research work) Assessment (out of 25+ 25marks)

Rubrics for Internship Report Assessment (out of 50 marks) =

Total Marks (Out of 100 marks)   =

Signature of Project Guide

Department of Master of Computer Applications

Rubrics for Technical/Research Seminar Presentation Assessment

Name of the Student: **USN:**

Seminar Guide:

Particulars	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Final Score
Knowledge of the topic at analyse level	Demonstrates in depth knowledge; answered all questions with elaboration	Adequate knowledge on most of the topics. Answered all questions but failed to elaborate	Superficial knowledge of topic; only able to answer basic questions	Does not have any knowledge; Unable to answer questions	
Organization of the presentation	Presented in logicalsequence; introductionand background giveproper context; key pointsand conclusions are clearand well presented	Most information presented in logical sequence; clear introduction; adequate background; some irrelevant information	Problems withsequencing, lacks clear transitions; incomplete or overly detailed introduction, Emphasis given to less important information	Little or no organization, difficult to follow; missing or ineffective troduction; confusing background; key points unclear	
Level of Understanding	Sufficient for understanding and presented very effectively	Sufficient for understanding and presented well	Sufficient for understanding but not clearly presented	Too brief or insufficient for understanding or too detailed	

Presentation Skills	Clear articulation, steady delivery rate, good posture and eye contact, confident and appropriately dressed	Clear Articulation but not very polished. Able to recover from minor mistakes. Appropriately dressed	Refers to slides to make points, occasional eye contact, incorrect pronunciations, and Voice fluctuation.	Inaudible or too loud, no eye contact, delivery rate is too slow or too fast, not in formal attire	
Visuals	Visually pleasing and easy to read; good use of white space, colour, backgrounds; images and Graphics support.	Adequate layout, but with some fonts, colours, backgrounds difficult toread	Difficult to read, cluttered appearance; images improperly sized; some distracting graphics or animations	Confusing layout, text extremely difficult to read;many graphics, sounds, animations distract from the presentation	
				Total Score	

Rubrics for Seminar Report Assessment

	Excellent (2)	**Good (1)**	**Poor(0)**	**Final Score**
Objective, relevance, impact and conclusion	The purpose and objective, relevance and impact of the topic is made clear, and the report addresses them in a focused and logical manner.	The purpose and objective, relevance and impact of the topic is made clear, and the report addresses them.	The report does not clearly address any of them.	

Grammar & Spelling	Very few spelling errors, correct punctuation, grammatically correct, complete sentences.	Occasional lapses in spelling, punctuation, grammar, but not enough to seriously distract the reader.	Numerous spelling errors, non-existent or incorrect punctuation, and/or severe errors in grammar that interfere with understanding.	
References	Sources are acknowledged with full reference details.	Sources are acknowledged with bare reference details.	Sources are not acknowledged.	
Report Format	All required elements of the report are present and completed efficiently.	All required elements of the report are present and completed to a satisfactory standard.	Key elements of the report are not provided. Overall presentation of the document is not to a professional standard.	
Plagiarism Check	Plagiarism below 10%	Plagiarism between 10% and 25%	Plagiarism more than 25%	
Total Score				

The seminar rubrics can be mapped to the following POs:

POs Rubrics	PO1/PO2	PO5/PO6	PO7	PO9	PO10
Knowledge of the topic	3		3		2
Organization of the presentation& Report	2	3	3	3	
Level of Understanding			3		1
Presentation Skills			3	3	
Visuals		3	3	3	

PO1: Apply knowledge of computing fundamentals to provide IT solutions.

PO2: Analyse IT problems using fundamental principles of mathematics and computing sciences

PO5: modern tool usage [for references handling, plagiarism check, spelling check etc]

PO6: Understand professional ethics, cyber regulations, and responsibilities.

PO7: Engage and learn independently for continual development as an IT professional.

PO9: Comprehend, write effective reports and make quality presentations.

PO10: Understand the impact of IT solutions on socio-environmental issues

Course outcomes: At the end of the Seminar Course, students will be able to

CO1: Analyse relevant topic in computing sciences and make valid conclusions on industry/society/environment using fundamental/ research based knowledge

[mapped to PO1, PO2 and PO10]

CO2: Demonstrate self-learning by making effective presentation and report writing

[Mapped to PO7 and PO9]

CO3: Understand ethics, cyber regulations / responsibilities and demonstrate the same by using relevant / modern tool [mapped to PO5 and PO6]

Rubrics for Seminar Presentation Assessment (out of 50 marks) =

Rubrics for Seminar Report Assessment(out of 50 marks) =

Total Marks (Out of 100 marks)   =

Note : Marks obtained out of 100 may be considered as attainment of CO1, CO2 and CO3 taken together.

Signature of Seminar Guide / Coordinator

1. **Name:**   2. **Name:**
    Signature: **Signature:**

Signature of HOD

Note: Department offering MCA programme can define its own programme outcomes/course outcomes/rubrics. Sample of such items given here may be referred.

Visvesvaraya Technological University

"Jnana Sangama", Belagavi - 590 018, Karnataka State

Prof. A S. Deshpande B.E. M.Tech., Ph.D.
REGISTRAR

Phone : (0831) 2498100
Fax : (0831) 2405467

Ref VTU/BGM/Aca-OS/Gen-Cirs/2019-20/ 3013

Date : 1 AUG 2019

NOTIFICATION

Sub: Regulations Governing the Degree of B.E./ B.Tech. under OBE and CBSE (Revised-2018) – reg...

Ref: Executive Council Resolution. No. 2.2.1 dt: 30ᵗʰ May, 2019

Pursuant to the aforesaid Executive Council Resolution, the **"Regulations Governing the Degree of B.E./ B.Tech. under outcome Based Education and Choice Based Credit System – (Revised – 2018) "** are hereby notified.

These Regulations are applicable for the following students:

1. Admitted to I semester/I year from the academic year 2018-19 (i.e. USN XXX18XXXXX)

2. Admitted to III semester/II year from the academic year 2019-20 (i.e. USN XXX19XX4XX)

You are hereby directed to bring the same to the notice of all the concerned and to follow them scrupulously.

The previous regulations in this regard (published on VTU website and printed in syllabus books are treated as null and void.

BY ORDER

01.08.2019

REGISTRAR

Encl: as above

To,
The of Principals of All Engineering Colleges under the ambit of VTU, Belagavi

Copy to:
1. Hon'ble Vice-Chancellor through the Secretary to VC, VTU, Belagavi for kind information
2. The Registrar (Evaluation), VTU, Belagavi
3. The Regional Directors (I/C) of all the Regional Offices of VTU for circulation
4. The Computer Network Centre, VTU, Belagavi- to upload on VTU website
5. PS to Registrar, VTU, Belagavi
6. All the concerned Special Officer and Case-workers of Academic Section, VTU, Belagavi