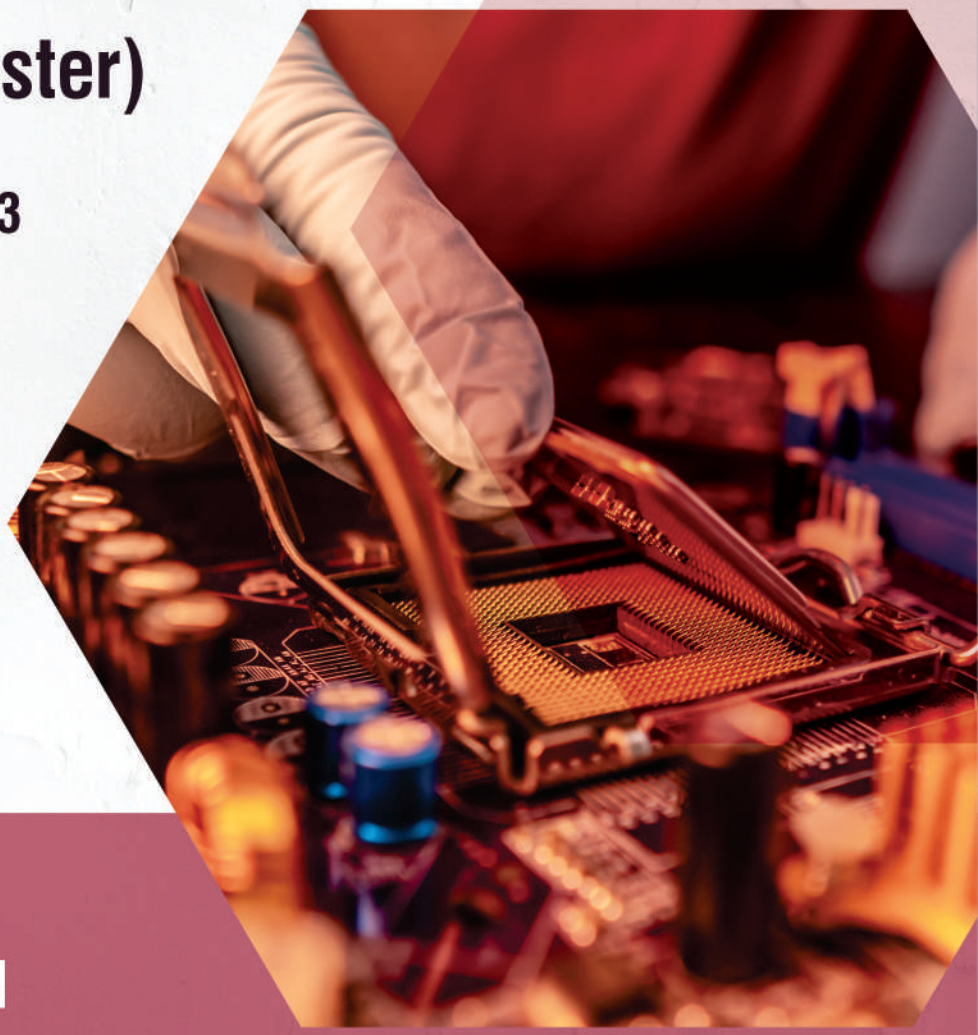
BE SCHEME & SYLLABUS

Second Year
(III and IV Semester)

With effect from 2022-23



Electronics and Communication Engineering

ST JOSEPH ENGINEERING COLLEGE

AN AUTONOMOUS INSTITUTION

Vamanjoor, Mangaluru - 575028

MOTTO

Service & Excellence

VISION

To be a global premier Institution of professional education and research.

MISSION

- Provide opportunities to deserving students of all communities, the Christian students in particular for quality professional education.
- Design and deliver curricula to meet the national and global changing needs through student-centric learning methodologies.
- Attract, nurture and retain the best faculty and technical manpower.
- Consolidate the state-of-art infrastructure and equipment for teaching and research activities.
- Promote all round personality development of the students through interaction with alumni, academia and industry.
- Strengthen the Educational Social Responsibilities (ESR) of the institution.

ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E.(CSE,ECE,EEE, ME and CIV) & MBA
NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS
(With effect from 2022-23)

Electronics and Communication Engineering

SECOND YEAR

(III and IV Semester)

AUTONOMY AND ACCREDITATION

St Joseph Engineering College (SJEC) is an Autonomous Institute under Visvesvaraya Technological University (VTU), Belagavi, Karnataka State, and is recognized by the All-India Council for Technical Education (AICTE), New Delhi. SJEC is registered under the trust "Diocese of Mangalore, Social Action Department".

The SJEC has been conferred Fresh Autonomous Status from the Academic Year 2021-22. The college was granted autonomy by the University Grants Commission (UGC) under the UGC Scheme for Autonomous Colleges 2018 and conferred by VTU. The UGC Expert Team had visited the college on 28-29 November 2021 and rigorously assessed the college on multiple parameters. The fact that only a handful of engineering colleges in the state have attained Autonomous Status adds to the college's credibility that has been on a constant upswing. Autonomy will make it convenient for the college to design curricula by recognizing the needs of the industry, offering elective courses of choice and conducting the continuous assessment of its students.

At SJEC, the Outcome-Based Education (OBE) system has been implemented since 2011. Owing to OBE practised at the college, SJEC has already been accredited by the National Board of Accreditation (NBA). Five of the UG programs, namely Computer Science & Engineering, Mechanical Engineering, Electronics and Communication Engineering, Electrical & Electronics Engineering and Civil Engineering and MBA programs, have accreditation from the NBA.

Also, SJEC has been awarded the prestigious A+ grade by the National Assessment and Accreditation Council (NAAC) for five years. With a Cumulative Grade Point Average (CGPA) of 3.39 on a 4-point scale, SJEC has joined the elite list of colleges accredited with an A+ grade by NAAC in its first cycle. The fact that only a small percentage of the Higher Education Institutions in India have bagged A+ or higher grades by NAAC adds to the college's credibility that has been on a constant upswing.

The college is committed to offering quality education to all its students, and the accreditation by NAAC and NBA reassures this fact. True to its motto of "Service and Excellence", the college's hard work has resulted in getting this recognition, which has endorsed the academic framework and policies that the college has been practicing since its inception. The college has been leveraging a flexible choice-based academic model that gives students the freedom to undergo learning in respective disciplines and a transparent and continuous evaluation process that helps in their holistic development.

CONTENTS

ABOUT THE DEPARTMENT

The Department of Electronics and Communication Engineering was setup during the inception of the college in 2002. With the effort of well qualified faculty and best infrastructure, the Department has grown from strength to strength in the last decade. Currently, the student intake is 120 at the UG level. VTU has approved the Department to offer M.Sc (Engg.) by research and PhD from 2015. The Department strives to empower students with the skills required to thrive in the field of Digital System Design, VLSI, Wireless Communication, Optical Communication, Embedded Systems, Biomedical Engineering, IoT, Artificial Intelligence and Robotics. Students are encouraged to present papers in symposium and conferences, and to participate in various intercollege technical and nontechnical events.

The Department is well equipped with state-of-art laboratories with the latest tools such as Cadence VLSI Design Suite, Xilinx Vivado-2018, MATLAB 2023a, ARM CORTEX, NI Multisim 14.2, NEXYS 4 DDR Artix-7 FPGA Board, Analog Discovery Kits, Digital Storage Oscilloscopes, Digital Signal Generators, Workstations etc. to skill the students Industry ready. With a large collection of books and materials for students, faculty, and staff, the Department offers a well-organized library. In addition, the Department has Biomedical Electronics Research Lab to encourage students to develop projects in the field of Biomedical Engineering in association with Father Mullers Research Centre and Hospital Mangaluru, Cyclops MedTech Private Limited Bengaluru and DST-Nitte University Technology Enabling Centre.

The Department has MOU with "Karmic Design Pvt Ltd" Manipal to facilitate the students in semiconductor chip design. Also, Department has MoU with College of Electrical & Information Engineering, Asia University, Taiwan to encourage students for Internship in the emerging areas such as Image Processing, Artificial Intelligence, Deep Learning, Computer Networks, Cyber Security etc. The Department actively organizes Industry visits, Conferences, Workshops, Technical talks, Faculty Development Programs from Industry/Academic experts in order to enhance students' learning abilities, creative thinking and also to bridge the gap between the Industry and Academia.

PRODIGY student association and **Samarthya Club** of the Department provides ample opportunities for the students to excel in technical and extra-curricular activities. The Department has well qualified faculty who are specialized in their respective domain and are actively involved in research. The Department has been shaping industry-ready graduates who have carved successful careers in the industry with placements almost nearing 100%.

DEPARTMENT VISION

To Excel in Electronics and Communication Engineering Education and Research, focusing on the needs of Industry and Society, with professional ethics.

DEPARTMENT MISSION

- Provide opportunities to deserving students for quality professional education in the field of Electronics and Communication.
- Design and deliver curricula to meet the changing needs of industry through student centric learning methodologies to excel in their profession.
- Recruit, Nurture and Retain best faculty and technical manpower.
- Consolidate the state-of-art infrastructure and equipment for teaching and research activities.
- Promote all round personality development of the students through interaction with alumni, academia and industry.
- Strengthen the Educational Social Responsibilities of the institution.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To provide students with the solid foundation in mathematical, scientific, Electronics and Communication engineering to analyze data and technical concepts for application to product design and also to pursue higher education.

2. To train students with good scientific and engineering breadth, including proficiency in software language and use of latest software tools so as to comprehend, analyze, design and create novel products and solutions for the real-life problems.
3. To develop skills in students for successful careers in industry that meet the needs of Indian and multinational companies, through rigorous education.
4. To inculcate in students professional and ethical attitude, effective communication skills and teamwork, multidisciplinary approach, and an ability to relate engineering issues to broader social context.
5. To provide students with an academic environment to become aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze 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 on complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and the synthesis of 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 modeling 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, and 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 a leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize 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)

Engineering Graduates will be able to:

PSO1: Analyze and develop solutions in the areas of Signal Processing and Communication Systems.

PSO2: Apply knowledge of Embedded Systems and VLSI to design and develop solutions for societal problems.

III Semester (B.E. – E&C Engineering)													
SI. No	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	BSC	22ECE31	Complex Functions, Fourier Series and Transforms	MAT	MAT	2	2	-	03	50	50	100	3
2	IPCC	22ECE32	Digital Design (Integrated)	ECE	ECE	2	2	2	03	50	50	100	4
3	IPCC	22ECE33	Network Theory (Integrated)	ECE	ECE	3	-	2	03	50	50	100	4
4	PCC	22ECE34	Analog Circuits	ECE	ECE	3	-	-	03	50	50	100	3
5	ESC	22ECE35X	ESC/ETC/PLC	ECE	ECE	2	2	-	03	50	50	100	3
6	PCCL	22ECE36L	Analog Circuits Laboratory	ECE	ECE	-	-	2	03	50	50	100	1
7	HSMC	22UHV37	Universal Human Values - II	COM	COM	2	-	-	02	50	50	100	2
		22BFE37	Biology for Engineers	COM	COM								
8	AEC/SDC	22IEP38	IoT Enabled Prototyping	COM	COM	-	-	2	02	50	50	100	1
9	MNCC	22ITB39A / 22ITC39B	Industry Oriented Training – Business Etiquettes/ Industry Oriented Training – Computing Skills	COM	COM	-	-	2	02	50	-	50	-
					Total	14	6	10	24	**450**	**400**	**850**	**21**

22ECE35X : Engineering Science Course/Emerging Technology Course/Programming Language Course			
22ECE351	Sensors and Instrumentation	22ECE353	Computer Organization and Architecture
22ECE352	Principles of Electromagnetics	22ECE354	Artificial Neural Networks

IV Semester (B.E. – E&C Engineering)													
SI. No	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	BSC	22ECE41	Linear Algebra and Statistical Methods	MAT	MAT	2	2	-	03	50	50	100	3
2	IPCC	22ECE42	Digital Design using Verilog HDL (Integrated)	ECE	ECE	2	2	2	03	50	50	100	4
3	IPCC	22ECE43	Signals & Systems (Integrated)	ECE	ECE	3	-	2	03	50	50	100	4
4	PCC	22ECE44	Analog Communication Engineering	ECE	ECE	3	-	-	03	50	50	100	3
5	ESC	22ECE45X	ESC/ETC/PLC	ECE	ECE	3	-	-	03	50	50	100	3
6	PCCL	22ECE46L	Analog Communication Laboratory	ECE	ECE	-	-	2	03	50	50	100	1
7	HSMC	22UHV47	Universal Human Values – II	COM	COM	2	-	-	02	50	50	100	2
	HSMC	22BFE47	Biology for Engineers	COM	COM								
8	AEC/SDC	22CTE48	Computational Tools for Engineers	COM	COM	-	-	2	02	50	50	100	1
9	AEC/SDC	22ITB49A / 22ITC49B	Industry Oriented Training – Business Etiquettes/ Industry Oriented Training – Computing Skills	COM	COM	-	-	2	02	50	-	50	-
					Total	15	4	10	24	**450**	**400**	**850**	**21**

22ECE45X : Engineering Science Course/Emerging Technology Course/Programming Language Course			
22ECE451	Physics of Semiconductor Devices	22ECE453	Control Engineering
22ECE452	Object Oriented Programming using C++	22ECE454	Cloud Computing

III Semester

Complex Functions, Fourier Series and Transforms			
Course Code	**22ECE31**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives:

1. To evaluate complicated real integrals in electronics and communication
2. To use the Fourier series to represent periodical physical phenomena in engineering analysis.
3. To use Fourier Transforms in electronics
4. To apply the method of solving difference equations by using Z transform

Module-1 8 Hours

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 properties of analytic functions (no proof). Construction of analytic functions: Milne-Thomson method-problems.

Text Book 1: Chapter 19 & 20 and Text Book 2: Chapter 13 to 18

Module-2 8 Hours

Conformal transformations: Introduction. Discussion of transformations of $w = e^z$, $w = z^2$ and $w = z + \frac{1}{z}$. **Bilinear transformation**- problems.

Complex integration: Line integral of a complex Function-Cauchy's theorem and Cauchy's integral formula and problems.

Text Book 1: Chapter 19 & 20 and Text Book 2: Chapter 13 to 18

Module-3 8 Hours

Fourier Series: Periodic functions, Dirichlet's conditions. Fourier series of periodic functions period 2l. Half range Fourier series for arbitrary period. Practical harmonic analysis, examples from the engineering field.

Text Book 1: Chapter 10 and Text Book 2: Chapter 11

Module-4 8 Hours

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

Discrete Fourier Transforms (DFT): Introduction to DFT, basic mathematical definition and formula related to DFT and Inverse DFT, DFT as a Linear transformation-problem**s.**

Text Book 1: Chapter 22 and Text Book 2: Chapter 11

Module-5 8 Hours

Z-Transforms and Difference Equations: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules (statement only). Inverse z-transform (by partial fraction method) and applications to solve difference equation.

Text Book 1: Chapter 23

Course Outcomes: At the end of the course the student will be able to:	
22ECE31.1	Apply complex analysis in electronics engineering
22ECE31.2	Utilize conformal transformation in problems in communication engineering
22ECE31.3	Describe a periodic signal in terms of cosine and sine waves
22ECE31.4	Use the concept of Fourier sine and cosine transform to solve the problems
22ECE31.5	Convert the discrete time data sets to discrete frequency using the concept of discrete Fourier transform
22ECE31.6	Apply the knowledge of Z-transforms to solve difference equations.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition., 2017
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition (Reprint), 2017
3	Digital signal processing – Principles Algorithms & Applications	Proakis & Manolakis	Pearson Education	4th Edition, 2007
Reference Books				
1	Engineering Mathematics	Srimanta Pal & Subodh C. Bhunia	Oxford University Press	3rd Edition, 2016
2	A textbook of Engineering Mathematics	N.P Bali and Manish Goyal	Laxmi Publications	10th Edition, 2022
3	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw Hill Book Co. New York,	6th Edition, 2017

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=Mwpz1zjPlzI&list=PLbMVogVj5nJS_i8vfVWJG16mPcoEKMuWT – Introduction to Complex Analysis
- https://www.youtube.com/watch?v=HswQxH4G63c – Cauchy Riemann Equations
- https://www.youtube.com/watch?v=2I4jKIGy238 – Conformal Transformation
- https://www.youtube.com/watch?v=D6xj6vy69_M – Cauchy's Integral Theorem
- https://www.youtube.com/watch?v=HoGNkZclxDU&list=PLs7oDAL8_ouJ5w8wCPtKnK2I09MlKC6kP – Fourier Series
- https://www.youtube.com/watch?v=lkAvgVUvYvY – Fourier Transforms
- https://www.youtube.com/watch?v=Q8wuqYsdnSs – Discrete Fourier Transforms
- https://www.youtube.com/watch?v=zmxWaXvKfdc&list=PLs7oDAL8_ouKSagWiC_IwrEsRwvD2WJ73 – Z –Transforms

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE31.1	2		1											
22ECE31.2		2	1											
22ECE31.3	2		1											
22ECE31.4														
22ECE31.5	2	1												
22ECE31.6		2	1											

1: Low 2: Medium 3: Hig

Digital Design			
Course Code	**22ECE32**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Illustrate concept of logic function optimization using Karnaugh Map
- Demonstrate skills to design various combinational logic circuits.
- Design and analyze sequential circuits and demonstrate minimization techniques
- Design and Develop various Shift Register and Counters
- Understand the need for state machine and its implementation
- Implement Combinational and Sequential logic using Discrete IC's and EDA Tools

Module - 1 (8 hours)

Optimized Implementation of Logic Functions: Karnaugh Map, Strategy for Minimization, Minimization of Product of Sum Forms, Incompletely Specified Functions, Multiple Output Circuits, Multilevel Synthesis, Analysis of Multilevel Circuits, A Tabular Method for Minimization.
Text 1: Chapter 4:4.1-4.7, 4.9
Exclusive-OR Function.
Text 2: Chapter 3: 3.9.

Module - 2 (8 hours)

Combinational Logic: Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Decoders, Encoders.
Text 2: Chapter 4: 4.1-4.11,
Binary Coded Decimal (BCD), Digital Codes, Code Converters, Multiplexers, Demultiplexers
Text 3: Chapter 2: 2.10-2.11, Chapter 6: 6.7-6.9.

Module - 3 (8 hours)

Synchronous Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Storage Elements: Flip-flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedure.
Text 2: Chapter 5: 5.1-5.5, 5.7-5.8.

Module - 4 (8 hours)

Counters and Shift Registers: Asynchronous Counters, Synchronous Counters, Up/Down Synchronous Counters, Design of Synchronous Counters, Cascaded Counters, Basic Shift Register Operations, Serial In/Serial Out Shift Registers, Serial In/Parallel Out Shift Registers, Parallel In/Serial Out Shift Registers, Parallel In/ Parallel Out Shift Registers, Bidirectional Shift Registers, Shift Register Counters.
Text 3: Chapter 9: 9.1-5.5, Chapter 10: 10.1-10.7.

Module - 5 (8 hours)

State Machines: Basic Design Steps, State-Assignment Problem, Melay State Model, Serial Adder Example (except Verilog Code), State Minimization, Design of Counter using the Sequential Circuit Approach, Algorithmic State Machine (ASM) Charts.
Text 1: Chapter 8:8.1-8.3, 8.5-8.7, 8.10.

PRACTICAL MODULE

Part A (Using Discrete Components)

1. Simplify Sum of Products and Product of Sum Expressions using K-Map and Verify the functionality using a) Basic Gates, b) Universal Gates
2. Design and implement Half Adder, Full Adder, Half Subtractor, Full Subtractor using a) Basic Gates, b) NAND Gates
3. Design and implement 4-bit Parallel Adder/Subtractor using IC 7483

4. Design and implement 5-bit Magnitude Comparator using IC7485
5. Realize a 4-variable function using IC 74151 (8:1 Mux)
6. Realize Master Slave JK, D and T Flip-flop using NAND Gates
7. Realize a) SIPO, b) PIPO, c) Johnson Counter using IC 7474/7495
8. Realize a) Mod-N counter using IC7490/7476

Part B (Using Multisim or any other similar EDA)

1. Design and implement Code Conversion, a) Binary to Grey and Vice Versa b) BCD to Excess -3 and Vice Versa
2. Design and Implement 1-bit and 2-bit Magnitude Comparator
3. Design and Implement 4:1 Multiplexer and 1:4 Demultiplexer.
4. Realize 4 variable functions using Decoders
5. Realize Ring Counter
6. Design Mod-N Synchronous Up and Down Counter using JK flipflop

Part C (Open Ended Experiments)

1. Design and simulate a Parallel Adder with Accumulator using EDA tool.

Course Outcomes: At the end of the course the student will be able to:	
22ECE32.1	Make use of Karnaugh Map and State Minimization techniques to optimize logic functions
22ECE32.2	Design and develop fundamental combinational logic circuits
22ECE32.3	Analyze the need for clocked circuits and its implementation techniques
22ECE32.4	Apply the concept of the sequential logic design to implement shifters and counters
22ECE32.5	Examine the need of state machines and its application in logic minimization
22ECE32.6	Make use Discrete component and EDA tools to design, implement and simulate combinational and sequential logic circuits

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Fundamentals of Digital Logic with Verilog Design	Stephen Brown and Zvonko Vranesic	McGraw – Hill Edition	2nd Edition, 2013
2	Digital Design – With an Introduction to the Verilog HDL	M. Morris Mano and Michael D Ciletti	Pearson	5th Edition, 2013
3	Digital Fundamentals	Thomas L. Floyd	Pearson	10th Edition, 2013
Reference Books				
1	Digital Design	John F. Wakerly	Pearson	4th Edition, 2013
2	Fundamentals of Logic Design	Charles H. Roth, Jr, Larry L. Kinney	Cengage Learning	7th Edition, 2017

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/106/108106177/
- https://nptel.ac.in/courses/106105185
- https://nptel.ac.in/courses/117106086

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE32.1	3	3	3											2
22ECE32.2	3	3	3	2										2
22ECE32.3	3	3	3	2										2
22ECE32.4	3	3	3	2										2
22ECE32.5	3	3	2											2
22ECE32.6		2	2	2	2			2	2	2	2	2		2

1: Low 2: Medium 3: High

Network Theory			
Course Code	**22ECE33**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power.
- Explain network Thevenin's, Millman's, Superposition, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits.
- Explain the behavior of networks subjected to transient conditions.
- Use applications of Laplace transforms to network problems.
- Analyze two port network parameters like Z, Y, T and h and their inter-relationships and applications.
- Analyze RLC Series and parallel tuned circuit

Module-1 Basic Concepts (8 hours)

Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh, source transformation.
(Text Book 1: Chapter 3 and Text Book 3: Chapter 2 & 3).

Module-2 Network Theorems (8 hours)

Superposition, Reciprocity, Millman's theorems, Thevenin's and Norton's theorems, Maximum Power transfer theorem. (Text Book 3: Chapter 4.3-4.8).

Module-3 RL RC RLC circuits (8 hours)

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. (Text Book 2: Chapter 2.5).

Module-4 Laplace Transformation & Applications (8 hours)

Solution of networks, step, ramp and impulse Responses, waveform Synthesis.
(Text Book 2: Chapter 5 & 6 and Text Book 3: Chapter 15 & 16).

Module-5 Two port network parameters & Resonance (8 hours)

Two port network parameters:
Definition of Z, Y, h and transmission parameters, modeling with these parameters, relationship between parameters sets. (Text Book 2: Chapter 12).

Resonance:
Series Resonance*:* Variation of Current and Voltage with Frequency, Selectivity and Bandwidth, Q-Factor, Circuit Magnification Factor, Selectivity with Variable Capacitance, Selectivity with Variable Inductance.
Parallel Resonance: Selectivity and Bandwidth, Maximum Impedance Conditions with C, L and f Variable, current in Anti-Resonant Circuit, The General Case-Resistance Present in both Branches. (Text Book 2: Chapter 8).

PRACTICAL MODULE

(Note: Experiments using Discrete components and Multisim Simulation tool)

1. Measurement and analysis of DC circuits- (to observe current division and voltage division)
2. Verification of Kirchhoff's voltage law and Kirchhoff's current law
3. Verification of Star to delta transformations
4. Simulation of Mesh analysis and Node analysis

5. Verification of Network Theorems- Superposition theorem
6. Simulation to obtain the transient response of Series RC and RL circuit.
7. Determination of the Impedance (Z) and admittance (Y) parameters of a two port network.
8. To find the resonant frequency, quality factor and bandwidth of a given series and parallel resonant circuits.
9. **Open ended experiment covering the concept of the entire syllabus.**

(Verification of Network Theorems -Thevenin's Theorems, Maximum Power transfer theorem, Reciprocity Theorem, Millman's theorems, Norton's theorems.)

Course Outcomes: At the end of the course the student will be able to:	
22ECE33.1	Inspect DC and AC Networks and Apply Node & Loop analysis concepts.
22ECE33.2	Examine and Make Use of various Circuit Analysis Theorems.
22ECE33.3	Develop and solve mathematical representations for simple RLC circuits
22ECE33.4	Utilize Laplace Transform to Solve the given networks
22ECE33.5	Analyze Two-Port Network Parameters
22ECE33.6	Illustrate the concept of Series and Parallel Resonance.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Network analysis	M.E. Van Valkenburg	Prentice Hall of India	3rd Edition, 2000
2	Networks and systems	Roy Choudhury	New Age International Publications	2nd Edition, 2006
3	Fundamentals of Electric Circuits	Charles K Alexander and Mathew N O Sadiku	Tata McGraw-Hill	4th Edition, 2009
Reference Books				
1	Engineering Circuit Analysis	Hayt, Kemmerly and Durbin	TMH	7th Edition, 2010
2	Basic Engineering Circuit Analysis	J. David Irwin /R. Mark Nelms	John Wiley	8th Edition, 2006
3	Engineering Circuit Analysis	Hayt, Kemmerly and Durbin	TMH	7th Edition, 2010

Web links and Video Lectures (e-Resources):

- NPTEL: NOC Network Analysis - Prof T K Bhattacharya - IIT – Kharagpur
- NPTEL: Networks and Systems - Prof V G K Murti - IIT – Madras
- NPTEL: Networks and Systems - Prof V G K Murti - IIT – Madras
- NPTEL: Circuit Theory - Prof S C Dutta Roy - IIT Delhi
- NPTEL: Network, Signal, and Systems - Prof T K Basu - IIT – Kharagpur
- NPTEL: Basic Electrical Circuits - Prof Nagendra K - IIT - Madras

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE33.1		3		2								2	3	
22ECE33.2		3		2	2			1	1	1		2	3	
22ECE33.3		3		2									3	
22ECE33.4		3		2	2			1	1	1		2	3	
22ECE33.5		3	2	2		2						2	3	
22ECE33.6	3			2										

1: Low 2: Medium 3: High

Analog Circuits			
Course Code	**22ECE34**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Describe the working MOS Transistor.
- Acquire knowledge of FET characteristics.
- Describe the MOS amplifier configurations.
- Explain various types of FET biasing, and demonstrate the use of FET amplifiers.
- Demonstrate the ability to design Amplifiers and Filters using Op-amp.
- Demonstrate the ability to design Op-amp based Oscillators, Multivibrators, and Precision rectifiers.

Module-1 MOS Field Effect Transistors (MOSFETs) (8 hours)

Device structure, Operation with no gate voltage, Creating a channel for current flow, Operation by varying V_{DS}, Current-Voltage characteristics-i_D-V_{DS} characteristics, i_D-V_{GS} characteristics, MOSFET circuits at DC (Problems), Role of the substrate-Body effect, Temperature effect, Breakdown and Input protection, Basis for amplifier operation, Voltage amplifier, Transfer characteristics, linear amplifier, Biasing in MOS amplifier circuits.

Text 1: Chapter 5: 5.1 (5.1.1 to 5.1.3, 5.1.5, 5.1.6), 5.2 (5.2.1 to 5.2.3), 5.3,5.4

Chapter 6: 6.1 (6.1.1 to 6.1.4),6.4(6.4.1)

Self-Study: P-channel MOSFET and characteristics.

Module-2 MOSFET Small Signal Operation and Models (8 hours)

DC bias point, Signal current in the drain terminal, Voltage gain, Separating the DC analysis and the signal analysis, Small signal equivalent circuit models, Transconductance, T-Equivalent circuit model, Basic MOSFET amplifier configuration, Three basic configuration, Common Source amplifier, Common Source amplifier with a source resistance, Common Gate amplifier, Common Drain amplifier.

Text 1: Chapter 6: 6.2(6.2.1), 6.3 (6.3.1 to 6.3.5)

Self-Study: High Frequency Model of MOSFET.

Module-3 Operational Amplifiers (8 hours)

Op-Amp with Negative Feedback and General Applications: General feedback structure, Properties of negative feedback, Four basic feedback topologies (Block diagram only), Voltage-Series feedback and Voltage-Shunt feedback Amplifiers – Closed Loop voltage gain, Input impedance, Output impedance, and Bandwidth with feedback. DC and AC Amplifiers, Scaling and Averaging amplifiers.

Text 1 Chapter 7: 7.1 to 7.3

Text 2 Chapter 3: 3.3 (3.3.1 to 3.3.6), 3.4 (3.4.1 to 3.4.5)

Chapter 6:6.2, 6.5, 6.6 (6.6.1)

Self-Study: Instrumentation Amplifier.

Module-4 Op-Amp Filters and Oscillators (8 hours)

Active Filters, First order low-pass Butterworth filter, Second order low-pass Butterworth filter, First order high-pass Butterworth filter, Second order high-pass Butterworth filter, Band-pass filters, Band reject filters. Oscillator principles, Oscillator types, Frequency Stability, Phase shift Oscillator and Wien Bridge Oscillator.

Text 2 Chapter 7: 7.2 to 7.6, 7.8, 7.9, 7.11 (7.11.1 to 7.11.3), 7.12, 7.13

Module-5 Op-Amp Circuits (8 hours)

Comparators, Zero Crossing Detector, Schmitt trigger, DAC - Weighted resistor and R-2R ladder,

ADC- Successive approximation type, Clippers and Clampers, Positive and Negative clippers, Small Signal half wave rectifier, Positive and Negative clampers, Sample and Hold circuit. 555 Timer, Monostable multivibrator - operation, Astable Multivibrator - operation.
Text 2 Chapter 8: 8.2 to 8.4, 8.11 (8.11.1a, 8.11.1b, 8.11.2a), 8.12, 8.15, Chapter 9: 9.4 (9.4.1, 9.4.1(a),9.4.3, 9.4.3(a)
Self-Study: Applications of Monostable and Astable Multivibrator.

Course Outcomes: At the end of the course the student will be able to:	
22ECE34.1	Illustrate the working principles, and characteristics of FET.
22ECE34.2	Compare the various FET biasing schemes.
22ECE34.3	Inspect the frequency response characteristics of CS amplifiers.
22ECE34.4	Design an op-amp based amplifier in inverting and non-inverting configuration.
22ECE34.5	Construct a filter and oscillator using op-amp.
22ECE34.6	Develop and explain the functioning of op-amp based linear and non- linear circuits.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Microelectronic Circuits Theory and Applications.	Adel S Sedra and Kenneth C. Smith	International Version, Oxford University Press	7th Edition, 2017
2	Op-Amps and Linear Integrated Circuits.	Ramakant A Gayakwad	Prentice Hall India	4th Edition, 2000
Reference Books				
1	Electronic Devices and Circuit Theory.	Robert L Boylestad and Louis Nashelsky	Pearson	10th Edition, 2009
2	Electronic Devices and Circuits.	David A Bell	Oxford University Press.	5th Edition, 2008.
3	Electronic Devices.	Thomas L Floyd	Pearson	9th Edition,2015
4	Fundamentals of Microelectronics.	Behzad Razavi	Wiley	3rd Edition,2021
5	Design with Operational Amplifiers and Analog Integrated Circuits.	Franco Sergio	Tata-McGraw-Hill	3rd Edition,2017

Web links/Video Lectures/MOOCs/papers:
- **NPTEL: Analog Circuits by Prof. A.N. Chandorkar, IIT Bombay, (https://nptel.ac.in/courses/117/101/117101106/)**
- **NPTEL: Analog Circuits and Systems 1 by Prof. K. Radhakrishna Rao, IISc Bangalore, (https://nptel.ac.in/courses/117/108/117108107/)**
- **NPTEL: Analog Circuits by Dr. Nagendra Krishnapura, IIT Madras, (https://nptel.ac.in/courses/108/106/108106084/)**

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE34.1	1													
22ECE34.2	1		2											
22ECE34.3	1													
22ECE34.4	1	2	2		3									
22ECE34.5	1	2	3		3									
22ECE34.6	1	2	3		3	1								

1: Low 2: Medium 3: High

Sensors and Instrumentation			
Course Code	**22ECE351**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Understand the functional elements of instrumentation/measurement systems.
- Provide the fundamental knowledge of Basic Sensors & Transducers.
- Acquire knowledge about types of sensors used in modern digital systems.
- Impart the basic concepts of digital instruments, oscilloscope and signal generators.
- Develop the skills for the measurement of Resistance, Capacitance, Inductance and Frequency.

Module-1 (8 hours)

Introduction, Performance Characteristics, Static Characteristics, Error in Measurement, Types of Static Error, Sources of Error, Dynamic Characteristics, Statistical Analysis, Standard, Electrical Standards, Atomic Frequency and Time Standard.
(Text Book 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10,1.11)

Module-2 (8 hours)

General concepts and terminology, sensor classification, primary sensors, material for sensors, microsensor technology, Thermistors, magneto resistors, light dependent resistors, resistive hygrometers, resistive gas sensors, liquid conductivity sensors. Capacitive Sensors, Inductive Sensors.
(Text Book 2: 1.1, 1.2, 1.7, 1.8, 1.9, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 4.1, 4.2.1, 4.2.2, 4.2.3)

Module-3 (8 hours)

Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors. Position encoders, resonant sensors.
(Text Book 2: 6.1, 6.2, 6.3, 6.4, 6.5, 8.1, 8.2)

Module-4 (8 hours)

DVMs: Introduction, Ramp technique, Dual slope integrating type DVM, Integrating type DVM, Successive approximation, Resolution and sensitivity of digital meters. Digital mustimeters, Digital frequency meter.
Oscilloscope: Introduction, Basic principle, CRT features, Block diagram of oscilloscope, Dual beam CRO, Dual trace oscilloscope.
(Text Book 1: 5.1, 5.2, 5.3, 5.4, 5.6, 5.9, 6.2, 6.3, 7.1, 7.2, 7.3, 7.4, 7.14, 7.15)

Module-5 (8 hours)

Signal Generators: Introduction, Fixed and variable AF oscillator, Standard signal generator, Modern laboratory signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator.
Bridge Circuits for Measurement of R, L & C:
DC bridges: Introduction, Wheatstone bridge, Kelvin Bridge, Practical Kelvin's double bridge.
AC bridges: Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Schering Bridge, Wien's bridge. (Relevant problems)
(Text Book 1: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 11.1, 11.2, 11.3, 11.4, 11.8, 11.9, 11.10, 11.11, 11.13, 11.14)

Course Outcomes: At the end of the course the student will be able to:	
22ECE351.1	Describe instrument characteristics, errors and generalized measurement system
22ECE351.2	Distinguish various types of sensors and their construction
22ECE351.3	Articulate the modern and intelligent sensors
22ECE351.4	Investigate the principle and working of digital multimeters and frequency meters
22ECE351.5	Explore the functioning of Oscilloscopes and Function generators
22ECE351.6	Analyze and use appropriate circuits for the measurement of resistance, capacitance, inductance and frequency

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition & Year**
Textbooks				
1	Electronic Instrumentation	H. S. Kalsi	Tata McGraw Hill Education Pvt. Ltd.	3rd Edition, 2012
2	Sensors and Signal Conditioning	Ramon Pallás Areny, John G. Webster,	John Wiley and Sons	2nd Edition, 2000
Reference Books				
1	Transducers and Instrumentation	D.V.S.Murty	Prentice Hall India	2nd Edition, 2009
2	Instrumentation Measurement & Analysis	B.C.Nakra and K.K.Choudhry	McGraw Hill Education Pvt.Ltd	3rd Edition. 2009
3	Electrical & Electronic Measurements & Instrumentation	A. K. Sawhney	Dhanpat Rai & Co. Pvt. Ltd	17th Edition, 2004
4	Electronic Instrumentation and Measurements	David A Bell	Oxford Higher Education	3rd Edition, 2013

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio
- https://www.youtube.com/watch?v=NuQqDFkhIlU&list=PLC7B26029C4E955FA

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE351.1	2	1							1	1		1		
22ECE351.2	2	1				2	1			1				1
22ECE351.3		1												1
22ECE351.4		1												
22ECE351.5		1	1											
22ECE351.6		1	1											1

1: Low 2: Medium 3: High

Principles of Electromagnetics			
Course Code	**22ECE352**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 hours Theory	Credits	03

Course Learning Objectives: The objective of the course is to

- Study the application of Coulomb's Law and Gauss Law for electric fields produced by different charge configurations
- Evaluate the energy and potential due to a system of charges.
- Study the behavior of an electric field across a boundary between a conductor and dielectric and between two different dielectrics
- Study the magnetic fields and magnetic materials.

Module-1 Coulomb's Law, Electric Field Intensity and Flux density (8 hours)

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 1: Chapter 2.1 to 2.5, 3.1)

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 V and divergence theorem, Numerical Problems (Text 1: Chapter 3.2 to 3.7).

Module-2 Energy, Potential and Conductors: (8 hours)

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 a point charge, Potential gradient, Numerical Problems (Text 1: Chapter 4.1 to 4.4 and 4.6). Current and Current density, Continuity of current. (Text 1: Chapter 5.1, 5.2).

Module-3 Poisson's and Laplace's Equations (8 hours)

Dielectric and capacitance: Dielectric materials, boundary conditions, the capacitance of different configurations. (Text 1: Chapter 5.7 and 5.8).

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 1: Chapter 6.6 to 6.8).

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 1: Chapter 7.1to 7.6) .

Module-4 Magnetic Forces (8 hours)

Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems (Text 1: Chapter 8.1 to 8.3).

Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, and Numerical problems (Text 1: Chapter 8.6 to 8.10). Faraday's law of Electromagnetic Induction -Integral form and Point form, Numerical problems (Text 1: Chapter 9.1) .

Module-5 Maxwell's equations & Uniform Plane Wave (8 hours)

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 1: Chapter 9.2 to 9.4).

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 (Text: Chapter 11.1to 11.3) .

Course Outcomes: At the end of the course the student will be able to:	
22ECE352.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
22ECE352.2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem
22ECE352.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation
22ECE352.4	Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
22ECE352.5	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits
22ECE352.6	Apply Maxwell's equations for time varying fields

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Engineering Electromagnetics	W.H. Hayt and J.A. Buck	TataMcGraw-Hill	8th Edition, 2012
Reference Books				
1	Elements of Electromagnetics	Matthew N.O., Sadiku	Oxford university press	4th Edition, 2007
2	Electromagnetic Waves and Radiating systems	E. C. Jordan and K.G Balmain	PHI	2nd Edition, 2015

Web links and Video Lectures (e-Resources):

- Vector Calculus for Electromagnetism 1 : Vector Components - Electromagnetic Field: https://www.youtube.com/watch?v=0Hv4a2KcXVc
- Differential equations for engineers: https://archive.nptel.ac.in/courses/111/106/111106100/
- Introduction to EM waves and various techniques of communication: https://nptel.ac.in/courses/117101056
- Electromagnetic Theory: https://nptel.ac.in/courses/115101005

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE352.1	2												1	
22ECE352.2	2	1											1	
22ECE352.3	2												1	
22ECE352.4	2												1	
22ECE352.5	2	1											1	
22ECE352.6	2												1	

1: Low 2: Medium 3: High

Computer Organization and Architecture			
Course Code	**22ECE353**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Identify the elements of modern instructions sets and their impact on processor design.
- Analyze the design of the various functional units and components of computers.
- Identify and compare different methods for computer input/output organization.
- Analyze the function of each element of a memory hierarchy.

Module -1 Basic Operational Concepts (8 hours)

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation.
Machine Instructions and Programs**:** Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing.
Text 1:1.1, 1.2, 1.3, 1.4, 1.5, 1.6 (1.6.1 & 1.6.2), 2.1, 2.2, 2.3, 2.4(up to 2.4.6)

Module - 2 Assembly Language Programming (8 hours)

Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions. Text 1: 2.5, 2.6, 2.7, 2.8, 2.9 (2.9.1 & 2.9.2), 2.10

Module - 3 Input / Output Organization (8 hours)

Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access.
Text 1: 4.1, 4.2(up to 4.2.4), 4.4(except 4.4.1)

Module - 4 Memory System (8 hours)

Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks.
The basics of caches: accessing cache memory, Handling cache misses, Handling writes.
Text 1: 5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to 5.5.4), 5.7 (except 5.7.1), 5.9, 5.9.1 Text 2: 5.3

Module - 5 Basic Processing Unit (8 hours)

Some Fundamental Concepts, Register Transfers, Performing an arithmetic or logical operation, Fetching a Word from the memory, Storing a word into Memory, Execution of a Complete Instruction, Branch Instructions, Multiple Bus Organization, Hardwired Control, A complete Processor, Microprogrammed Control.
Text 1: 7.1, 7.2, 7.3, 7.4, 7.5 (except 7.5.1 to 7.5.6)

Course Outcomes: At the end of the course the student will be able to:	
22ECE353.1	Interpret basic operational concepts of computer and their interconnection to form a computer system.
22ECE353.2	Apply the concepts of computer arithmetic and summarize memory operations.
22ECE353.3	Identify assembly level instruction sets and implement basic I/O operations.
22ECE353.4	Demonstrate the concept of interrupts in data communication between I/O Devices.
22ECE353.5	Compare different types of memory components of a computer system.
22ECE353.6	Illustrate the organization and functions of basic computer processing unit and apply it in instruction execution.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Computer Organization	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Tata McGraw-Hill	5th Edition, 2002
2	Computer Organization and Design- The Hardware/Software Interface	David A. Patterson, John L. Henessy	Elsevier	5th Edition, 2014
Reference Books				
1	Computer Organization & Architecture	William Stallings	Prentice Hall India	10th Edition, 2017
2	Computer Systems Design and Architecture	Vincent P. Heuring Harry F. Jordan	Pearson Education	2nd Edition, 2004

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106103180/
- https://nptel.ac.in/courses/106106092/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE353.1		2					1							
22ECE353.2		2							1					
22ECE353.3				1	1				2					
22ECE353.4		1			1									
22ECE353.5										2				
22ECE353.6													1	1

1: Low 2: Medium 3: High

Artificial Neural Networks			
Course Code	**22ECE354**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives: This course will enable students to:

- Understand the basics of ANN and compare it with human brain
- Acquire knowledge on various ANN architectures
- Understand statistical learning theory
- Understand principle behind supervised and unsupervised algorithms of ANN
- Understand recurrent neural networks.

Module-1 (8 hours)

Introduction: Fundamentals of neural network, biological neuron, benefits of neural networks, artificial neural model, McCulloch-Pitts neuron model, types of activation functions.
Network Architecture: Feedforward and Feedback – single and multilayered architecture, convex set, convex hull and linear separability, non-linear separable problem - XOR problem, multilayer networks.
Learning Processes: Learning Algorithms - Supervised and Unsupervised learnings.
Chapter 1 and 3 – Textbook 1, Chapter 1 and 2 – Textbook 2

Module-2 (8 hours)

Supervised Learning I: Perceptron learning algorithm, perceptron convergence theorem, perceptron learning and non-separable sets, α-Least Mean Square learning, MSE error surface, steepest descent search, application of LMS to noise cancelling.
Supervised Learning II: Multilayered Network Architecture - Back propagation learning algorithm - pattern update and batch update, practical consideration of BP algorithm .
Chapter 5 and 6 – Textbook 1, Chapter 3 and 4 – Textbook 2

Module-3 (8 hours)

Statistical Learning Theory: Bias and Variance dilemma, ERM, SRM, VC dimension
Support Vector Machines: Support vectors, soft margin classifier, non-linear classifier, SVM as feed forward NN.
Radial Basis Function: Radial Basis Function Network (RBFN) and regularization theory, interpolation, solution for XOR problem using RBFN, Generalized RBF Networks.
Chapter 8 – Textbook 1, Chapter 5 and 6 – Textbook 2

Module-4 (8 hours)

Attractor Neural Networks: Neurodynamical systems, Hebbian learning, Lyapunov stability theorem, Cohen-Grossberg theorem, associative learning and associative memory model, linear associative memory, Hopfield network and its application, spurious attractors, Brain State in a Box neural network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.
Chapter 9 and 10 – Textbook 1, Chapter 14 – Textbook 2

Module-5 (8 hours)

Self-organization Feature Map: Oja's rule, Maximal Eigenvector Filtering, Principal Component Analysis, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.
Chapter 12 – Textbook 1, Chapter 8 and 9 – Textbook 2

Course Outcomes: At the end of the course the student will be able to:	
22ECE354.1	Analyze building blocks of Artificial Neural Network
22ECE354.2	Apply supervised learning algorithm

22ECE354.3	Examine the principles of RBF and SVM
22ECE354.4	Acquire the knowledge of learning in Artificial Neural Network
22ECE354.5	Illustrate Artificial Neural Network as a memory model
22ECE354.6	Illustrate possible application of ANN

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Neural Networks A Classroom Approach	Satish Kumar	McGraw Hill Education Pvt. Ltd.	2nd Edition, 2020
2	Neural Networks: A Comprehensive Foundation	Simon Haykin	Pearson Education	2nd Edition, 1997
Reference Books				
1	Introduction to Artificial Neural Systems	J.M. Zurada	Jaico Publications	1st Edition, 2004
2	Artificial Neural Networks	B. Yegnanarayana	PHI, New Delhi	1st Edition, 2006

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/117105084
- https://archive.nptel.ac.in/courses/117/105/117105101/

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE354.1	2	1												
22ECE354.2	2	1												
22ECE354.3	2	1												
22ECE354.4	2	1												
22ECE354.5	2	1												
22ECE354.6	2	1												

1: Low 2: Medium 3: High

Analog Circuits Laboratory			
Course Code	**22ECE36L**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE	3 Hours
Total Hours	10 Lab Slots	Credits	01

Course Learning Objectives:

1. Build the MOSFET Circuit and verify the Input and Output characteristics.
2. Design and Test of Analog Circuits Using Op-Amps.
3. Design an Oscillator for a Given Frequency.
4. Build a Filter for Given Cut-Off Frequency.
5. Design a Multivibrator for a given frequency and Duty Cycle.
6. Use of Circuit Simulation for the Analysis of Electronic Circuits.

PART A: Experiments using Discrete Components

1. To determine the characteristics of MOSFET in CS configuration and evaluation of various parameters.
2. MOSFET amplifier (CS) - frequency response characteristics.
3. Design Active Second Order Butterworth Low Pass and High Pass Filters for a Given Cut-off Frequency.
4. Design Adder, Integrator and Differentiator Circuits Using Op-Amp for a Given Input Frequency.
5. Design a Schmitt Trigger for the Given UTP and LTP Values and Obtain the Hysteresis.
6. Design 4 Bit R – 2R Op-Amp Digital to Analog Converter (I) Using 4-Bit Binary Input From Toggle Switches and (Ii) Generating Digital Inputs Using Mod-16 Counter.
7. Design a Monostable and Astable Multivibrator Using 555 Timer.

Part B: Simulation using EDA Software

1. Design and Set-Up BJT/FET i) Colpitts Oscillator and ii) RC Phase Shift Oscillator.
2. Test a Comparator Circuit Using 741 Op-Amp.
3. Test a Precision Half and Full Wave Rectifier.
4. Design a Second order Narrow Band-Pass Filter and Narrow Band-Reject Filter.

Open Ended Experiments

1. Design an Inverting Amplifier with Gain = 2.
2. Design an Non-Inverting Amplifier with Unity Gain.
3. Design a Voltage Follower and Check the Output Voltage.
4. Design and Set Up an Instrumentation Amplifier.
5. Design Log and Antilog Amplifier and Check the Output in Multisim.
6. Set Up a Zero Crossing Detector Circuit.
7. Set Up a Non-Zero Crossing Detector Circuit Taking any Reference Voltage.
8. Design a Differential Amplifier, Rig up the Circuit and Measure the OutputVoltage.
9. Design and Set Up a RC Phase Shift Oscillator Using FET In Multisim.
10. Design and Set Up a Hartleys Oscillator.

Course Outcomes: At the end of the course the student will be able to:	
22ECE36L.1	Analyze the Input and Output Characteristics of a MOSFET.
22ECE36L.2	Design and Analyze the Second Order Butterworth Low-Pass and High-Pass Filter.
22ECE36L.3	Demonstrate and Analyze the Working of Oscillators and Multivibrators.

22ECE36L.4	Design and Analyse the Linear and Non-linear Circuits Using Op-Amps.
22ECE36L.5	Design and Analyse the Multivibrator circuits using 555 Timer IC.
22ECE36L.6	Make Use of EDA Tools to Perform the Analysis and Simulations of circuits.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Reference Books				
1	Microelectronic Circuits – Theory and Applications	Adel S Sedra, Kenneth C. Smith	Oxford University Press	7th Edition - International Version, 2017
2	Electronic Devices and Circuit Theory	Robert L Boylestad, Louis Nashelsky,	Pearson	10th Edition, 2009
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008
4	Op-Amps and Linear Integrated Circuits	Ramakant A Gayakwad	Prentice Hall India	4th Edition, 2000
5	Design with Operational Amplifiers and Analog Integrated Circuits	Franco Sergio	Tata-McGraw-Hill	3rd Edition, 2017

Web links/Video Lectures/MOOCs

1. https://nptel.ac.in/courses/108/106/108106084/
2. https://nptel.ac.in/courses/117/105/117105147/

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE36L.1			2	2				1	1	1				
22ECE36L.2			2	2				1	1	1			1	
22ECE36L.3			2	2				1	1	1			1	
22ECE36L.4			2	2				1	1	1			1	
22ECE36L.5						1						2		
22ECE36L.6					2							1		

1: Low 2: Medium 3: High

Universal Human Values- II			
Course Code	**22UHV37**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives: This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement toward value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Module-1 Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Activities: Sharing about Oneself, Exploring Human Consciousness and Exploring Natural Acceptance. **5 Hours**

Module-2 – Harmony in the Human Being

Understanding Human beings as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Activities: Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body and Exploring the difference of Needs of Self and Body. **5 hours**

Module 3 – Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Activities: Exploring the Feeling of Trust, Exploring the Feeling of Respect and Exploring the Feeling systems to fulfil Human Goal. **5 hours**

Module-4 – Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Activities: Exploring the Four Orders of Nature and Co-existence in Existence. **5 hours**

Module-5 – Implications of the Holistic Understanding – a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Activities: Exploring Ethical Human Conduct**,** Humanistic Models in Education and steps of Transition towards Universal Human Order. **5 hours**

Course Outcomes: At the end of the course the student will be able to:	
22UHV37.1	Practice the method of self-exploration to understand the basic human aspiration.
22UHV37.2	Distinguish between needs of self and body.
22UHV37.3	Evolve a program for self-regulation and health.
22UHV37.4	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them.
22UHV37.5	Realize sustainable solutions to the problems in society and nature.
22UHV37.6	Develop competence in professional ethics and strategies for the transition towards a value-based life/profession.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi	2nd Revised Edition, 2019
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books New Delhi	2nd Revised Edition, 2019
Reference Books				
1	Jeevan Vidya: Ek Parichaya	A Nagaraj	Jeevan Vidya Prakashan Amarkantak	1999
2	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi	2004

Additional Resources/Web links/Video Lectures

1. The Story of Stuff (Book).
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
4. Economy of Permanence - J C Kumarappa
5. Bharat Mein Angreji Raj – Pandit Sunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)
11. UHV-I Teaching material (Presentations, Pre & Post Surveys etc.)
https://fdp-si.aicte-india.org/AicteSipUHV_download.php
12. Details of UHV-II: Universal Human Values – Understanding Harmony and Ethical Human Conduct
https://drive.google.com/file/d/1cznDaqDwKy__EKWmqJLWF94MeY4AXcsU/view?usp=sharing
13. Recorded FDP (Refresher 1 Part 1: Preparing to teach UHV-I in SIP)
https://www.youtube.com/watch?v=kejuD4faDDE&list=PLWDeKF97v9SOjS4RanhaYj4YLiImqm5pj&index=1

14. Resources, including the class notes and presentations
https://drive.google.com/drive/folders/1nh9m5ibEtvMyqekeiexAJtfbdNtmtt6-?usp=sharing

15. Hindi Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SMRfe5PK1HPYnEcrrJOL6K7

16. English Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22UHV37.1						3		2						
22UHV37.2						2			3					
22UHV37.3						2		3						
22UHV37.4							3							
22UHV37.5			3				2							
22UHV37.6								3				2		

1: Low 2: Medium 3: High

Biology for Engineers			
Course Code	**22BFE37**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives:

1. To bring awareness of biological concepts to engineering students
2. To introduce the building blocks of life and their complexity
3. To encourage interdisciplinary studies and projects
4. To appreciate the discoveries that mimic nature and its working
5. To inculcate nature-inspired design and operational principles

Module-1 **5 Hours**

Basic Cell Biology: Introduction to Biology, The cell: the basic unit of life, Expression of genetic information-protein structure and function, Cell metabolism; Cells respond to their external environments, Cells grow and reproduce, Cellular differentiation.

Module-2 **5 Hours**

Biochemistry and Molecular Aspects of Life: Biodiversity-Chemical bonds in Biochemistry; Biochemistry and Human biology, Protein synthesis -DNA; RNA, Transcription and translation factors play key roles in protein synthesis, Differences between eukaryotic and prokaryotic protein synthesis, Stem cells and their applications.

Module-3 **5 Hours**

Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network), Respiratory system, sensory system (electronic nose, electronic tongue), Visual and auditory prosthesis (Bionic eye and cochlear implant).

Module-4 **5 Hours**

Relevance of Biology as an interdisciplinary approach: Biological observation that led to major discoveries, Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Bird flying (aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro).

Module-5 **5 Hours**

Bioinspired Algorithms and Applications: Genetic algorithm, Gene expression modelling, Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems, Dynamic Updating DNA Computing Algorithms, Bee-Hive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour.

Course Outcomes: At the end of the course the student will be able to:	
22BFE37.1	Discuss how the cell forms the basic building block of life
22BFE37.2	Distinguish between transcription and translation
22BFE37.3	Describe the role played by proteins within the cell
22BFE37.4	Analyze the role of bioinspired design in novel applications
22BFE37.5	Apply bioinspired design principles to other domains
22BFE37.6	Implement a simple genetic algorithm

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Biology for Engineers	Thyagarajan.S., Selvamurugan. N., Rajesh.MP, Nazeer RA, Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K	Tata McGraw Hill	2012
2	Molecular Biology	Robert Weaver	McGraw-Hill	5th Edition, 2012
Reference books				
1	Lewin's Genes XII	Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick	Jones and Bartlett Learning	2017
2	Bioinspired Engineering	Jenkins, C.H.	Momentum Press	2012
3	Bio mimetics: Nature-Based Innovation	Yoseph Bar-Cohen	CRC Press	1st Edition, 2016
4	A Practical Guide to Bio-inspired Design	Hashemi Farzaneh, Helena, Lindemann, Udo	Springer	2019

Web links/Video Lectures/MOOCs

1. https://books.google.co.in/books?id=-2LNBQAAQBAJ&printsec=frontcover#v=onepage&q&f=false
2. https://www.aminotes.com/2017/02/biology-for-engineers-module-1-cocepts.html

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22BFE37.1	2					1								
22BFE37.2		1				1								
22BFE37.3	2					2								
22BFE37.4		2										2		
22BFE37.5	2											2		
22BFE37.6		2										2		

1: Low 2: Medium 3: High

IOT ENABLED PROTOTYPING			
Course Code:	**22IEP38**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives:

1. Understand the IoT concepts such as sensing, actuation, and communication.
2. Development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication and Protocols
3. Understand the significance of Project Management and the different techniques of planning
4. To introduce fundamental aspects of intellectual property rights, Govt. policies on IPR, and patentability search techniques.

Module 1

Internet of Things – Hardware / System Design

Introduction to IoT fundamentals, Introduction to sensors, Difference between analog and Digital sensors, Interfacing Temperature, Light and Humidity sensor with Arduino, Interfacing Motors with Arduino, A simple program to control actuator based on the analog sensor. **6 Hours**

Module 2

Internet of Things

Networking in IoT:

Introduction to wireless communication, Wifi Module ESP8266 interface with Arduino, Machine to Machine (M2M) communication using WiFi module. A simple demonstration of sensing temperature from one device and control actuator on a second device (M2M)

IoT in Web/ Cloud Platform:

Introduction to a web server - XAMPP(windows), A simple interactive web page using HTML5, Bootstrap (or CSS), and Javascript. Interfacing ESP8266 with webserver, ThingSpeak API, and MQTT protocol, A simple project to demonstrate the status of two IoT devices communicating with a Web Server. **6 Hours**

Module 3

Project Planning and Management

Project initiation, Project charter, Project planning, and implementation, Scheduling and costing, Project monitoring and control, Project closure and reports.

6 Hours

Module 4

Intellectual Property Rights

Introduction and the need for intellectual property right (IPR) – Kinds of Intellectual Property Rights, Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application, Non - Patentable Subject Matter, Registration Procedure, Patentability search methods, Patent landscape, Freedom-to-market, National IPR Policy, Govt. initiatives and scheme in promoting IPR. **6 Hours**

Course Project

Develop IoT-based prototypes (solutions) to solve any industrial or societal problems. The prototype building is teamwork of 3-5 students. The goals should be clearly defined and should use robust technologies and rigorous testing. **6 Hours**

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

22IEP38.1	Analyze the basics of IoT and protocols.
22IEP38.2	Develop IoT-based prototypes to solve industrial and societal problems.
22IEP38.3	Apply appropriate approaches to plan a new project and develop a project schedule.

22IEP38.4	Discuss the ethical aspects in IPR, Govt. policies on IPR, and conducting patentability searches.
22IEP38.5	Inculcate the teamwork and communication skills.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books				
1	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	Orient Blackswan Private Limited	1st Edition, 2015
2	Fundamentals of Intellectual Property	Dr. Kalyan C. Kankanala	Asia Law House	1st Edition, 2012
3	Project Management Absolute Beginner's Guide	Greg Horine	Pearson Education (US)	4th Edition, 2017

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22IEP38.1			**2**		**2**				**2**	**2**				
22IEP38.2			**2**								**3**			
22IEP38.3					**2**						**2**			
22IEP38.4								**1**		**2**				
22IEP38.5								**1**	**2**	**2**				

1: Low 2: Medium 3: High

Industry Oriented Training - Business Etiquettes			
Course Code	**22ITB39A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	02

Course Learning Objectives:

6. Know the components of self-introduction
7. Develop a resume with the inclusion of core competencies
8. Involve and contribute to group discussions
9. Develop effective communication to succeed in the professional career
10. Know the etiquettes of digital communication

Module-1

Self-Introduction &Essentials of grooming

Self-Introduction: Learn the secret to introducing Yourself, Things to avoid when introducing yourself. Activity: Video record the self-introduction. **Essentials of grooming:** Creating the first impression, what does the well-dressed man wear? What does the well-dressed woman wear? Personal hygiene and habits. **4 Hours**

Module-2

Resume Writing

Purpose, Identifying Relevant Competencies, Understanding Applicant Tracking Systems, Lists of Competencies, Writing Accomplishment/ Objective Statements, Finding the Right Words- Action verbs, The Most Popular Resume Format, Other Popular Resume Formats, Do's and Don'ts. Activity: Students have to submit a copy of their resume. **4 Hours**

Module-3

Group Discussion

Types, process, Evaluation criteria, Do's and Don'ts Activity: Group discussions have to be held during the training sessions. **4 Hours**

Module-4

Communicate effectively

Build a Story, Just a Minute, Group Activities, Team building activities, Role Play, Presentation Skills. **4 Hours**

Module-5

Digital right and wrong

Virtual Communication: Agenda, being prepared, Dressing appropriately, background, Use Microphone and camera the right way, restraining from off tasks during virtual meetings, protecting confidential data during online presentations, time management. **4 Hours**

Course Outcomes: At the end of the course the student will be able to:	
22ITB39A.1	Articulate the essential components required for self-introduction in any business or a networking event and also recognize the need to dress appropriately for a successful career in the corporate
22ITB39A.2	Develop a resume inclusive of core competencies, and action verbs which are compatible with Applicant Tracking Systems
22ITB39A.3	Demonstrate the types, process and evaluation process of Group Discussion and carry out effective group discussions
22ITB39A.4	Develop skills required for effective communication
22ITB39A.5	Associate and be accustomed to the etiquette to be followed during online meetings

Sources

1. English for Common Interactions in the Workplace: Basic Level: Coursera: https://www.coursera.org/learn/english-common-interactions-workplace-basic-level
2. Personal Communication-Introduce Yourself With Confidence: https://www.udemy.com/course/how-to-introduce-yourself/
3. Professionalism, Grooming and Etiquette: https://www.edx.org/course/professionalism-grooming-and-etiquette
4. How to Write a Resume: https://www.coursera.org/learn/how-to-write-a-resume#syllabus
5. Group Discussion Strategies: https://www.udemy.com/course/group-discussion-strategies/
6. Communication Strategies for a Virtual Age: https://www.coursera.org/learn/communication-strategies-virtual-age#syllabus

References

1. https://simplifytraining.com/course/personal-hygiene-and-good-grooming/
2. https://www.udemy.com/course/group-discussion-strategies/
3. https://www.educba.com/course/group-discussion/
4. https://getrafiki.ai/meetings/rules-of-virtual-meeting-etiquette-every-sales-professional-should-follow/
5. https://thedigitalworkplace.com/articles/online-meeting-etiquette-for-attendees/
6. https://rigorousthemes.com/blog/virtual-meeting-etiquette-guidelines-ground-rules/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ITB39A.1									2	3		1		
22ITB39A.2										3		1		
22ITB39A.3									2	3	1	1		
22ITB39A.4									2	3	1	1		
22ITB39A.5									2	3	1	1		

1: Low 2: Medium 3: High

Industry Oriented Training - Computing Skills			
Course Code	**22ITC39B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	02

Course Learning Objectives:

1. Use logical conditions for problem-solving and also introduce the concepts of arrays
2. Know functions, function calls, and parameter passing
3. Introduce algorithms and appreciate their importance in problem-solving
4. Introduce the core concepts of OOP's
5. Differentiate between front-end & back-end development and recognize the use of database management

Module-1

Introduction to computing constructs

Logical conditions: For Loops, Nested For Loops, While Loops, Do-While Loops, Nesting and Boxes, and combine/negate several logical conditions using logic operations AND, OR, and NOT.

Arrays & strings: Create arrays of characters (strings), use the null terminator, and manipulate strings. **4 Hours**

Module-2

Functions & Pointers

Introduction to Functions, Returning Data From a Function, Passing Data Into a Function, Getting Valid User Input, Changing Parameter Values, Pointer Basics, Changing the Pointed to Value, Walking an Array with Pointers, Dynamic Memory Allocation, Getting More Memory, Pointers to Structure. **4 Hours**

Module-3

Algorithm analysis

Introduction to Algorithm Analysis, Big-O, Big-O Examples, Dynamic Array Operations, Bubble Sort, Selection Sort, Insertion Sort, Recursion, Recursive Binary Search, Merge Sort. **4 Hours**

Module-4

Object-oriented programming

Designing for Object-Oriented Programming, Core Concepts of OO Programming: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object-oriented programming paradigm. **4 Hours**

Module-5

Frontend and backend development

UI, Database management: DBMS overview, Relational Data Model and the CREATE TABLE Statement, Basic Query Formulation with SQL. **4 Hours**

Course Outcomes: At the end of the course the student will be able to:	
22ITC39B.1	Illustrate the use of logical conditions, declare and manipulate data into arrays
22ITC39B.2	Implement functions, function calls, and parameter passing
22ITC39B.3	Design, implement, and evaluate an algorithm to meet desired needs
22ITC39B.4	Describe the core concepts of OOP's
22ITC39B.5	Recognize the concepts of front-end development and database management

Sources
1. Computational Thinking with Beginning C Programming Specialization: https://www.coursera.org/learn/simulation-algorithm-analysis-pointers?specialization=computational-thinking-c-programming#syllabus 2. Simulation, Algorithm Analysis, and Pointers: https://www.coursera.org/lecture/simulation-algorithm-analysis-pointers/big-o-examples-pdCan 3. Programming Fundamentals: https://www.coursera.org/learn/programming-fundamentals?specialization=c-programming#syllabus 4. Object-Oriented Programming Concepts: https://www.coursera.org/learn/concepts-of-object-oriented-programming#syllabus 5. Introduction to Back-End Development: https://www.coursera.org/learn/introduction-to-back-end-development

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ITC39B.1	2	1	1											
22ITC39B.2	2	1	1											
22ITC39B.3	1	1	2											
22ITC39B.4	2		1											
22ITC39B.5	2	1	1											

1: Low 2: Medium 3: High

IV Semester

Linear Algebra and Statistical Methods			
Course Code	**22ECE41**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives:

- To apply principles of Linear Algebra in Engineering applications.
- To equip students with essential tools for statistical analysis at the graduate level.
- To develop problem-solving techniques needed to accurately calculate probabilities.
- To describe principal concepts about sampling and explains the advantages of sampling.

Module-1 Linear Algebra- I (8 Hours)

Determinants, Properties of Determinants, Formulas for Determinants-permutations, cofactors, Eigen Values and Eigen vectors: Review of Eigen Values and Eigen vectors, Diagonalization of the matrix (up to order 3x3).
Text Book 2: Chapter 4 & 5

Module-2 Linear Algebra- II (8 Hours)

Inner product, length & orthogonality, orthogonal set, orthogonal projection Gram-Schmidt process, QR factorization of matrices.
(Recapitulation) Diagonalization of symmetric matrices. The singular value decomposition.
Text Book 2: Chapter 3

Module-3 Statistical Methods and Curve Fitting (8 Hours)

Correlation and regression-Karl Pearson's coefficient of 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 = ax^2+ bx + c and y = ax^b.
Text Book 1: Chapter 24 & 25

Module-4 Probability Distributions (8 Hours)

Random variables (discrete and continuous), probability mass/density functions, cumulative density function. Binomial, Poisson, exponential (with the derivation for mean and standard deviation) and normal distributions- problems.
Text Book 1: Chapter 26 and Text Book 3: Chapter 3

Module-5 Sampling Theory 8 Hours

Introduction, sampling distributions, Testing of hypothesis for means, level of significance, confidence limits, Sampling of variables, central limit theorem, confidence limits for unknown mean, student's t-distribution, Chi-square distribution as a test of goodness of fit.
Text Book 1: Chapter 27 and Text Book 3: Chapter 8

Course Outcomes: At the end of the course the student will be able to:	
22ECE41.1	Use the properties of determinants, permutations and cofactors applicable in engineering field.
22ECE41.2	Apply the technique of singular value decomposition for data compression and least-square approximation in solving inconsistent linear systems.
22ECE41.3	Examine the given data for the appropriate probability distribution and solve using the known techniques.
22ECE41.4	Apply the knowledge of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.

22ECE41.5	Find the relation between dependent & independent variables using the least square curve fitting method.
22ECE41.6	Analyze the validity of testing the hypothesis to arrive at a decision regarding the population through a sample.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2017
2	Linear Algebra & its Applications	Gilbert Strang	Cengage Learning India Edition	4th Edition, 2006
3	Probability & Statistics for Engineers & Scientists	Ronald Walpole, R H Myers, S L Myers and K. Ye	Pearson Publication	9th Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C.Ray Wylie, Louis C.Barrett	McGraw- Hill Book Co., New York	6th Edition, 2017
2	Linear Algebra & its applications	David C. Lay	Pearson Publication	3rd Edition, 2014
3	Schaum's Outline of Linear Algebra	Seymour Lipschutz and Marc Lipson	McGraw Hill Education	5th Edition, 2012

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=23LLB9mNJvc – Cofactors
- https://www.youtube.com/watch?v=ERfbtPBEYVA – Inner Product space
- https://www.youtube.com/watch?v=R78FjKzDfZM – QR factorization
- https://www.youtube.com/watch?v=9quic27dcgY – Singular Value Decomposition
- https://www.youtube.com/watch?v=i6ZmA9EEzrI – Curve Fitting
- https://www.youtube.com/watch?v=fNLeogEjMmM – Correlation & Regression
- https://www.youtube.com/watch?v=UftY0e2ilM4 – Random variables & Probability Distribution
- https://www.youtube.com/watch?v=PjihjKfBuzc – Exponential Distribution
- https://www.youtube.com/watch?v=efF_lFcx1m0 – Sampling Theory
- https://www.youtube.com/watch?v=lQ1ec1nQvKM – Chi Square Distribution

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1**	**PO1**	**PO1**	**PSO**	**PSO**
22ECE41.1	2			1										
22ECE41.2	2	1												
22ECE41.3	2		1											
22ECE41.4	2		1											
22ECE41.5	2	1												
22ECE41.6	2		1											

1: Low 2: Medium 3: High

Digital Design Using Verilog HDL			
Course Code	**22ECE42**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Illustrate concept of digital system design using Verilog HDL
- Demonstrate various Verilog HDL design modeling techniques.
- Design and analyze combinational and sequential circuits using Verilog HDL
- Experiment with synthesis of combinational and sequential circuits
- Make use of FPGA board to implement Verilog HDL Designs

Module - 1 (8 hours)

Overview of Digital Design with Verilog HDL: Evolution of Computer-Aided Digital Design, Emergence of HDLs, Typical Design Flow.
Hierarchical Modeling Concepts: Design Methodologies, Modules, Instances, Components of a Simulation
Basic Concepts: Lexical Conventions, Data Types, System Tasks and Compiler Directives
Modules and Ports: Modules, Ports, Hierarchical Names
Text 1: Chapter 1:1.1-1.3, Chapter 2: 2.1,2.3-2.5, Chapter 3:3.1-3.3, Chapter 4: 4.1-4.3

Module - 2 (8 hours)

Gate-Level Modeling: Gate Types, Gate Delays
Dataflow Modeling: Continuous Assignments, Delays, Expressions, Operators and Operands, Operator Types, Examples
Text 1: Chapter 5: 5.1-5.2, Chapter 6: 6.1-6.5

Module - 3 (8 hours)

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multiway Branching, Loops, Sequential and Parallel Blocks, Generate Blocks, Examples
Tasks and Functions: Differences between Tasks and Functions, Tasks, Functions
Text 1: Chapter 7: 7.1-7.9, Chapter 8: 8.1-8.3

Module - 4 (8 hours)

Logic Design with Behavioral Models of Combinational and Sequential Logic: Latches and Level-Sensitive Circuits in Verilog, Cyclic Behavioral Models of Flip-Flops and Latches, Cyclic Behavior and Edge Detection, Behavioral Models of Multiplexers, Encoders and Decoders, Algorithmic State Machine Charts for Behavioral Modeling, ASMD Charts, Behavioral Models of Counters, Shift Registers and Register Flies
Text 2: Chapter 5: 5.5-5.7, 5.9, 5.14- 5.16

Module - 5 (8 hours)

Synthesis of Combinational and Sequential Logic: Introduction to Synthesis, Synthesis of Combinational Logic, Synthesis of Sequential Logic with Latches, Synthesis of Sequential Logic with Flip-Flops, Synthesis of Explicit State Machines, Registered Logic, State Encoding, Registers and Counters, Resets
Text 2: Chapter 6:6.1-6.3, 6.5, 6.7-6.10

PRACTICAL MODULE

Part A (Design and Verification)

1. Write a Verilog code to realize all the logic gates using Gate Level and Dataflow modelling. Verify the design using Verilog Test Bench Code.
2. Write a Verilog code for 8 to Priority Encoder using Gate Level modelling. Verify the design using Verilog Test Bench Code.
3. Write a Verilog code for 4 Bit Comparator using Dataflow modelling. Verify the design using Verilog Test Bench Code.
4. Write a Verilog code for 4-bit Ripple Carry Adder using Full Adders. Ensure that the Ful Adder is designed using Half Adder. Verify the designs using Verilog Test Bench Code.
5. Write a Verilog code for 8:1 Multiplexer using 4:1 Multiplexers. Make use of 2:1 Multiplexers to design 4:1 Multiplexer. Verify the designs using Verilog Test Bench Code.
6. Write a Verilog to detect sequence "1010" in a bit stream with and without overlap. Verify the design using Verilog Test Bench Code.

Part B (Design and Implementation on FPGA)

7. Write a Verilog code to realize SR, JK, D and T Flipflops using Behavioral modeling. Verify the design using Verilog Test Bench Code. Implement any two of the design on a Nexys 4 DDR FPGA Board.
8. Write a Verilog code to implement 4 bit Binary and BCD with Synchronous reset and Asynchronous reset to implement any sequence (up, down or both) using Behavioral modeling. Verify the design using Verilog Test Bench Code. Implement any two of the design on a Nexys 4 DDR FPGA Board.
9. Write a Verilog code to Display Messages the seven-segment display of the Nexys 4 DDR FPGA Board.

Part C (Open Ended Design)

Design a Traffic Signal Controller as per the specifications provided in the Text 1: Chapter 7, Section 7.9.3.

Course Outcomes: At the end of the course the student will be able to:	
22ECE42.1	Analyze and demonstrate the concept of Verilog Module, Ports, Instances, Stimulus Block and Lexical Conventions.
22ECE42.2	Develop Verilog descriptions of digital systems using Verilog Gate and Dataflow modeling
22ECE42.3	Illustrate the need of Behavioral modeling, Tasks and Functions in Verilog
22ECE42.4	Build complex combinational and sequential digital systems using Verilog Behavioral modeling
22ECE42.5	Examine the need of synthesis process in combinational and sequential digital systems
22ECE42.6	Make use EDA and FPGA board to design, simulate and implement Verilog HDL Codes

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Verilog HDL – A Guide to Digital Design and Synthesis	Samir Palnitkar	Pearson Education	2nd Edition 2014
2	Advanced Digital Design with the Verilog HDL	Michael D. Ciletti	PHI Learning	2nd Edition, 2003

Reference Books				
1	Digital Design – With an Introduction to the Verilog HDL	M. Morris Mano and Michael D Ciletti	Pearson	5th Edition , 2013
2	Fundamentals of Digital Logic with Verilog Design	Stephen Brown and Zvonko Vranesic	McGraw – Hill Edition	2nd Edition, 2013

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/103/108103179/
- https://archive.nptel.ac.in/courses/106/105/106105165/
- http://www.asic-world.com/verilog/index.html

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE42.1	3	3												2
22ECE42.2	3	3	3											2
22ECE42.3	3	3	3											2
22ECE42.4	3	3	3											2
22ECE42.5		3	2	2										2
22ECE42.6		2	2	2	2			2	2	2	2	2		2

1: Low 2: Medium 3: High

Signals and Systems			
Course Code	**22ECE43**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Describe the continuous time (CT) signals and systems.
- Describe the discrete time (DT) signals and systems.
- Represent the LTI systems in time domain using convolution sum and integral.
- Analyze non periodic CT and DT signals in frequency domain.
- Analyze DT signals in Z domain.

Module-1 Introduction & Classification of signals (8 hours)

Introduction and Classification of Signals: Definition of signal and systems, communication and control system as examples, Classification of signals.

Basic Operations on Signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal.

Elementary Signals: Exponential, Sinusoidal, Step, Impulse and Ramp Functions.

Textbook 1: 1.1-1.6

Module-2 System Properties & Time Domain Representation (8 hours)

Properties of Systems: Linear-nonlinear, Time variant-invariant, causal-non-causal, static-dynamic, stable-unstable, invertible.

Time domain representation of LTI System: Impulse response, convolution sum, convolution integral.

Interconnections of LTI systems, Relationship between LTI system Properties and the Impulse Response, Step response. Textbook 1: 1.8, 2.1- 2.8

Module-3 Continuous Time Fourier Transform (CTFT) (8 hours)

Fourier Representation of aperiodic Signals: Continuous Time Non Periodic Signals: The Fourier Transform-Definition, Properties and Basic Problems. Textbook 1: 3.7-3.12

Module-4 Discrete Time Fourier Transform (DTFT) (8 hours)

Discrete Time Non Periodic Signals: The Discrete Time Fourier Transform-Definition, Properties and Problems. Textbook 1: 3.6, 3.8-3.12

Discrete Fourier Transform: Introduction to DFT, The DFT .Textbook 2: 10.1,10.2

Module-5 Z Transform (8 hours)

The Z-Transforms: Two sided Z Transforms, Properties of Two sided Z transform, Poles, Zeros, and the z-Plane, The Transfer Function, The Inverse Z transform. Textbook 2: 4.1-4.4, 4.8

PRACTICAL MODULE

A– Exercise (compulsorily to be conducted):

A1. Generate and analyse the elementary signals

A2. Perform various operations on signals such as addition, multiplication, time scaling, time shifting, time folding etc.

A3. Compute energy and average power of a given signal.

A4. Compute the output of a Linear Time Invariant System using Linear convolution. Also verify the properties of Linear Convolution.

A5. Compute the Fourier Transform of a given signal and plot its' magnitude and phase spectrum.

A6. Verify the properties of DTFT of a given discrete-time signal.

A7. Compute DFT of a given discrete time signal.

A8.Locate the zeros and poles in the Z plane for the given transfer function.

B–Open Ended Experiments

B1. Analyze various Bio Medical Signals in Time and Frequency Domain.

Course Outcomes: At the end of the course the student will be able to:	
22ECE43.1	Explain & Classify Continuous Time (CT) and Discrete Time (DT) Signals and Systems.
22ECE43.2	Analyze the response of CT and DT Linear Time Invariant (LTI) Systems
22ECE43.3	Represent and Analyze CT and DT Non-Periodic Signals in Frequency Domain
22ECE43.4	Describe & Analyze Discrete Fourier Transform
22ECE43.5	Apply Z-transform techniques for the analysis of DT LTI Systems.
22ECE43.6	Analyze various Signals and LTI Systems in Time & Frequency Domain using MATLAB

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Signals and Systems	Simon Haykins and Barry Van Veen	Wiley India	2nd Edition, 2008
2	Digital Signal Processing-A Modern Introduction	Ashok Ambardar	Nelson Engineering	1st Edition, 2007
Reference Books				
1	Signals and Systems	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab	Pearson Education Asia / PHI,	2nd Edition, 1997. Indian Reprint 2002.
2	Linear Systems and Signals	B. P. Lathi	Oxford University Press	2nd Edition, 2008

Web links and Video Lectures (e-Resources):

- **MIT OPEN COURSEWARE:** https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/ Author: Prof. Alan V. Oppenheim
- **NPTEL:** Signals & Systems by PROF. KUSHAL K. SHAH, Department of Electrical and Electronics Engineering IISER Bhopal https://nptel.ac.in/courses/108/106/108106163/#

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE43.1	2	2											2	
22ECE43.2	2		2										2	
22ECE43.3	2		2										2	
22ECE43.4	2		1										2	
22ECE43.5	2		2										2	
22ECE43.6				2	3				3	2				

1: Low 2: Medium 3: High

Analog Communication Engineering			
Course Code	**22ECE44**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Explain the fundamentals of the communication system and significance of modulation techniques.
- Classify the various Amplitude modulation techniques and learn the generation and detection of the same.
- Explain the need for single side band and vestigial side band techniques in AM modulation scheme.
- Analyze the scope of Frequency modulation and also its generation and detection schemes
- Investigate the effect of noise in the AM and FM receiver.
- Explain the need and steps involved for digitization of the analog signals.

Module-1 Fundamentals of Communication System (8 hours)

Introduction to Communications, Elements of a Communication system, Transmission of message signals, limitations and resources of communication systems, Ideal Low Pass filters and Band Pass Transmission. Amplitude Modulation: Introduction, Amplitude Modulation: Time & Frequency Domain description, Generation of AM waves- Square Law Modulator, switching modulator, Detection of AM waves- Square Law Detector, Envelop detector.
Text1:1.4,1.5,1.6, 3.4,3.5 and 7.1)
Self-learning Topics: Time division and frequency division multiplexing

Module-2 DSB-SC and SSB-SC System (8 hours)

Double Side Band-Suppressed Carrier Modulation: Time and Frequency Domain description, Generation of DSBSC-waves, Balanced and Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.
Introduction to Hilbert Transform, Properties of Hilbert Transform SSB Modulation: Tim domain Description, Frequency Domain Description, Generation of SSB modulated wave- Frequency Discrimination Method, Phase discrimination method, Demodulation of SSB Waves.
(Text1:7.2-7.3) : Self-learning Topics: Radio broadcasting, Television, HDTV

Module-3 Angle Modulation (8 hours)

Angle Modulation: Basic Concepts, Frequency Modulation, Single tone frequency modulation, Spectrum analysis of sinusoidal FM wave, Narrow Band FM, Wide Band FM, Transmission bandwidth of FM waves, Generation of FM waves, Demodulation of FM waves, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL.
(Text1:7.10,7.11, 7.12 and 7.14)
Self-learning Topics: FM Radio, FM stereo Multiplexing

Module-4 Random Process & Noise (8 hours)

Mathematical definition of a Random Process, Mean, Correlation and Covariance functions, Power Spectral Density Noise: Shot, Noise, Thermal Noise, White Noise, Narrowband Noise, Representation of Narrowband noise in terms of In-Phase and Quadrature Components, Sine wave plus Narrowband Noise (Signal to Noise Ratios: Basic definitions, Noise in AM Receivers using Envelope detection and Noise in FM Receivers.
(Text2:1.2, 1.4 and 1.7, 1.9, 1.10,1.11, 1.13, 2.10, 2.12 and 2.13)
Self-learning Topics: Noise in FM reception, Maximization of Output Signal to Noise Ratio.

Module-5 Introduction to Digital Communication (8 hours)

Introduction, Why Digitize Analog Sources, Digital pulse modulation, Pulse code modulation, Sampling, Sample and Hold circuit, Pulse Amplitude modulation, Quantization, Quantizing noise, Coding, Digital formats, Decoding and Regeneration. (Text1:5.1–5.6)
Self-learning Topics: Differential Pulse Code Modulation and Delta Modulation

Course Outcomes: At the end of the course the student will be able to:	
22ECE44.1	Explain the fundamentals of communication system and scope of modulation techniques.
22ECE44.2	Classify the various amplitude modulated schemes and compare the generation and detection of the same.
22ECE44.3	Analyze the need for single side band and vestigial side band modulation schemes.
22ECE44.4	Apply the concepts of angle modulation for the design of communication systems.
22ECE44.5	Describe the statistical characteristics of noise and evaluate the performance of Communication System in the presence of noise.
22ECE44.6	Explain the various digitization techniques in communication systems.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	An Introduction to Analog and Digital Communications	Simon Haykins	John Willey & Sons	5th Edition, 2008
2	Communication Systems	Simon Haykins	John Willey	4th Edition, 2010
Reference Books				
1	Modern Digital and Analog Communication Systems	B. P. Lathi	Oxford University Press	4th Edition, 2012
2.	Principles of Communication Systems	H.Taub & D.L.Schilling,	TMH	2nd Edition, 2011

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/117105143
- https://www.youtube.com/watch?v=-iqg05qUl0k
- https://www.tutorialspoint.com/analog_communication/index.htm

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE44.1	2	2			2									
22ECE44.2				2	2									
22ECE44.3		2		2										
22ECE44.4				2										
22ECE44.5	1	2												
22ECE44.6	2	1												

1: Low 2: Medium 3: High

Physics of Semiconductor Devices			
Course Code	**22ECE451**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Outline the importance of charge carriers in a Semiconductor and illustrate its carrier process
- Critically analyze the PN junction and its modes of operation
- Summarize the basic semiconductor device fabrication process
- Differentiate between Metal-Semiconductor and Metal-Oxide-Silicon Junctions

Module- 1 Atomic Structure, Energy Band and Current Carriers in Semiconductors (8 hours)

Introduction, Crystal and the Unit Cell, Energy Level Splitting, Energy Bond Formation, Covalent Bond Model, Current Carriers – Electrons and Holes, Conductors, Semiconductors and Insulators, Density of States, Fermi-Dirac Distribution Function, Carrier Densities.
Text 1: Chapter 1: 1.0-1.1, Chapter 2: 2.2-2.3, 2.5-2.6, 2.8, Chapter 3: 3.1-3.3

Module-2 Extrinsic Semiconductors and Carrier Processes (8 hours)

Extrinsic Semiconductors, Thermal Equilibrium, Densities of Carriers in Extrinsic Semiconductors, Fermi Level in Extrinsic Semiconductors, Which Semiconductor? Thermal Velocity, Collisions and Scattering, Collisions Effects, Mobility, Drift Current and Conductivity, Resistivity and Resistance, Particle Diffusion and Diffusion Current, Carrier Currents, Recombination and Generation.
Text 1: Chapter 3: 3.4-3.8, Chapter 4: 4.2-4.10.

Module-3 The PN Junction Diode (8 hours)

Introduction, Space-Charge Region, Analytical Relations and Equilibrium, Conditions in the Diode with Voltage Applied, Current in Diodes, Real Diode Characteristics in the Reverse Direction. Text 1: Chapter 5: 5.0-5.4, Chapter 7: 7.2

Module-4 Fabrication Technology (8 hours)

Introduction, Why Silicon? The Purity of Silicon, The Czochralski Growing Process, Fabrication Processes, Planar PN. Junction Diode Fabrication, Fabrication of Resistors and Capacitors in IC. Text 1: Chapter 6

Module-5 Metal-Semiconductor and Metal-Oxide-Silicon (8 hours)

Junctions Introduction, Energy-Band Diagrams of Metal and N-Semiconductor, Schottky Barrier Diode, Non-Rectifying Ohmic Contacts, Energy Band Diagrams, Band Bending and the Effect of Bias Voltages, Analytical Relations for the Charge Densities, Threshold Voltage.
Text 1: Chapter 11: 11.0-11.2,11.5, Chapter 12: 12.0-12.4

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

22ECE451.1	Outline the basic concepts related energy levels, bonds and current carries in a semiconductor.
22ECE451.2	Examine the properties of extrinsic semiconductor in terms of equilibrium and Fermi level.
22ECE451.3	Illustrate the effect of mobility on diffusion and drift currents, conductivity and resistivity of a semiconductor material.
22ECE451.4	Analyze the working of a PN Junction Diode under equilibrium and potential applied.
22ECE451.5	Review the basic semiconductor fabrication process.
22ECE451.6	Distinguish between Metal-Semiconductor and Metal-Oxide-Silicon Junctions in terms of energy diagrams and voltages applied.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Semiconductor Devices	Kannan Kano	PHI Learning	2012
Reference Books				
1	Semiconductor Devices, Physics and Technology	S.M. Sze and Ming-Kwei Lee	Wiley	18th Edition 2015
2	Physics of Semiconductor Devices	S.M. Sze and Kwok K. Ng	Wiley	3rd Edition, 2008

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/108/108108122/
- https://archive.nptel.ac.in/courses/108/108/108108112/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE451.1	2	2			2									
22ECE451.2				2	2									
22ECE451.3		2		2										
22ECE451.4				2										
22ECE451.5	1	2												
22ECE451.6	2	1												

1: Low 2: Medium 3: High

Object Oriented Programming using C++			
Course Code	**22ECE452**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L: T: P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours Theory	Credits	3

Course Learning Objectives: The objective of the course is to

- Explain various advantages of object-oriented programming.
- Implement efficient and flexible code using a wide range of data types and structures, including arrays, strings, classes, and templates.
- Illustrate the characters and behavior of the objects that comprise a system.
- Explain how to achieve reusability using inheritance.
- Illustrate function overloading and operator overloading.
- Solve the problem with an object-oriented approach.

Module-1 Beginning with C++ and its features (8 Hours)

Introduction to C++, Applications and Structure of C++ Program, Different Data types, Variables, Different Operators, Expressions, Operator Overloading and Control Structures in C++.
(Topics from Chapters - 2,3 of Textbook 1)

Module-2 Functions, Classes and Objects (8 Hours)

Functions, Inline Function, Function Overloading, Friend and Virtual Functions, Specifying a Class, C++ Program with a Class, Arrays within a Class, Memory Allocation to Objects, Array of Objects, Members, Pointers to Members and Member Functions.
(Selected Topics from Chapters - 4, 5 of Textbook 1).

Module-3 Constructors, Destructors and Operator overloading (8 Hours)

Constructors, Multiple Constructors in a class, Copy Constructor, Dynamic Constructor, Destructors, Defining Operator Overloading, Overloading Unary and Binary Operators, Manipulation of Strings using Operators.
(Selected topics from Chapter - 6, 7 of Textbook 1).

Module-4 Inheritance, Pointers, Virtual Functions, Polymorphism (8 Hours)

Derived Classes, Single, Multilevel, Multiple Inheritance, Pointers to Objects and Derived Classes, this Pointer, Virtual and Pure Virtual Functions.
(Selected topics from Chapter – 8, 9 of Textbook 1).

Module-5 Streams And Working with Files (8 Hours)

C++ Streams and Stream Classes, Formatted and Unformatted I/O Operations, Output with Manipulators, Classes for File Stream Operations, Opening and Closing a File, EOF.
(Selected topics from Chap-10, 11 of Textbook 1).

Course Outcomes: At the end of the course the student will be able to:	
22ECE452.1	Identify and explain the principles of object-oriented programming.
22ECE452.2	Analyze basic building blocks of the C++ language, including variables, data types, operators, control structures, and functions.
22ECE452.3	Apply the object initialization and destroy concepts using constructors and destructors.
22ECE452.4	Examine the concept of Function overloading, operator overloading and virtual functions.
22ECE452.5	Analyze Object Oriented Programs using inheritance, I/O Operation and File Operations.
22ECE452.6	Implement and debug the C++ program using Object Oriented Concepts to solve problems.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Object-Oriented Programming in C++	E.Balaguruswamy	McGraw Hill	8th Edition, 2020
Reference Books				
1	Object-Oriented Programming in C++	Robert Lafore	Galgotia	4th Edition, 2010
2	C++ Primer	Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo	Addison-Wesley Educational Publishers Inc	5th Edition, 2012
3	C++ Programming Language	Bjarne Stroustrup	Addison-Wesley Educational Publishers Inc	4th Edition, 2013
4	Programming: Principles and Practice Using C++	Bjarne Stroustrup	Addison-Wesley Educational Publishers Inc	2nd Edition, 2014

Web links/Video Lectures/MOOCs/papers

- https://nptel.ac.in/courses/106105234
- https://nptel.ac.in/courses/106101208
- https://en.cppreference.com/w/cpp/11
- https://www.learncpp.com/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE452.1	1													
22ECE452.2		1												
22ECE452.3		1			1									
22ECE452.4		1	1		1									
22ECE452.5		1	1		1									
22ECE452.6			1		1				1					

1: Low 2: Medium 3: High

Control Engineering			
Course Code	**22ECE453**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Comprehend the fundamental principles and mathematical modeling of systems.
- Illustrate block diagrams and perform reductions for a given system.
- Derive transfer functions through reduction and employ signal flow graph techniques.
- Evaluate the system's time and frequency domain response.
- Interpret and devise control systems utilizing state space analysis.

Module-1 Introduction to Control Systems (8 hours)

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Applications of Control Theory, Differential Equation of Physical Systems – Mechanical Systems, Electrical Systems, Electromechanical Systems, Analogous Systems.
(Text 1: 1.1, 1.4, 1.5, 1.6, 2.1, 2.2)

Module-2 Block Diagrams and Signal Flow Graphs (8 hours)

Block Diagrams and Signal Flow Graphs: Transfer functions, Block Diagram Algebra and Signal Flow graphs. (Text 1: 2.3, 2.4, 2.5, 2.6)

Module-3 Time Response of Feedback Control Systems (8 hours)

Time Response of Feedback Control Systems: Standard test signals, Unit step response of First and Second Order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). (Text 1: 3.1, 3.2, 3.3, 3.4, 3.5, 3.7)

Module-4 Stability Analysis (8 hours)

Stability Analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion.
Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.
(Text 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 5.1, 5.2, 5.3)
Frequency Domain Analysis and Stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. (Text 1: 6.1, 6.2, 6.4, 6.6)

Module-5 State Variable Analysis (8 hours)

Stability in Frequency Domain: Mathematical Preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded). (Text 1: 7.1, 7.2, 7.3)
Lead Compensation, Lag Compensation, Lead-Lag Compensation, Parallel Compensation.
(Text 2: 6.6, 6.7, 6.8, 6.9)
Introduction to State Variable Analysis: Concepts of State, State Variable and State Models for electrical systems, Solution of State Equations. (Text 1: 8.1, 8.2, 8.4)

Course Outcomes: At the end of the course the student will be able to:	
22ECE453.1	Create mathematical models for mechanical and electrical systems.
22ECE453.2	Analyze control systems by developing transfer functions through block diagram reduction techniques and signal flow graph methods.
22ECE453.3	Evaluate time domain specifications for first and second-order systems.
22ECE453.4	Assess system stability in the time domain using the Routh-Hurwitz criterion and Root-locus technique.
22ECE453.5	Evaluate system stability in the frequency domain using Nyquist and Bode plots.
22ECE453.6	Apply state variable analysis to systems by formulating and solving state equations

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Control Systems Engineering	I.J. Nagarath and M. Gopal	New Age International (P) Limited, Publishers	5th Edition, 2008
2	Modern Control Engineering	K. Ogata	Pearson Education Asia/ PHI	4th Edition, 2002
Reference Books				
1	Automatic Control Systems	Benjamin C. Kuo	John Wiley India Pvt. Ltd	8th Edition, 2008
2	Feedback and Control System	Joseph J Distefano III, Allen R Stubberud, Ivan J Williams	Schaum's Outlines, TMH	2nd Edition, 2007

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ee31/preview
- https://onlinecourses.nptel.ac.in/noc20_ee90/preview
- https://ocw.mit.edu/courses/6-302-feedback-systems-spring-2007/pages/syllabus/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE453.1	1	1	1											
22ECE453.2	1	1												
22ECE453.3		1		1										
22ECE453.4	1	1												
22ECE453.5	1	1												
22ECE453.6	1	1												

1: Low 2: Medium 3: High

Cloud Computing			
Course Code	**22ECE454**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Articulate the importance of various infrastructures of cloud.
- Analyze the applications and paradigms of cloud computing.
- Apply the knowledge of virtualization of cloud resource.
- Develop the knowledge of resource management and scheduling.
- Describe the principle of storage systems and security in cloud.

Module-1: Cloud Infrastructure (8 hours)

Introduction: Network centric computing and network centric content, Peer-to-peer systems, Cloud Computing, Delivery models & Services, Ethical issues, Vulnerabilities, Challenges (Topics: 1.1 to 1.6 of Text 1).

Cloud Infrastructure: Amazon, Google, Azure & online services, Open-source private clouds. Storage diversity and vendor lock-in, Intercloud, Energy use & ecological impact, Service and compliance level agreement, Responsibility sharing, User experience, Software licensing (Topics: 3.1 to 3.11 of Text 1).

Module-2: Cloud Applications & Paradigms (8 hours)

Challenges, Existing and new application opportunities, Architectural styles, Workflows, The ZooKeeper model, The MapReduce programming model, GrepTheWeb application, Clouds for science and engineering, High performance computing on a cloud, Cloud computing for biological research, Social computing, Digital content, and cloud computing.
(Topics: 4.1 to 4.11 of Text 1)

Module-3: Cloud Resource Virtualization (8 hours)

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual machines, Performance and security isolation, Full virtualization and paravirtualization, Hardware support for virtualization, *Xen* -a VMM based on paravirtualization, Optimization of network virtualization in *Xen* 2.0, *vBlades - x86-64* Itanium processor, A performance comparison of virtual machines, The darker side of virtualization, Software fault isolation.
(Topics: 5.1 to 5.13 of Text 1)

Module-4: Cloud Resource Management and Scheduling (8 hours)

Policies and mechanisms, Applications of control theory, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based web services, Resource bundling, Scheduling algorithms, fair queuing, Start time fair queuing, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines.
(Topics: 6.1 to 6.13 of Text 1).

Module-5: Storage and Security (8 hours)

Storage systems: Evolution, Storage models, File systems, Databases, DFS, General parallel File system, GFS, Apache Hadoop, Locks & Chubby, TPS & NoSQL databases, BigTable, Mega store. (Topics: 8.1 to 8.10 of Text 1).

Cloud Security: Risks, Security, Privacy and privacy impacts assessments, Trust, Operating system and virtual machine Security, Security of virtualization, Security risks in shared images.
(Topics: 9.1 to 9.8 of Text 1).

Course Outcomes: At the end of the course the student will be able to:	
22ECE454.1	Articulate different aspects and infrastructures of cloud computing including delivery models & services

22ECE454.2	Describe various cloud computing applications & paradigms
22ECE454.3	Illustrate cloud resource virtualization strategies with case studies.
22ECE454.4	Describe cloud resource management and scheduling policies and mechanisms.
22ECE454.5	Identify the cloud storage systems and the types.
22ECE454.6	Discuss cloud security with virtualization.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Cloud Computing: Theory and Practice	Dan C Marinescu	MK Publishers	1st Edition 2013
Reference Books				
1	Distributed and Cloud Computing, From Parallel Processing to the Internet of Things	Kai Hwang, Jack Dongarra, Geoffrey Fox	MK Publishers	1st Edition, 2012
2	Cloud Computing: A Practical Approach	Anthony T. Velte, Toby J. Velete, Robert Elsenpeter	Tata McGraw Hill	2010

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc21_cs14/preview
- https://archive.nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs16/
- http://www.infocobuild.com/education/audio-video-courses/computer-science/CloudComputing-IIT-Kharagpur/lecture-24.html
- https://onlinecourses.nptel.ac.in/noc21_cs15/preview

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22ECE454.1	2	2												
22ECE454.2		2	2											
22ECE454.3		1												
22ECE454.4		2												
22ECE454.5		1												
22ECE454.6		2												

1: Low 2: Medium 3: High

Analog Communication Laboratory			
Course Code	**22ECE46L**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	SEE	3 Hours
Total Hours	24 Hrs	Credits	1

Course Learning Objectives: The objective of the course is to

- Design and analyze the various forms of amplitude modulation and demodulation schemes and analyze the output waveforms.
- Design the frequency modulation scheme and analyze the output waveforms.
- Design the PAM, PWM and PPM modulation and demodulation Circuits and analyze the waveforms.
- Design Sample and Hold circuit and analyze the waveforms.
- Use the simulation tools for analyzing the various modulation and demodulation schemes.

Part A: Conduct the following experiments using MATLAB/SIMULINK

1. Demonstrate and analyze the generation and detection of DSB-FC and DSB-SC scheme.
2. Demonstrate and analyze the generation and detection of SSB-SC scheme.
3. Design and analyze the phase modulation and demodulation scheme.
4. Design and analyze the pulse code modulation and demodulation scheme.

Part B: Conduct the following experiments using discrete components

1. Design and analyze the circuit to generate the frequency modulated waveforms.
2. Design and analyze pulse amplitude modulation and demodulation techniques.
3. Demonstrate the pulse width modulation and demodulation techniques.
4. Design a pulse position modulation circuit and plot the waveforms.
5. Design a frequency mixer circuit and observe the difference in the frequency of two signals.
6. Design and analyze the sample and hold circuit and plot the waveforms.

Course Outcomes:

At the end of the course the student will be able to:

22ECE46L.1	Demonstrate the various amplitude modulation and demodulation schemes.
22ECE46L.2	Design and analyze the angle and digital modulation schemes.
22ECE46L.3	Analyze the design of PWM, PPM and PAM modulation /demodulation Schemes.
22ECE46L.4	Demonstrate and analyze the frequency modulation scheme.
22ECE46L.5	Design a circuit for mixing of two signals using discrete components.
22ECE46L.6	Design and analyze the Sample and Hold circuit.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Communication Systems	Simon Haykins	John Willey, India Pvt. Ltd	5th Edition, 2010
Reference Books				
1	Principles of communication	Herbert Taub & D.L.Schilling	TMH	2nd Edition, 2008

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/117105143
- https://www.youtube.com/watch?v=A9N9EGe_4tU
- https://www.youtube.com/watch?v=8eOojJovM6A
- https://www.youtube.com/watch?v=NQoyPy8utH8

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE46L.1	2				3				2					
22ECE46L.2	2				3				2					
22ECE46L.3	2		2	3					2					
22ECE46L.4	2		2	3					2					
22ECE46L.5	2		2	3					2					
22ECE46L.6	2		2	3					2					

1: Low 2: Medium 3: High

Universal Human Values- II			
Course Code	**22UHV47**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives:

This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement toward value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Module-1 Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Activities: Sharing about Oneself, Exploring Human Consciousness and Exploring Natural Acceptance. **5 Hours**

Module-2 – Harmony in the Human Being

Understanding Human beings as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Activities: Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body and Exploring the difference of Needs of Self and Body. **5 hours**

Module 3 – Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Activities: Exploring the Feeling of Trust, Exploring the Feeling of Respect and Exploring the Feeling systems to fulfil Human Goal. **5 hours**

Module-4 – Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Activities: Exploring the Four Orders of Nature and Co-existence in Existence. **5 hours**

Module-5 – Implications of the Holistic Understanding – a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Activities: Exploring Ethical Human Conduct**,** Humanistic Models in Education and steps of Transition towards Universal Human Order. **5 hours**

Course Outcomes: At the end of the course the student will be able to:	
22UHV47.1	Practice the method of self-exploration to understand the basic human aspiration.
22UHV47.2	Distinguish between needs of self and body.
22UHV47.3	Evolve a program for self-regulation and health.
22UHV47.4	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them.
22UHV47.5	Realize sustainable solutions to the problems in society and nature.
22UHV47.6	Develop competence in professional ethics and strategies for the transition towards a value-based life/profession.

Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi	2nd Revised Edition, 2019
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books New Delhi	2nd Revised Edition, 2019
Reference Books				
1	Jeevan Vidya: Ek Parichaya	A Nagaraj	Jeevan Vidya Prakashan Amarkantak	1999
2	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi	2004

Additional Resources/Web links/Video Lectures

1. The Story of Stuff (Book).
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
4. Economy of Permanence - J C Kumarappa
5. Bharat Mein Angreji Raj – Pandit Sunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)
11. UHV-I Teaching material (Presentations, Pre & Post Surveys etc.)
https://fdp-si.aicte-india.org/AicteSipUHV_download.php
12. Details of UHV-II: Universal Human Values – Understanding Harmony and Ethical Human Conduct
https://drive.google.com/file/d/1cznDaqDwKy__EKWmqJLWF94MeY4AXcsU/view?usp=sharing

13. Recorded FDP (Refresher 1 Part 1: Preparing to teach UHV-I in SIP)
https://www.youtube.com/watch?v=kejuD4faDDE&list=PLWDeKF97v9SOjS4RanhaYj4YLiImqm5pj&index=1

14. Resources, including the class notes and presentations
https://drive.google.com/drive/folders/1nh9m5ibEtvMyqekeiexAJtfbdNtmtt6-?usp=sharing

15. Hindi Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SMRfe5PK1HPYnEcrrJOL6K7

16. English Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22UHV47.1						3		2						
22UHV47.2						2			3					
22UHV47.3						2		3						
22UHV47.4							3							
22UHV47.5			3				2							
22UHV47.6								3				2		

1: Low 2: Medium 3: High

Biology for Engineers			
Course Code	**22BFE47**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives:

1. To bring awareness of biological concepts to engineering students
2. To introduce the building blocks of life and their complexity
3. To encourage interdisciplinary studies and projects
4. To appreciate the discoveries that mimic nature and its working
5. To inculcate nature-inspired design and operational principles

Module-1 **5 Hours**

Basic Cell Biology: Introduction to Biology, The cell: the basic unit of life, Expression of genetic information-protein structure and function, Cell metabolism; Cells respond to their external environments, Cells grow and reproduce, Cellular differentiation.

Module-2 **5 Hours**

Biochemistry and Molecular Aspects of Life: Biodiversity-Chemical bonds in Biochemistry; Biochemistry and Human biology, Protein synthesis -DNA; RNA, Transcription and translation factors play key roles in protein synthesis, Differences between eukaryotic and prokaryotic protein synthesis, Stem cells and their applications.

Module-3 **5 Hours**

Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network), Respiratory system, sensory system (electronic nose, electronic tongue), Visual and auditory prosthesis (Bionic eye and cochlear implant).

Module-4 **5 Hours**

Relevance of Biology as an interdisciplinary approach: Biological observation that led to major discoveries, Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Bird flying (aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro).

Module-5 **5 Hours**

Bioinspired Algorithms and Applications: Genetic algorithm, Gene expression modelling, Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems, Dynamic Updating DNA Computing Algorithms, Bee-Hive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour.

Course Outcomes: At the end of the course the student will be able to:	
22BFE47.1	Discuss how the cell forms the basic building block of life
22BFE47.2	Distinguish between transcription and translation
22BFE47.3	Describe the role played by proteins within the cell
22BFE47.4	Analyze the role of bioinspired design in novel applications
22BFE47.5	Apply bioinspired design principles to other domains
22BFE47.6	Implement a simple genetic algorithm

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Biology for Engineers	Thyagarajan.S., Selvamurugan. N., Rajesh.MP, Nazeer RA, Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K	Tata McGraw Hill	2012
2	Molecular Biology	Robert Weaver	McGraw-Hill	5th Edition, 2012
Reference books				
1	Lewin's Genes XII	Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick	Jones and Bartlett Learning	2017
2	Bioinspired Engineering	Jenkins, C.H.	Momentum Press	2012
3	Bio mimetics: Nature-Based Innovation	Yoseph Bar-Cohen	CRC Press	1st Edition, 2016
4	A Practical Guide to Bio-inspired Design	Hashemi Farzaneh, Helena, Lindemann, Udo	Springer	2019

Web links/Video Lectures/MOOCs

1. https://books.google.co.in/books?id=-2LNBQAAQBAJ&printsec=frontcover#v=onepage&q&f=false
2. https://www.aminotes.com/2017/02/biology-for-engineers-module-1-cocepts.html

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22BFE47.1	2					1								
22BFE47.2		1				1								
22BFE47.3	2					2								
22BFE47.4		2										2		
22BFE47.5	2											2		
22BFE47.6		2										2		

1: Low 2: Medium 3: High

COMPUTATIONAL TOOLS FOR ENGINEERS			
Course Code:	**22CTE48**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives:

1. Apply modeling and simulation tools for a wide range of engineering problems.
2. Understand the analysis of data in Excel with statistics.
3. Use MATLAB and Simulink to perform engineering system analysis.

The engineering design process heavily relies on modeling and simulation. Modern simulation techniques enable the development of multi-physical, holistic system models that account for all system interactions. These digital models speed up the design and testing processes, saving time and money.

Module 1

Engineering Design Analysis

Need for engineering design analysis. Product and system design. Introduction to analysis parameters – stress, deformation, acceleration, internal force and stability. Static structural analysis of engineering design using finite element method (case studies). Heat transfer and fluid dynamics modeling and simulation using CFD software (case studies).

10 Hours

Module 2

Data Analysis with EXCEL

Calculate Mean, Median, Mode, Minimum, Maximum, Quartiles, Variance and Standard Deviation from some numbers. Analyze a population using data samples. Group data, build XY charts, apply Logarithmic Scale and Trend Line on a chart, forecast from some data, and calculate running averages. Normal Distribution, Exponential Distribution, Uniform Probabilities, Binomial Distribution, and Poisson Distribution.

4 Hours

Module 3

MATLAB and Simulink for Engineers

Applications of MATLAB and Simulink in electrical engineering, electrical machines and power system projects, simulation of rectifiers, inverters, choppers, and cycloconverters.

10 Hours

Course Project

Solve complex engineering problems via modeling and simulation. The project work is teamwork of 3-5 students. The goals should be clearly defined, use any software tool, and rigorous validation of the mathematical model should be done (experimental or theoretical).

Course Outcomes: At the end of the course, the student will be able to:	
22CTE48.1	Apply the Finite Element Method to solve engineering problems
22CTE48.2	Solve statistical problems using Excel
22CTE48.3	Perform system-level analysis using MATLAB and Simulink
22CTE48.4	Build mathematical models for any given engineering problem.
22CTE48.5	Demonstrate teamwork and communication skills

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books				
1	**MATLAB and Simulink for Engineers**	Agam Kumar Tyagi	Oxford University Press	2012
2	**Practical Finite Element Analysis**	Nitin S.Gokhale	Finite to Infinite	2020
3	**Excel Crash Course for Engineers**	Eklas Hossain	Springer	2021

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CTE48.1	1				1	1								
22CTE48.2		1			2				2					
22CTE48.3		1			2									
22CTE48.4					2	2								
22CTE48.5	1								2					

1: Low 2: Medium 3: High

Industry Oriented Training - Business Etiquettes			
Course Code	**22ITB49A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	02

Course Learning Objectives:

11. Know the components of self-introduction
12. Develop a resume with the inclusion of core competencies
13. Involve and contribute to group discussions
14. Develop effective communication to succeed in the professional career
15. Know the etiquettes of digital communication

Module-1

Self-Introduction &Essentials of grooming

Self-Introduction: Learn the secret to introducing Yourself, Things to avoid when introducing yourself. Activity: Video record the self-introduction. **Essentials of grooming:** Creating the first impression, what does the well-dressed man wear? What does the well-dressed woman wear? Personal hygiene and habits. **4 Hours**

Module-2

Resume Writing

Purpose, Identifying Relevant Competencies, Understanding Applicant Tracking Systems, Lists of Competencies, Writing Accomplishment/ Objective Statements, Finding the Right Words- Action verbs, The Most Popular Resume Format, Other Popular Resume Formats, Do's and Don'ts. Activity: Students have to submit a copy of their resume. **4 Hours**

Module-3

Group Discussion

Types, process, Evaluation criteria, Do's and Don'ts Activity: Group discussions have to be held during the training sessions. **4 Hours**

Module-4

Communicate effectively

Build a Story, Just a Minute, Group Activities, Team building activities, Role Play, Presentation Skills. **4 Hours**

Module-5

Digital right and wrong

Virtual Communication: Agenda, being prepared, Dressing appropriately, background, Use Microphone and camera the right way, restraining from off tasks during virtual meetings, protecting confidential data during online presentations, time management. **4 Hours**

Course Outcomes: At the end of the course the student will be able to:	
22ITB49A.1	Articulate the essential components required for self-introduction in any business or a networking event and also recognize the need to dress appropriately for a successful career in the corporate
22ITB49A.2	Develop a resume inclusive of core competencies, and action verbs which are compatible with Applicant Tracking Systems
22ITB49A.3	Demonstrate the types, process and evaluation process of Group Discussion and carry out effective group discussions
22ITB49A.4	Develop skills required for effective communication
22ITB49A.5	Associate and be accustomed to the etiquette to be followed during online meetings

Sources

1. English for Common Interactions in the Workplace: Basic Level: Coursera: https://www.coursera.org/learn/english-common-interactions-workplace-basic-level
2. Personal Communication-Introduce Yourself With Confidence: https://www.udemy.com/course/how-to-introduce-yourself/
3. Professionalism, Grooming and Etiquette: https://www.edx.org/course/professionalism-grooming-and-etiquette
4. How to Write a Resume: https://www.coursera.org/learn/how-to-write-a-resume#syllabus
5. Group Discussion Strategies: https://www.udemy.com/course/group-discussion-strategies/
6. Communication Strategies for a Virtual Age: https://www.coursera.org/learn/communication-strategies-virtual-age#syllabus

References

1. https://simplifytraining.com/course/personal-hygiene-and-good-grooming/
2. https://www.udemy.com/course/group-discussion-strategies/
3. https://www.educba.com/course/group-discussion/
4. https://getrafiki.ai/meetings/rules-of-virtual-meeting-etiquette-every-sales-professional-should-follow/
5. https://thedigitalworkplace.com/articles/online-meeting-etiquette-for-attendees/
6. https://rigorousthemes.com/blog/virtual-meeting-etiquette-guidelines-ground-rules/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ITB49A.1									2	3		1		
22ITB49A.2										3		1		
22ITB49A.3									2	3	1	1		
22ITB49A.4									2	3	1	1		
22ITB49A.5									2	3	1	1		

1: Low 2: Medium 3: High

Industry Oriented Training - Computing Skills			
Course Code	**22ITC49B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	02

Course Learning Objectives:

6. Use logical conditions for problem-solving and also introduce the concepts of arrays
7. Know functions, function calls, and parameter passing
8. Introduce algorithms and appreciate their importance in problem-solving
9. Introduce the core concepts of OOP's
10. Differentiate between front-end & back-end development and recognize the use of database management

Module-1

Introduction to computing constructs

Logical conditions: For Loops, Nested For Loops, While Loops, Do-While Loops, Nesting and Boxes, and combine/negate several logical conditions using logic operations AND, OR, and NOT.

Arrays & strings: Create arrays of characters (strings), use the null terminator, and manipulate strings. **4 Hours**

Module-2

Functions & Pointers

Introduction to Functions, Returning Data From a Function, Passing Data Into a Function, Getting Valid User Input, Changing Parameter Values, Pointer Basics, Changing the Pointed to Value, Walking an Array with Pointers, Dynamic Memory Allocation, Getting More Memory, Pointers to Structure. **4 Hours**

Module-3

Algorithm analysis

Introduction to Algorithm Analysis, Big-O, Big-O Examples, Dynamic Array Operations, Bubble Sort, Selection Sort, Insertion Sort, Recursion, Recursive Binary Search, Merge Sort. **4 Hours**

Module-4

Object-oriented programming

Designing for Object-Oriented Programming, Core Concepts of OO Programming: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object-oriented programming paradigm. **4 Hours**

Module-5

Frontend and backend development

UI, Database management: DBMS overview, Relational Data Model and the CREATE TABLE Statement, Basic Query Formulation with SQL. **4 Hours**

Course Outcomes: At the end of the course the student will be able to:	
22ITC49B.1	Illustrate the use of logical conditions, declare and manipulate data into arrays
22ITC49B.2	Implement functions, function calls, and parameter passing
22ITC49B.3	Design, implement, and evaluate an algorithm to meet desired needs
22ITC49B.4	Describe the core concepts of OOP's
22ITC49B.5	Recognize the concepts of front-end development and database management

Sources
1. Computational Thinking with Beginning C Programming Specialization: https://www.coursera.org/learn/simulation-algorithm-analysis-pointers?specialization=computational-thinking-c-programming#syllabus 2. Simulation, Algorithm Analysis, and Pointers: https://www.coursera.org/lecture/simulation-algorithm-analysis-pointers/big-o-examples-pdCan 3. Programming Fundamentals: https://www.coursera.org/learn/programming-fundamentals?specialization=c-programming#syllabus 4. Object-Oriented Programming Concepts: https://www.coursera.org/learn/concepts-of-object-oriented-programming#syllabus 5. Introduction to Back-End Development: https://www.coursera.org/learn/introduction-to-back-end-development

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ITC49B.1	2	1	1											
22ITC49B.2	2	1	1											
22ITC49B.3	1	1	2											
22ITC49B.4	2		1											
22ITC49B.5	2	1	1											

1: Low 2: Medium 3: High

Core Values of the Institution

SERVICE

A Josephite will keep service as the prime goal in everything that is undertaken. Meeting the needs of the stakeholders will be the prime focus of all our endeavors.

EXCELLENCE

A Josephite will not only endeavor to serve, but serve with excellence. Preparing rigorously to excel in whatever we do will be our hallmark.

ACCOUNTABILITY

Every member of the SJEC Family will be guided to deliver on assurances given within the constraints set. A Josephite will always keep budgets and deadlines in mind when delivering a service.

CONTINUOUS ADAPTATION

Every member of the SJEC Family will strive to provide reliable and continuous service by adapting to the changing environment.

COLLABORATION

A Josephite will always seek to collaborate with others and be a team-player in the service of the stakeholders.

Objectives

- Provide Quality Technical Education facilities to every student admitted to the College and facilitate the development of all round personality of the students.
- Provide most competent staff and excellent support facilities like laboratory, library and internet required for good education on a continuous basis.
- Encourage organizing and participation of staff and students in in-house and outside Training programmes, seminars, conferences and workshops on continuous basis.
- Provide incentives and encouragement to motivate staff and students to actively involve in research-innovative projects in collaboration with industry and R &D centres on continuous basis
- Invite more and more number of persons from industry from India and abroad for collaboration and promote Industry-Institute Partnership.
- Encourage consultancy and testing and respond to the needs of the immediate neighbourhood.

St Joseph Engineering College

AN AUTONOMOUS INSTITUTION

Affiliated to VTU, Belagavi | Recognised by AICTE, New Delhi
Accredited by NAAC with A+ Grade
B.E. (CSE, ECE, EEE, ME, CIV), MBA & MCA Accredited by NBA, New Delhi

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