MCA
SCHEME & SYLLABUS

ST JOSEPH ENGINEERING COLLEGE

AN AUTONOMOUS INSTITUTION

Vamanjoor, Mangaluru - 575028

MOTTO

Service and 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-Belgaum & Recognized by AICTE
NBA-Accredited: B.E. (CSE, ECE, EEE, ME, CIV) & MBA
NAAC – Accredited with grade A+

Master of Computer Applications

(MCA)

SYLLABUS

(I and II SEM)

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 5 per cent 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 practising 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.

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Scheme of Teaching and Examination

I Semester MCA

Sl.No.	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Theory Lecture L	Tutorial T	Practical/ P	Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	21MCA101	Computer Fundamentals and Operating System	MCA		04	-	-	-	03	50	50	100	04
2	PCC	21MCA102	Data Structures with Algorithms	MCA		04	-	-	-	03	50	50	100	04
3	PCC	21MCA103	Web Technologies	MCA		04	-	-	-	03	50	50	100	04
4	PCC	21MCA104	Database Management System	MCA		03	-	-	-	03	50	50	100	03
5	BSC	21MCA105	Discrete Mathematics and Statistics	MCA		03				03	50	50	100	03
6	PCC	21MCL106	Data Structures with Algorithms Lab	MCA		01		02		03	50	50	100	02
7	PCC	21MCL107	Web Technologies Lab with Mini Project	MCA		01		02		03	50	50	100	02
8	PCC	21MCL108	DBMS Laboratory	MCA		01		02		03	50	50	100	02
9	SDC	21MCS109	Technical Seminar	MCA		-	02	-	-	-	100		100	01
10	SDC	21ITM110	Industry Oriented Training- I (Mathematical Skills)	COM			02	-	-	02	50		50	-
Total						**21**	**04**	**06**		**26**	**550**	**400**	**950**	**25**

II Semester MCA

Sl.No.		Course and Course Code	Course Title	Teaching Department	Paper Setting Board	Teaching Hours/Week			Duration in hours	Examination			Credits
						Lecture L	Tutorial T	Practical/ Drawing P		CIE Marks	SEE Marks	Total Marks	
1	PCC	21MCA201	Software Engineering	MCA		03	-	-	03	50	50	100	03
2	PCC	21MCA202	Data Analytics using Python	MCA		04	-	-	03	50	50	100	04
3	PCC	21MCA203	Object Oriented Programming with Java	MCA		04	-	-	03	50	50	100	04
4	PCC	21MCA204	Research Methodology & IPR	MCA		02		-	03	50	50	100	02
5	PEC	21MC205X	Elective-1	MCA		03	-	-	03	50	50	100	03
6	PEC	21MC206X	Elective-2	MCA		03	-	-	03	50	50	100	03
7	PCC	21MCL207	Software Engineering Lab	MCA		01		02	03	50	50	100	02
8	PCC	21MCL208	Data Analytics Lab with Mini Project	MCA		01		02	03	50	50	100	02
9	PCC	21MCL209	Java Programming Lab	MCA		01		02	03	50	50	100	02
10	SDC	21ITP210	Industry Oriented Training II (**Problem Solving Skills**)	MCA			02		02	50		50	-
			Total			**22**	**02**	**06**	**29**	**500**	**450**	**950**	**25**

Elective I		Elective II	
21MC205A	Cyber Security	21MC206A	Cryptography and Network Security
21MC205B	Data Mining and Business Intelligence	21MC206B	Artificial Intelligence
21MC205C	Enterprise Resource Planning	21MC206C	Mobile Application Development
21MC205D	Machine Learning	21MC206D	Distributed Operating Systems
21MC205E	Optimization Techniques	21MC206E	Natural Language Processing

Summer Internship: All the students admitted shall have to undergo a mandatory summer internship of minimum 04 weeks during II and III semester vacation. Summer Internship shall include Inter / Intra Institutional activities. Internship examination shall be conducted during III semesters and the prescribed credit shall be included in III semesters. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements

III Semester MCA

SI.No.	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours/Week					Examination					Credits
						Theory Lecture L	Tutorial T	Practical/Drawing P		Duration in hours	CIE Marks	SEE Marks	Total Marks		
1	PCC	21MCA301	Computer Networks	MCA		03	-	-		03	50	50	100		03
2	PCC	21MCA302	Internet of Things(IoT)	MCA		03	-	-		03	50	50	100		03
3	PCC	21MCA303	Advances in Java	MCA		03	-	-		03	50	50	100		03
4	PEC	21MC304X	Elective-III	MCA		03	-	-		03	50	50	100		03
5	PEC	21MC305X	Elective-IV	MCA		03	-	-		03	50	50	100		03
6	PCC	21MCL306	Computer Networks Lab	MCA		01	-	02		03	50	50	100		02
7	PCC	21MCL307	IoT Lab with Mini Project	MCA		01	-	02		03	50	50	100		02
8	PCC	21MCL308	Advances in Java Lab	MCA		01	-	02		03	50	50	100		02
9	SDC	21MCA309	Add on Course on Entrepreneurship	MCA		-	02	-		02	50	50	100		01
10	INT	21INT310	Summer Internship - I								50	50	100		03
			Total			18	02	06		27	500	500	1000		25

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Elective III		Elective IV	
21MC304A	Blockchain Technology	21MC305A	Deep Learning
21MC304B	Cloud Computing	21MC305B	Big Data Analytics
21MC304C	Digital Marketing	21MC305C	Programming using C#.NET
21MC304D	Software Testing	21MC305D	Software Project Management
21MC304E	NoSQL	21MC305E	Software Defined Networks

IV Semester MCA

Sl.No.	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours/Week Theory Lecture L	Tutorial T	Practical/Drawing P	Duration in hours	Examination CIE Marks	SEE Marks	Total Marks	Credits
1	SDC	21AEC401	MOOC	MCA		Any MOOC topic (Choices are given by the department) with minimum 16 weeks to be completed between I Sem to IV Sem						100	04
2	SDC	21MCS402	Research / Technical Seminar	MCA		-	-	-	02	100	-	100	1
3	SDC	21MCP403	Project Work	MCA		-	-	-	02	50	50	100	10
4	INT	21INT404	Industry Internship for 12 weeks			-	-	-	03	50	50	100	10
			Total			00	00	00	07	200	100	400	25

Note: PCC: Professional Core Course; PEC = Professional Elective Course; BSC: Basic Science Course

SDC = Skill Development Course; INT =Internship

Definition of Credit:	One-hour Lecture (L) per week per semester = 1 Credit
	Two-hour Tutorial (T) per week per semester = 1 Credit
	Two-hour Practical/Laboratory/Drawing (P) per week per semester = 1 Credit
	Four hours of Self-study = 1 Credit

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PG Credit distribution

Sl. No.	Course Area	I	II	III	IV	Total
1.	BSC	3	-	-	-	03
2.	PCC	21	19	15	-	55
3.	PEC	-	6	6	-	12
4.	SDC	1	-	1	15	17
5.	INT	-	-	3	10	13
	Total	**25**	**25**	**25**	**25**	**100**

COMPUTER FUNDAMENTALS AND OPERATING SYSTEM

Course Code	**21MCA101**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(4:0:0)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:
1. To realize the concepts of computer system organization.
2. To get the basic insights of operating system.
3. To analyze process management in operating system.
4. To summarize process synchronization techniques.
5. To describe memory management techniques in operating system
6. To implement basic Unix commands and to construct patterns using regular expressions

Module-1	**10Hrs**

Binary Systems and Combinational Logic Digital Computers and Digital Systems, Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers, subtraction using r's and r-1 complements, Binary Storage and Registers, Binary Logic, Integrated Circuits, Digital Logic Gates, Basic structure of computers, Computer Types, Functional Units, Basic Operational Concepts, Bus structure.

Module-2	**10Hrs**

Introduction to Operating Systems, Computer System Architecture; Operating System Operations; Operating System Structure: Operating System Services; System Calls; Types of System Calls; System Programs; Virtual Machines; System boot.
Process Management: Process concept, process state, process control block, Process Scheduling.

Module-3	**10Hrs**

Scheduling criteria, Scheduling Algorithms: FCFS, SJFS, Priority scheduling, Round Robin Scheduling, Multi-level queue scheduling, Multi-level feedback queue scheduling.
Process Synchronization: Critical section problem, Synchronization hardware, semaphore, classic problems of synchronization.

Module-4	10Hrs
Deadlocks: System model; Deadlock Characterization, Methods for handling deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from deadlock. Memory Management: Memory Management Strategies: Background, Swapping; Contiguous Memory Allocation; Paging; Segmentation; Virtual Memory Management; Demand Paging; Page Replacement; Allocation of Frames; Thrashing.	

Module-5	10Hrs
Introduction to Unix system, Basic commands: ls, cat, cal, date, calendar, who, echo, tty etc. Unix File System: The Parent-Child Relationship, The HOME Variable: The Home Directory, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, Basic File Attributes: ls options, File Ownership, File Permissions, chmod, Directory Permissions, Changing the File Ownership More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links. Pattern matching: the wildcards, escaping and quoting, Filters using regular expression: grep, regular expression, egrep, fgrep, sed instruction.	

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

21MCA101.1	Realize the concepts of computer system organization.
21MCA101.2	Get the basic insights of operating system.
21MCA101.3	Analyze process management in operating system.
21MCA101.4	Summarize process synchronization techniques.
21MCA101.5	Describe memory management techniques in operating system.
21MCA101.6	Implement basic Unix commands and to construct patterns using regular expressions.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	UNIX Concepts and Applications	Sumitabha Das	Tata McGraw Hill	4th Edition, 2006.
2	Operating Systems Concept	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	Wiley – India	8th Edition.

3.	Digital Logic and Computer Design.	M.Morris Mano,	Pearson	2012
4.	Computer Organization	Carl Hamacher, Zvonko Vranesic Safwat Zaky	Tata McGraw-Hill	5th edition, 2011
Reference Books				
1	UNIX: The Complete Reference	Kenneth Roson et al	Osborne/ McGraw Hill	2000.
2	Using UNIX: 2nd Edition	Steve Montsugu	Prentice Hall India	1999.
3	UNIX and Shell Programming	M G Venkateshmurthy	Pearson Education Asia	2005.
4	Operating Systems – A Concept Based Approach	D M Dhamdhere	Tata McGraw – Hill	2nd Edition, 2002
5	Operating Systems	P C P Bhatt	PHI	2nd Edition, 2006.
6	Operating Systems	Harvey M Deital	Addison Wesley	3rd Edition, 1990.

Web links/Video Lectures/MOOCs
1. https://www.coursera.org/learn/os-power-user
2. https://nptel.ac.in/courses/106/102/106102132/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 11	PO 12	PO 13
21MCA101.1	-	2	-	-	-	-	-	-	-	-	-	-
21MCA101.2	-	2	-	-	-	-	-	-	-	-	-	-
21MCA101.3	-	-	1	-	-	-	-	-	-	-	-	-
21MCA101.4	-	-	2	-	-	-	-	-	-	-	-	-
21MCA101.5	-	2	2	-	-	-	-	-	-	-	-	-
21MCA101.6	-	2	-	-	-	1	-	-	-	-	-	-

1: Low 2: Medium 3: High

DATA STRUCTURES WITH ALGORITHMS

Course Code	**21MCA102**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(4:0:0)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. To use the concepts of Stack, Queue, Lists, Trees and Hashing.
2. To describe concepts and algorithms for searching and sorting.
3. To build solutions for real world problems using concepts of data structures.
4. To appraise the efficiency of algorithms in terms of asymptotic notations for the given problem.

Module-1	10Hrs

Classification of Data Structures: Primitive and Non- Primitive, Linear and Nonlinear; Data structure Operations, Stack: Definition, Representation, Operations and Applications: Polish and reverse polish expressions, Infix to postfix conversion, evaluation of postfix expression, infix to prefix, postfix to infix conversion.

Module-2	10Hrs

Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi. Queue: Definition. Representation, Queue Variants: Circular Queue, Priority Queue, Double Ended Queue, Applications of Queues. Programming Examples**.**

Module-3	10Hrs

Linked List: Limitations of array implementation, Memory Management: Static (Stack) and Dynamic (Heap) Memory Allocation, Memory management functions, Definition.
Representation, Operations: getnode() and Freenode() operations, Types: Singly Linked List. Linked list as a data Structure, Inserting and removing nodes from a list, Linked implementations of stacks, Header nodes, Array implementation of lists.

Module-4	10Hrs
Introduction, Fundamentals of the Analysis of Algorithm Efficiency Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms. Brute Force: Selection Sort and Bubble Sort, Sequential Search, Exhaustive search and String Matching.	
Module-5	10Hrs
Divide-and-Conquer Mergesort, Quicksort, Binary Search, Binary tree Traversals and related properties. Decrease-and-Conquer Insertion Sort, Depth First and Breadth First Search, Topological sorting. Greedy Technique Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.	

Course Outcomes:	
At the end of the course the student will be able to:	
21MCA102.1	Demonstrate the concepts of Stack and its applications
21MCA102.2	Apply the concepts of Queue and Lists
21MCA102.3	Describe concepts and algorithms for searching and sorting.
21MCA102.4	Appraise the efficiency of algorithms in terms of asymptotic notations for the given problem.
21MCA102.5	Apply decrease and conquer and greedy algorithms in problem solving.
21MCA102.6	Build solutions for real world problems using concepts of data structures.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin,	Pearson Education,	2nd Edition.
2	Programming in ANSI C,	Balaguruswamy,	McGraw Hill Education	

3	Data Structures Using C and C++	Yedidyah Langsam and Moshe J. Augenstein and Aaron M Tenanbanum,	Pearson Education Asia,	2nd Edition, 2002.
4	Introduction to Data Structure and Algorithms with C++	Glenn W. Rowe.		
Reference Books				
1	Data Structures	Seymour Lipschutz, Schaum's Outlines	Revised 1st edition, McGraw Hill	2014
2	Fundamentals of Data Structures in C	Ellis Horowitz and SartajSahni,	2nd edition, Universities Press,	2014

Web links/Video Lectures/MOOCs
1. https://nptel.ac.in/courses/106/102/106102064/
2. https://www.coursera.org/specializations/data-structures-algorithms

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA102.1	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCA102.2	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCA102.3	2	2	-	-	-	-	-	-	-	-	-	-	-
21MCA102.4	-	2	-	-	-	-	-	-	-	-	-	-	-
21MCA102.5	-	2	-	2	-	-	-	-	-	-	-	-	-
21MCA102.6	-	-	-	2	-	-	-	-	-	-	-	-	2

1: Low 2: Medium 3: High

WEB TECHNOLOGIES

Course Code	**21MCA103**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(4:0:0)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:
1. To describe the basics of Web Technologies.
2. To implement interactive event driven documents using JavaScript and HTML.
3. To apply Database concepts to the Web Page using PHP and MySQL
4. To demonstrate the usage of JQuery
5. To implement the bootstrap programs and its applications.

Module-1	10Hrs

Web browsers, web servers, MIME, URL, HTTP Introduction to HTML5 tags, Basic syntax and structure, text markups, images,, lists , tables , Media tags-audio and video ,forms.

Introduction to CSS, Levels of CSS, Selectors, Font, color and Text Properties, BOX Model, Span and Div tags.

Module-2	10Hrs

Introduction to JavaScript, controls statements, Arrays and functions, pattern matching, Element Access, Event Handling.
Introduction, Syntax of XML, XML Document Structure, Document type definitions , Namespaces, XML schemas.

Module-3	10Hrs

Essentials of PHP- Installation of Web Server, XAMPP Configurations-PHP Forms- GET and POST method - Regular Expressions-Cookies- Sessions-Usage of Include and require statements- File:read and write from the file- PHP Filters-PHP XML Parser- MySQL.

Module-4	10Hrs

Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery and CSS.

Module-5	10Hrs

Introduction to Bootstrap, First example, containers, Bootstrap elements: colors, tables, images, buttons, button groups, progress bars, Forms, utilities, Classes, alerts, custom forms, Grid System.

	Course Outcomes:			
	At the end of the course the student will be able to:			
21MCA103.1	Apply the concept and usages web based programming techniques using XHTML and HTML5 coding techniques.			
21MCA103.2	Demonstrate the use of JavaScript documents.			
21MCA103.3	Apply PHP and MySQL concepts for XHTML document structure.			
21MCA103.4	Design and implement user interactive dynamic web based applications using Jquery scripting.			
21MCA103.5	Use Bootstrap concepts to develop customized web pages.			
21MCA103.6	Apply the relevant web technologies for solving real world problems.			

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Programming the World Wide Web	Robert W.Sebesta	Pearson education	4th Edition, 2012
2	HTML5 Black Book		Dreamtech	
3	jQuery in Action	Bear Bibeault	Manning Publications	
4	Bootstrap Essentials	Snig Bhaumik	PACKT publishing, open source	
5	Web Programming	Chris Bates	Wiley Publications	
Reference Books				
1	Web Technologies	Uttam K Roy	Oxford University Press	
2	Web Programming, building internet applications	Chris Bates	2nd edition Wiley Dreamtech	
3	Bootstrap: Responsive Web Development	Jake Spurlock	O'Reilly Media	2014

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA103.1	-	-	-	-	-	-	2	-	-	-	-	-	-
21MCA103.2	-	-	-	-	-	-	2	-	-	-	-	-	-
21MCA103.3	-	-	-	-	-	-	-	-	-	2	-	-	-
21MCA103.4	-	-	-	-	-	-	-	-	-	-	2	-	-
21MCA103.5	-	-	-	-	-	-	2	-	-	-	-	-	-
21MCA103.6	-	-	-	-	-	-	2	-	-	2	2	-	-

1: Low 2: Medium 3: High

DATABASE MANAGEMENT SYSTEM

Course Code	**21MCA104**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**(3:0:0)**	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. To describe the basics of SQL and construct queries using SQL.
4. To emphasize the importance of normalization in databases.

Module-1	8Hrs

Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, A Brief History of Database Applications, Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, the database system environment, Centralized and client-server architectures, Classification of Database Management systems.

Module-2	8Hrs

Structure of Relational Databases, Database Schema, Keys, Relational Query Languages, Relational Operations.
Entity-Relationship Model: Conceptual Database using high level conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets Attributes and Keys Relationship types, Relationship Sets Functional Dependencies, Normal Forms based on Primary.

Module-3	8Hrs

SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, Insert, update and delete statements in SQL, aggregate functions in SQL, group by and having clauses.

Module-4	8Hrs

Introduction to triggers in SQL, views in SQL, schema change statements in SQL, stored procedures and functions.

Module-5	8Hrs

Introduction to transaction processing, transaction and system concepts, desirable properties of transactions, transaction support in SQL. Concurrency control techniques: two-phase locking techniques, concurrency control based on timestamp ordering, multi version concurrency control techniques, validation concurrency control techniques. Recovery techniques: recovery concepts, recovery in multi database systems, database backup and recovery from catastrophic failures.

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

21MCA104.1	Apply the basic concepts of database management in designing the database for the given problem.
21MCA104.2	Design entity-relationship diagrams to the given problem to develop database Application with appropriate fields and validations.
21MCA104.3	Implement a database schema for a given problem domain.
21MCA104.4	Formulate SQL queries in Oracle to the given problem.
21MCA104.5	Apply normalization techniques to improve the database design to the given problem.
21MCA104.6	Distinguish database storage structures and access techniques.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Fundamentals of Database Systems,	Elmasri and Navathe:	Addison -Wesley,	5th Edition, 2011.
2	Data base System Concepts,	Silberschatz, Korth and Sudharshan	Tata McGraw Hill	6th Edition, 2011
Reference Books				
1	An Introduction to Database Systems,	C.J. Date, A. Kannan, S. Swamynatham:	Pearson education,	8th Edition, 2009.
2	Database Management Systems,	Raghu Ramakrishnan and Johannes Gehrke:	McGraw-Hill,	3rd Edition, 2003.

Web links/Video Lectures/MOOCs
1.https://coursera.org/learn/database-management

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA104.1	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCA104.2	-	-	-	-	2	-	-	2	-	-	-	-	-
21MCA104.3	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCA104.4	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCA104.5	-	-	-	2	-	-	-	-	-	-	-	-	-
21MCA104.6	-	-	-	-	-	-	-	**2**	-	-	-	-	-

1: Low 2: Medium 3: High

DISCRETE MATHEMATICS AND STATISTICS

Course Code	**21MCA105**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. Use propositional logic in knowledge representation.
2. Apply set theory in computer applications.
3. Find relation between different sets.
4. Fit a curve for given data points.
5. Apply probability distributions in real life problems.
6. Identify different graphs and use it to generate prefix codes.

Module-1	8Hrs

Fundamentals of Logic:
Basic Connectives and Truth Tables, Logical Equivalence: The laws of logic, LogicalImplications, Rules of inference. Open Statement, Quantifiers.
Self Study: Logical NAND and NOR.

Module-2	8Hrs

Set Theory and Relations
Sets, Operations on sets , Laws of set theory, inclusion-exclusion principle, Soft Set Theory, Properties of relations, Digraph and Matrix of relation, EquivalenceRelations and Partitions.
Self Study: Pigeonhole Principle.

Module-3	8Hrs

Statistical methods and Curve Fitting Correlation, coefficient of correlations, lines of regression-principle of least square. Curve Fitting, Principle of least square- to fit a straight line and parabola. Fitting of $y = ae^{bx}$, $y = ax^b$

Self Study: Rank Correlation.

Module-4	8Hrs

Random variable and probability distribution
Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and Standard deviations of random variables. Binomial and Poisson distribution, Exponential and normal distribution with mean and variables and problems.
Self Study: Derivation of Mean and Variance of Binomial and Poisson Distribution.

Module-5	8Hrs

Graph Theory

Graphs and sub graphs, Graph Isomorphism, Vertex degree, Euler Graphs, Planar Graphs, Graph Coloring, Trees and Sorting, and Prefix Codes.

Self Study: Properties of trees.

Course Outcomes:

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

21MCA105.1	Apply knowledge of propositional logic in truth verification.
20MCA105.2	Demonstrate the application of discrete structures in different fields of computer applications.
20MCA105.3	Recognize relations in real life applications.
20MCA105.4	Correlate data points and fit curves for different data points.
20MCA105.5	Relate discrete and continuous probability distributions in real life problems.
20MCA105.6	Find applications of graph theory in real life.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Discrete and Combinatorial Mathematics- An Applied Introduction	Ralph P. Grimaldi and B V Ramana	Pearson Education	5th Edition, 2017
2	Fundamentals of Statistics	S.C. Gupta	Himalaya Publishing	6th Edition 2018
3	Soft Set Theory	P K Maji, R Biswas and A R Roy	Elsvier	2003
4	Operations on Soft Graphs	Muhammad Akram and Saira Nawaz	Elsvier	2015

Reference Books

1	Discrete Mathematical Structures with Applications to Computer Science	J.P. Tremblayand R. Manohar	McGraw Hill	1st Edition, 2017
2	Discrete Mathematics and its Applications	Kenneth H. Rosen	Tata – McGraw Hill	7th Edition, 2017
3	First Look at Graph Theory	John Clark and Darek Allan Holtan	World Scientific Publishers	1st edition 1993

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA105.1	1	1	-	-	-	-	-	-	-	-	-	-	-
21MCA105.2	-	1	-	-	-	-	-	-	-	-	-	-	1
21MCA105.3	1	1	-	-	-	-	-	-	-	-	-	-	-
21MCA105.4	1	1	-	-	-	-	-	-	-	-	-	-	-
21MCA105.5	1	-	-	-	-	-	-	-	-	-	-	-	1
20MCA105.6	1	1	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

DATA STRUCTURES WITH ALGORITHMS LAB

Course Code	**21MCL106**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**(1:0:2)**	SEE Marks	50
Credits	**02**	Exam Hours	03

Course Learning Objectives:

1. Familiarize the knowledge of various types of data structures, operations and algorithms sorting and searching operations.
2. Implement and analyze the performance of Stack, Queue, Lists, Trees, Hashing, Searching and Sorting techniques.
3. Implement all the applications of Data structures in a high-level language.
4. Suggest and apply appropriate data structures for solving computing problems.

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1. Write a C program to Implement the following searching techniques a. Linear Search Binary Search.

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2. Write a C program to implement the following sorting algorithms using user defined functions:
   a. Bubble sort (Ascending order)
   b. Selection sort (Descending order)

---

3. Write a C Program implement STACK with the following operations
   a. Push an Element on to Stack
   b. Pop an Element from Stack

---

4. Implement a Program in C for converting an Infix Expression to Postfix Expression.

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5. Implement a Program in C for evaluating an Postfix Expression.

---

6. Write a C program to simulate the working of a singly linked list providing the following operations:
   a. Display & Insert
   b. Delete from the beginning/end
   c. Delete a given element

---

7. Obtain the Topological ordering of vertices in a given graph with the help of a c programming.

---

8. Check whether a given graph is connected or not using DFS method using C programming.

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9. From a given vertex in a weighted connected graph, find shortest paths to other vertices Using Dijkstra's algorithm (C programming).

10. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm (C programming).
11. Implement merge sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
12. Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the 1st to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

Course Outcomes: At the end of the course the student will be able to:	
21MCL106.1	Perform various sorting and searching techniques.
21MCL106.2	Analyze the sorting techniques.
21MCL106.3	Implement stack operations and its applications.
21MCL106.4	Implement decrease and conquer algorithms.
21MCL106.5	Implement greedy algorithms.
21MCL106.6	Design and apply appropriate data structures for solving computing problems.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCL106.1	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCL106.2	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCL106.3	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCL106.4	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL106.5	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL106.6	-	-	2	-	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

WEB TECHNOLOGIES LAB WITH MINI PROJECT

Course Code	**21MCL107**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**(1:0:2)**	SEE Marks	50
Credits	**02**	Exam Hours	03

Course Learning Objectives:
1. Implement XHTML documents using JavaScript and CSS.
2. Demonstrate a web page using HTML5.
3. Use JQuery to develop an interactive web page.
4. Apply database concepts to the interactive Web Page using PHP and MySQL.

Part A
1. Create a Web Page for the admission department of your college using XHTML and HTML5 tags. Design all the necessary input fields to collect the information of the student. Apply different levels of style sheets for the Web Page.

2. Develop and demonstrate, using JavaScript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. Modify the above document so that when a text is moved from the top stacking position, it returns to its original position rather than to the bottom.

3. Develop a XML page for the student placement application and apply CSS and XML style sheets.

4. Develop and demonstrate using jQuery to solve the following:
   a) Limit character input in the text area including count.
   b) Based on check box, disable/enable the form submit button

5. Develop and demonstrate using jQuery to solve the following:
   a) Fade in and fade out all division elements.
   b) Animate an element, by changing its height and width.

6. Write a PHP program to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.

7. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table using PHP. Provide buttons to update and delete data for the same.

PART-B	
	Develop a web application (mini-project) using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. Database connection needs to be implemented.

Note:

1. A team of two students must develop the mini project. However during the examination, each student must demonstrate the project individually.
2. Each students has to execute one program picked from Part-A during the semester end examination.
3. The team must submit a brief project report (20-25 pages) that must include the following a. Introduction b. Requirement Analysis c Software Requirement Specification d. Analysis and Design, e. Implementation f. Testing
4. Brief synopsis not more than two pages to be submitted by the team as per the format given. It was recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects.
5. Rubrics may be used to evaluate the Mini-Project

Note: In CIE and SEE part-A and part-B shall be given weightage of 50% each.

Course Outcomes:	
At the end of the course the student will be able to:	
21MCL107.1	Apply the concept and usage of web based programming techniques.
21MCL107.2	Develop webpages using XHTML, HTML5, JavaScript and CSS.
21MCL107.3	Apply XML and XHTML concepts.
21MCL107.4	Use jquery scripts for interactive web pages.
21MCL107.5	Design and implement user interactive dynamic web based applications using PHP and MySQL.
21MCL107.6	Evaluate the given web application and enhance it using latest web Technologies.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCL107.1	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL107.2	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL107.3	-	-	-	-	2	-	-	-	-	-	-	-	-
21MCL107.4	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL107.5	-	-	-	-	-	-	-	-	-	-	2	2	-
21MCL107.6	-	-	2	-	-	-	-	2	2	-	-	2	-

1: Low 2: Medium 3: High

DBMS LABORATORY

Course Code	21MCL108	CIE Marks	50
Teaching Hours/Week (L:T:P)	(1:0:2)	SEE Marks	50
Credits	02	Exam Hours	03

Course Learning Objectives:

1. To familiarize the participant with the nuances of database environments towards an information-oriented data-processing oriented framework.

2. To facilitate a good formal foundation on the relational model of data.

3. To demonstrate SQL and procedural interfaces to SQL comprehensively.

4. To introduce systematic database design approaches covering conceptual design, logical design and an overview of physical design.

Instructions for the Exercises:

1. Draw ER diagram based on given scenario with various Constraints.

2. Create Relational Database Schema based on the scenario using Mapping Rules.

3. Perform the given queries using any RDBMS Environment.

4. Suitable tuples have to be entered so that queries are executed correctly.

5. The results of the queries may be displayed directly.

Part-A

1. Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries.

   BRANCH (Branchid, Branchname, HOD)

   STUDENT (USN, Name, Address, Branchid, sem)

   BOOK (Bookid, Bookname, Authorid, Publisher, Branchid)

   AUTHOR (Authorid, Authorname, Country, age)

   BORROW (USN, Bookid, Borrowed_ Date)

Execute the following Queries:

i. List the details of Students who are all studying in 2nd sem MCA.

ii. List the students who are not borrowed any books.

iii.Display the USN, Student name, Branch_name, Book_name, Author_ name,books_Borrowed_Date of 2nd sem MCA Students who borrowed books.

iv. Display the number of books written by each Author.

v. Display the student details who borrowed more than two books.

vi. Display the student details who borrowed books of more than one Author.

vii. Display the Book names in descending order of their names.

viii. List the details of students who borrowed the books which are all published by the same publisher.

2. Consider the following schema:

STUDENT (USN, name, date_of_birth, branch, mark1, mark2, mark3, total, GPA)

Execute the following queries:

i.   Update the column total by adding the columns mark1, mark2, mark3.
ii. Find the GPA score of all the students.
iii. Find the students who born on a particular year of birth from the date_ of_birth column.
iv. List the students who are studying in a particular branch of study.
v.   Find the maximum GPA score of the student branch-wise.
vi. Find the students whose name starts with the alphabet "S".
vii. Find the students whose name ends with the alphabets "AR".
viii. Delete the student details whose USN is given as 1001.

3. Design an ER-diagram for the following scenario, Convert the same into a relational model and then solve the following queries.

Consider a Cricket Tournament "ABC CUP" organized by an organization. In the tournament there are many teams are contesting each having a Teamid,Team_Name, City, a coach. Each team is uniquely identified by using Teamid. A team can have many Players and a captain. Each player is uniquely identified by Playerid, having a Name, and multiple phone numbers,age. A player represents only one team. There are many Stadiums to conduct matches. Each stadium is identified using Stadiumid, having astadium_name,Address (involves city,area_name,pincode). A team can play many matches. Each match played between the two teams in the scheduled date and time in the predefined Stadium. Each match is identified uniquely by using Matchid. Each match won by any of the one team that also wants to record in the database. For each match man_of_ the match award given to a player.

Execute the following Queries:

i.   Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.
ii. List the details of the stadium where the maximum number of matches were played.
iii. List the details of the player who is not a captain but got the man_of _match award at least in two matches.
iv. Display the Team details who won the maximum matches.
v.   Display the team name where all its won matches played in the same stadium.

Part-B
A group of two students has to develop a mini-project where they need to implement SQL queries for inserting, deleting and searching the required record.
Note: In CIE and SEE part-A and part-B shall be given weightage of 50% each.

Course Outcomes:	
At the end of the course the student will be able to:	
21MCL108.1	Design entity-relationship diagrams to solve simple database applications
21MCL108.2	Implement a database schema for a given problem domain.
21MCL108.3	Formulate SQL queries in Oracle
21MCL108.4	Apply normalization techniques to improve the database design
21MCL108.5	Build database for any given problem
21MCL108.6	Analyze and select storage and recovery techniques of database system

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCL108.1	-	-	2		2	-	-	-	-	-	-	-	-
21MCL108.2	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL108.3	-	-	-	-	2	-	-	-	-	-	-	-	-
21MCL108.4	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL108.5	-	-	-	-	-	-	-	-	2	-	-	-	-
21MCL108.6	-	-	2	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TECHNICAL SEMINAR

Course Code	**21MCS109**	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	-
Credits	**01**	Exam Hours	-

Course Learning Objectives:
1. Analyze relevant topic in computing sciences and make valid conclusions on industry/society/environment using fundamental/ research based knowledge.
2. Demonstrate self-learning by making effective presentation and report writing.
3. Implement ethics, cyber regulations / responsibilities and demonstrate the same by using relevant / modern tool.

Technical Seminar:
- Participation in the seminar by all the students of the programme shall be mandatory.
- The CIE marks awarded for Technical Seminar shall be based on the evaluation of Seminar Report, Presentation skill and performance in Question and Answer session.

Course Outcomes: At the end of the course the student will be able to:	
21MCS109.1	Analyze relevant topic in computing sciences and make valid conclusions on industry/society/environment using fundamental/ research based knowledge.
21MCS109.2	Develop higher cognitive abilities.
21MCS109.3	Communicate effectively by improving their verbal and nonverbal communication style.
21MCS109.4	Develop the feeling of cooperation.
21MCS109.5	Demonstrate self-learning by making effective presentation and report writing.
21MCS109.6	Implement ethics, cyber regulations / responsibilities and demonstrate the same by using relevant / modern tool.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCS109.1	-	-	-	-	-	-	-	2	-	-	-	-	-
21MCS109.2	-	-	-	-	-	-	-	2	-	-	-	-	-
21MCS109.3	-	-	-	-	-	-	-	-	2	-	-	-	-
21MCS109.4	-	-	-	-	-	-	-	2	-	-	-	-	-
21MCS109.5	-	-	-	-	-	-	-	2	2	-	-	-	-
21MCS109.6	-	-	-	-	-	2	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

INDUSTRY ORIENTED TRAINING – I (MATHEMATICAL SKILLS)

Course Code	**21ITM110**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	(0:2:0)	SEE Marks	-
Credits	-	Exam Hours	2

Course Learning Objectives:
1. To equip the students with basic concepts and tools of Mathematics to solve placement aptitude papers.
2. To enhance the problem solving skills and improve the basic mathematical skills to help students preparing for competitive examinations.

Module-1	**4 Hours**

Number System: Various types of Numbers; Tests of Divisibility; HCF and LCM; Roots and Squares.
Algebra: Identities; BODMAS Rule; Logarithms; Indices; Number Series; Simple Interest and Compound Interest.

Module-2	**4 Hours**

Time and Work: Facts and Formulae; Group work; Pipes and Cisterns.
Time and Distance: Basics of Time, Speed and Distance; Average journey speed; Relative Speeds; Boats and Streams.

Module-3	**4 Hours**

Average, Percentage, Age problems: Average; Concept of percentage, Results on Population and Depreciation; Problems on ages.
Profit and Loss: Profit and Loss formulae; Percentage of profit and loss, Discount.

Module-4	**4 Hours**

Permutations, Combinations, Probability: Factorial Notation; Permutations; Combinations; Random Experiment; Probability of Occurrence of events.
Ratio, Proportion, Partnership: Ratio; Ratio in terms of Percentage, Proportion, Mean Proportion; Variation; Partnership.

Module-5	**4 Hours**

Geometry: Pythagoras theorem - Heights and Distances; Area; Volume; Surface Area.
Clock and Calendar: Problems related to clocks; Calendars; odd days; leap year; Day of the week related to Odd days.

Course Outcomes:

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

21ITM110.1	Apply the basic concepts of quantitative abilities related to Number system.
21ITM110.2	Evaluate time related problems by knowing the relationship between time/speed/distance or time/work.
21ITM110.3	Apply the concepts of average, percentage, appreciation and depreciation in real life problems
21ITM110.4	Solve application problems involving permutations and combinations.
21ITM110.5	Apply Ratio and Proportion concepts to solve the partnership problems where people share the ownership.
21ITM110.6	Apply the geometrical concepts in real- world applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Quantitative Aptitude for Competitive Examinations	Dr R S Aggarwal	S. Chand & Company LTD	44th Edition
2	Quantitative Aptitude for Competitive Examination	R.K Tyagi	MTG Learning Media	

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21ITM110.1	-	-	-	2	-	-	1	-	-	-	-	-	-
21ITM110.2	-	3	-	-	-	-	-	-	-	-	-	-	-
21ITM110.3	-		-	2	-	-	1	-	-	-	-	-	-
21ITM110.4	-	3	-		-	-	-	-	-	-	-	-	-
21ITM110.5	-		-	2	-	-	1	-	-	-	-	-	-
21ITM110.6	-	3	-		-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

SOFTWARE ENGINEERING

Course Code	**21MCA201**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. To get insight on IEEE/ACM code of software engineering ethics.
2. To describe requirement engineering.
3. To analyze different requirements using UML tools.
4. To discuss UML based object and class concepts.
5. To apply design and planning concepts.
6. Apply correct process models for software development.

Module-1	8Hrs

Introduction: Professional Software Development Attributes of good software, software engineering diversity, IEEE/ACM code of software engineering ethics, case studies. Software Process and Agile Software Development Software Process models: waterfall, incremental development, reuses oriented, Process activities; coping with change, The Rational Unified Process. Agile Methods, Plan-Driven and Agile Development, Extreme Programming, Agile Project Management.

Module-2	8Hrs

Requirement Engineering: Functional and non-functional requirements, The Software requirements document, Requirements specification, Requirements engineering processes, Requirement elicitation and analysis, Requirement validation, Requirement management.

Module-3	8Hrs

Object orientation and OO development. OO features, OO themes. Modeling as design Technique: Modeling: The three models. Object and class concepts, Link and associations concepts, Generalization and inheritance, A sample class model. Navigation of class models, Practical tips. Advanced objects and class concepts; Associations ends; N-array association; Aggregation, composition, Abstract class, Multiple inheritance, metadata, reification, constraints, derived data, packages and practical.

Module-4	8Hrs

State modeling: Events, States, Transitions and Conditions. State Diagram: State diagram behavior, Practical tips. Advanced State Modeling: Nested state diagram, Nested states, signal generalization, concurrency, A sample state model.
Interaction modeling: Use Case models, Sequence models, Activity models. Use case relationships: Procedural sequence models, special constructs for activity models.

Module-5	8Hrs

Project Design and planning: Process planning, Effort estimation, project scheduling and staffing, Software configuration Management plan, Quality plan, Risk Management, Project Monitoring plan Design: Design concepts, Function oriented design, detailed design, verification, matrix.

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

21MCA201.1	Get insight on IEEE/ACM code of software engineering ethics.
21MCA201.2	Describe requirement engineering.
21MCA201.3	Analyze different requirements using UML tools.
21MCA201.4	Discuss UML based object and class concepts.
21MCA201.5	Apply design and planning concepts.
21MCA201.6	Apply correct process models for software development.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Software Engineering	Ian Sommerville	Pearson Edition Ltd	9thEdiion, 2011
2	Software Engineering	PankajJalote	Wiley India Pvt Ltd	2nd Edition, 2010
3	Object Oriented Modeling and Design with UML	Michel Blaha, James Rumbaugh	Pearon	2nd Edition 2007

Reference Books				
1	Object oriented software engineering	Stephan R. Schach,	Tata McGraw Hill,2008	
2	Applying UML and Patterns,	Craig Larman,	Pearson Education,	3rd ed, 2005.

Web links/Video Lectures/MOOCs

1. https://nptel.ac.in/courses/106/105/106105182/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA201.1	-	-	-	-	-	2	-	-	-	-	-	-	-
21MCA201.2	-	-	-	-	-	-	-	2	-	-	-	-	-
21MCA201.3	-	-	-	-	-	2		2	-	-	-	-	-
21MCA201.4	-	-	-	-	-	-	-	2	-	-	-	-	-
21MCA201.5	-	-	-	-	-	-	-	2	-	-	-	2	-
21MCA201.6	-	-	-	-	-	-	-	2	-	2	-	-	-

1: Low 2: Medium 3: High

DATA ANALYTICS USING PYTHON

Course Code	**21MCA202**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(4:0:0)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:
1. Implement Python programming concepts.
2. Demonstrate Python collection objects and functions.
3. Implement object oriented programming using Python.
4. Demonstrate numpy array functionalities and pandas data structures for data analysis.
5. Demonstrate data loading and wrangling.
6. Demonstrate data visualization using matplotlib and seaborn libraries.

Module-1	**10Hrs**

Python Basic Concepts and Programming: Interpreter – Program Execution – Statements – Expressions – Flow Controls – Functions - Numeric Types – Sequences - Strings, Parts of Python Programming Language, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type( ) Function and Is Operator, Control Flow Statements, The if Decision Control Flow Statement, The if… else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Module-2	**10Hrs**

Python Collection Objects, Classes
Strings- Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists-Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods. Sets, Tuples and Dictionaries. Files: reading and writing files. Class Definition – Constructors – Inheritance – Overloading.

Module-3	10Hrs

Introduction to Numpy and Pandas

Numpy: Understanding datatypes in python, basics of Numpy arrays, computation on NumPy arrays: universal function. (refer chapter 2 from python datascience handbook).

Pandas: Introducing to pandas data structure, essential functionally, summarizing and computing descriptive statistics, handling missing data. (refer chapter 5 from python for data Analytics).

Module-4	10Hrs

Data Loading and Data Wrangling

Reading and writing data in text format, interacting with database, combining and merging data sets, reshaping and pivoting, data transformation, string manipulation (refer chapter 6 and 7 from python for data Analytics).

Module-5	10Hrs

Visualization with Matplotlib, and Seaborn

General Matplotlib tips, simple line plots, simple scatter plots, visualizing errors, density and contour plots, histograms, binning and density, customizing plot legends and colorbars, customizing matplotlib, visualization with seaborn.

(refer chapter 4 from python data science handbook)

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

21MCA202.1	Implement Python programming concepts.
21MCA202.2	Demonstrate Python collection objects and functions.
21MCA202.3	Implement object oriented programming using Python.
21MCA202.4	Demonstrate numpy array functionalities and pandas data structures for data analysis.
21MCA202.5	Demonstrate data loading and wrangling.
21MCA202.6	Demonstrate data visualization using matplotlib and seaborn libraries.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Think Python: How to Think Like a Computer Scientist	Allen B. Downey	Shroff/ O'Reilly Publishers	2nd edition, Updated for Python 3,2016

2	An Introduction to Python	Guido van Rossum and Fred L. Drake Jr	Network Theory Ltd	2011
3	Python Data Science Handbook: Essential tools for working with data	Jake Vander plas	O'Reilly Publishers	I Edition

Reference Books				
1	Programming Python	Mark Lutz		4th edition, 2010
2	Python 3 for Absolute Beginners	Tim Hall and J-P Stacey		1st edition, 2009
3	Beginning Python: From Novice to Professional	Magnus Lie Hetland		Second Edition, 2005.
4	Beginning Python Visualization Crafting Visual Transformation Scripts	ShaiVaingast,		2nd edition, 2014.

Web links/Video Lectures/MOOCs
1. https://www.coursera.org/learn/python-python-for-applied-data science-ai
2. https://www.coursera.org/learn/python-for-data-visualization

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA202.1	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCA202.2	-	-	-	-	-	-	-	-	-	-	-	-	1
21MCA202.3	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCA202.4	-	-	-	2	-	-	-	-	-	-	-	-	2
21MCA202.5	-	2	-	-	-	-	-	-	-	-	-	-	-
21MCA202.6	-	2	-	2	-	-	-	-	-	-	-	-	2

1: Low 2: Medium 3: High

OBJECT ORIENTED PROGRAMMING WITH JAVA

Course Code	**21MCA203**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(4:0:0)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:
1. To demonstrate the basic structure and components of java program.
2. To apply the concepts of class and inheritance for a problem.
3. To create and analyze the application using of Packages, Interfaces, Exceptions and Multithreading.
4. To apply Enumerations, Wrappers, Auto boxing, Collection framework and I/O operations for effective coding.
5. To implement the concepts of Applets, to create GUI applications and networking using Java network classes for distributed applications.

Module-1	**10Hrs**

Java Programming Fundamentals
The Java Language, The Key Attributes of Object-Oriented Programming, The Java Development Kit, A First Simple Program, The Java Keywords, Identifies in Java, The Java Class Libraries.

Introducing Data Types and Operators
Java's Primitive Types, Literals, A Closer Look at Variables, The Scope and Lifetime of Variables, operators, Shorthand Assignments, Type conversion in Assignments, Using Cast.

Program Control Statements
Input characters from the Keyword, if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Use break, Use continue, Nested Loops.

Introducing Classes, Objects and Methods
Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, Parameterized Constructors, The new operator Revisited, Garbage Collection and Finalizers, The this Keyword.

More Data Types and Operators
Arrays, Multidimensional Arrays, Alternative Array Declaration Syntax, Assigning Array References, Using the Length Member, The For-Each Style for Loop, Strings.

String Handling
String Fundamentals, The String Constructors, Three String-Related Language Features, The Length() Method, Obtaining the characters within a string, String comparison, using index Of() and last Index Of(), Changing the case of characters within a string, String Buffer and String Builder.

Module-2	10Hrs

A Closer Look at Methods and Classes:
Controlling Access to Class Members, Pass Objects to Methods, How Arguments are passed, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, varargs: Variable-Length Arguments.

Inheritance:
Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, Order of execution of constructors in inheritance, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Using Abstract Classes, Using final, The Object Class.

Module-3	10Hrs

Interfaces
Interface Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Constants in Interfaces, Interfaces can be extended, Nested Interfaces.

Packages
Package Fundamentals, Packages and Member Access, Importing Packages, Static import.

Exception Handling
The Exception Hierarchy, Exception Handling Fundamentals, The Consequences of an Uncaught Exception, Exceptions Enable you to handle errors gracefully using Multiple catch clauses, Catching subclass Exceptions, try blocks can be nested, Throwing an Exception, A Closer look at Throwable, using finally, using throws, Java's Built-in Exceptions.

Module-4	10Hrs

Multithreaded Programming
Multithreading fundamentals, The Thread Class and Runnable Interface, Creating Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, Synchronization, using Synchronization Methods, The Synchronized Statement, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads.

I/O, Applets, Enumerations, Auto boxing and Annotations
I/O basics, Reading Console input, Writing console Output, The Print Writer class, Reading and writing files, Automatically closing a file, Applet fundamentals, enumerations type wrappers auto boxing annotations, Generics: The general form of a generics class, creating a generic method, generics interfaces.

Module-5	10Hrs

Networking with Java.net
Networking fundamentals, The Networking classes and Interfaces, The InetAddress class, The Socket Class, The URL class, The URL Connection Class, The http URL Connection Class.
The collections Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection via an Iterator.

Course Outcomes:	
At the end of the course the student will be able to:	
21MCA203.1	Demonstrate the basic programming constructs of Java and OOP concepts to develop Java programs for a given scenario.
21MCA203.2	Illustrate the concepts of generalization and run time polymorphism applications to develop reusable components.
21MCA203.3	Exemplify the usage of Packages and Interfaces.
21MCA203.4	Implement Exceptions and Multithreading in building efficient applications.
21MCA203.5	Apply Enumerations, Wrappers, Auto boxing, Collection framework and I/O operations for effective coding.
21MCA203.6	Implement the concepts of Applets with user friendly interface and networking using Java network classes for distributed applications

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Java Fundamentals, A comprehensive Introduction.	Herbert Schildt, Dale Skrien	Tata Mc Graw Hill	Edition 2013.
2	JAVA the Complete Reference, (Chapter 17)	Herbert Schildt	Tata McGraw Hill	7th/9th Edition, 2007.
Reference Books				
1	Java Programming,	Hari Mohan Pandey	Pearson Education	2012

2	Java 6 Programming, Black Book	KoGenT	Dreamtech Press	2012.
3	Java 2 Essentials	Cay Hortsmann	Wiley	second edition

Web links/Video Lectures/MOOCs
1. https://nptel.ac.in/courses/106/105/106105191/
2. https://www.coursera.org/projects/learn-programming-java

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA203.1	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCA203.2	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCA203.3	-	-	2	-	-	-	-	-	-	-	2	-	-
21MCA203.4	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCA203.5	-	-	2	-	-	-	2	-	-	-	-	-	-
21MCA203.6	-	-	-	-	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

RESEARCH METHODOLOGY AND IPR

Course Code	**21MCA204**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	03

Course Learning Objectives:
1. Identify suitable research methods and articulate research steps for any given problem.
2. Define the problem statement, perform a literature survey and suggest appropriate solutions.
3. Test the problem and perform experimental design with the samplings
4. Schedule data collection from various sources to segregate primary and secondary data.
5. Apply Copy Right Act/Patent Act/Cyber Law/Trademark concepts and develop conclusions.

Module-1	5Hrs

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Module-2	5Hrs

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Module-3	5Hrs

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Module-4	5Hrs
Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	
Module-5	**5Hrs**
Intellectual Property Law Basics, Types of Intellectual Property, Agencies Responsible for Intellectual Property Registration, International Organizations, Agencies, and Treaties, The Increasing Importance of Intellectual Property Rights.	

Course Outcomes:	
At the end of the course the student will be able to:	
21MCA204.1	Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem.
21MCA204.2	Carry out literature survey, define the problem statement and suggest suitable solution for the given problem.
21MCA204.3	Analyze the problem and conduct experimental design with the samplings.
21MCA204.4	Perform the data collection from various sources segregate the primary and secondary data.
21MCA204.5	Analyze the results obtained and build on the discussions.
21MCA204.6	Apply some concepts/section of Copy Right Act /Patent Act /Cyber Law/ Trademark to the given case and develop – conclusions.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1.	Research Methodology: Methods and Techniques	C.R. Kothari, Gaurav Garg	New Age International	4th Edition, 2018

2.	Research Methodology, a Step-by- Step Guide for Beginners	Ranjit Kumar	SAGE Publications Ltd	3rd Edition, 2011
3.	Intellectual Property, The Law of Trademarks, Copyrights, Patents, and Trade Secrets	Debirag E. Bouchoux	Cengage learning	4th Edition, 2013
Reference Books				
1	Research Methods: The Concise Knowledge Base	William Trochim	Atomic Dog Publishing	2005
2	Conducting Research Literature Reviews: From the Internet to Paper	Arlene Fink	Sage Publications	5th Edition, 2009

Web links/Video Lectures/MOOCs
1. https://onlinecourses.nptel.ac.in/noc20_hs78/announcements?force=true
2. https://onlinecourses.nptel.ac.in/noc20_ge22/announcements?force=true

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCA204.1	-	-	-	-	-	-	-	-	-	-	-	-	2
21MCA204.2	-	-	-	-	-	-	-	-	-	-	-	-	2
21MCA204.3	-	-	-	-	-	-	-	-	-	-	-	-	2
21MCA204.4	-	-	-	-	-	-	-	-	-	-	-	-	2
21MCA204.5	-	-	-	-	-	2	-	-	-	-	-	2	-
21MCA204.6	-	-	-	-	-	2	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

CYBER SECURITY

Course Code	**21MC205A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. Examine IT ACT (Cyber law) to the given case/problem and infer from the given case and analyze the gap if exists.
2. Analyze the working of cyber security principles in designing the system.
3. Analyze the given problem (cybercrime, vulnerability, threat), develop a strategy (physical, logical or administrative controls) to mitigate the problem and articulate consequences on Society and National Economy.
4. Examine relevant network defense / web application tool to solve given cyber security problem evaluate its suitability.
5. Investigate the influence of Block chain technology for the cyber security problem and evaluate its role.
6. Evaluate provisions available in Indian cyber law to handle infringement of intellectual property rights that happens on the cyber platform.

Module-1	**8Hrs**

Introduction to Cybercrime and Laws
Introduction, Cybercrime: Definition and Origins of the word, Cybercrime and information Security, Cyber criminals, Classifications of Cybercrimes. How Criminals Plan Them – Introduction, How Criminals Plan the Attacks, Cybercafé and Cybercrimes, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.

Module-2	**8Hrs**

Tools and Methods used in Cybercrime Introduction, Proxy Server and Anonymizers, Password Cracking, Key loggers and
Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow.

Module-3	**8Hrs**

Phishing and Identity Theft Introduction, Phishing – Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Module-4	**8Hrs**

Unix Command Lines, Backtrack Linux, Mac Ports, Cygwin, Windows Power Shell, Net Cat Commands, Net Cat Uses, SSH, Data Pipe, Fpipe

Module-5	8Hrs
Network Defense tools and block chain technology Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Intrusion Detection System, introduction to block chain technology (definition, tools used for implementation) and its applications.	

Course Outcomes:

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

21MC205A.1	Apply IT ACT (Cyber law) to the given case/problem and infer from the given case and analyze the gap if exists.
21MC205A.2	Analyze the working of cyber security principles in designing the system.
21MC205A.3	Analyze the given problem (cybercrime, vulnerability, threat), develop a strategy(physical, logical or administrative controls) to mitigate the problem and articulate consequences on Society and National Economy.
21MC205A.4	Examine relevant network defense / web application tool to solve given cyber security problem evaluate its suitability.
21MC205A.5	Investigate the influence of Block chain technology for the cyber security problem and evaluate its role.
21MC205A.6	Evaluate provisions available in Indian cyber law to handle infringement of intellectual property rights that happens on the cyber platform.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Anti-Hacker Tool Kit (Indian Edition) by, Publication McGraw Hill.	Mike Shema	Publication McGraw Hill.	
2	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Nina Godbole and SunitBelpure,	Publication Wiley.	

	Reference Books			
1	Computer Forensics and Cyber Crime: An Introduction	Marjie T. Britz	Pearson	
2	Introduction to Computer Networks and Cyber Security	2. Chwan-Hwa (John) Wu,J. David Irwin	CRC Press	
3	Guide to Computer Forensics and Investigations -Cengage Learning	Bill Nelson, Amelia Phillips, Christopher Steuart		

Web links/Video Lectures/MOOCs
1. https://www.coursera.org/specializations/cyber-security
2. https://www.edx.org/course/introduction-to-cybersecurity

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC205A.1	-	-	-	-	-	-	-	-	-	1	-	-	1
21MC205A.2	-	-	-	-	-	-	-	-	2	-	-	-	-
21MC205A.3	-	-	-	-	-	-	2	-	-	-	-	-	1
21MC205A.4	-	-	-	-	-	-	-	-	2	2	-	-	-
21MC205A.5	-	-	-	1	-	-	-	-	-	-	-	-	-
21MC205A.6	-	-	-	-	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

DATA MINING AND BUSINESS INTELLIGENCE

Course Code	**21MC205B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. Differentiate data warehouse, Business Intelligence and OLAP.
2. Demonstrate data pre-processing techniques and application of association rule mining algorithms.
3. Use various classification algorithms and evaluation of classifiers for the given problem.
4. Analyze data mining for various business intelligence applications for the given problem.
5. Interpret classification and regression techniques for the given problem.

Module-1	8Hrs

Overview and concepts Data Warehousing and Business Intelligence: Why reporting and Analyzing data, Raw data to valuable information-Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing. The Architecture of BI and DW BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP – Dimension analysis – Cubes, Drill-down and roll-up - slice and dice or rotation – OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations.

Module-2	8Hrs

Introduction to data mining (DM): Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process Data Pre – processing- Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.

Module-3	8Hrs

Concept Description and Association Rule Mining, Concept description - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm -generating rules – Improved Apriori algorithm – Incremental ARM – Associative Classification – Rule Mining.

Module-4	8Hrs

Classification and prediction: Difference between classification and prediction – Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression. Introduction of tools such as DB Miner /WEKA/DTREG DM Tools.

Module-5	8Hrs

Data Mining for Business Intelligence Applications: Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., Data Analytics Life Cycle: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

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

21MC205B.1	Analyze the concept of data warehouse, Business Intelligence and OLAP.
21MC205B.2	Demonstrate data pre-processing techniques and application of association rule mining algorithms.
21MC205B.3	Apply various classification algorithms and evaluation of classifiers for the given problem.
21MC205B.4	Analyze data mining for various business intelligence applications for the given problem.
21MC205B.5	Apply classification and regression techniques for the given problem.
21MC205B.6	Describe big data business analytics.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	"Data Mining Concepts and Techniques", Morgan Kaufmann	J. Han, M. Kamber,		
2	"Data mining: Concepts, models, methods and algorithms,	M. Kantardzic	John Wiley &Sons Inc.	
3	"Data Warehousing Fundamentals"	Paulraj Ponnian,	John Willey.	
4	"Data Mining: Introductory and Advanced Topics"	M. Dunham,	Pearson Education.	
5	"Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner	G. Shmueli, N.R. Patel, P.C. Bruce,	Wiley India	

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC205B.1	-	-	-	-	-	-	-	-	-	2	-	-	-
21MC205B.2	-	-	-	1	-	-	-	-	-	-	-	-	-
21MC205B.3	-	-	-		-	-	-	-	-	-	-	-	1
21MC205B.4	-	-	-	1	-	-	-	-	2	-	-	-	-
21MC205B.5	-	-	-	-	-	-	2	-	-	-	-	-	1
21MC205B.6	-	-	-	-	-	-	-	-	2	-	-	-	-

1: Low 2: Medium 3: High

ENTERPRISE RESOURCE PLANNING

Course Code	**21MC205C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. Examine the pros and cons of ERP, data warehousing/mining and OLAP.
2. Test the implementation of ERP in the context of business.
3. Implement ERP for different business modules.
4. Explain ERP marketing.
5. Examine the design ERP with future e-commerce and internet.

Module-1	8Hrs

Introduction To ERP Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering, Data Warehousing, Data Mining, On–line Analytical Processing, Supply Chain Management.

Module-2	8Hrs

ERP Implementation: Implementation of Life Cycle, Implementation Methodology, Hidden Costs, Organizing Implementation, Vendors, Consultants and Users, Contracts, Project Management and Monitoring.

Module-3	8Hrs

Business Modules: Business Modules in an ERP Package, Finance, Manufacturing, Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution.

Module-4	8Hrs

ERP Market : ERP Market Place, SAP AG, People Soft, Baan Company, JD Edwards World Solutions Company, Oracle Corporation, QAD , System Software Associates.

Module-5	8Hrs

ERP–Present And Future : Turbo Charge the ERP System, EIA, ERP and E–Commerce, ERP and Internet, Future Directions in ERP.

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

21MC205C.1	Analyze the pros and cons of ERP, Data warehousing/ Mining and OLAP for the given problem/application.

21MC205C.2	Analyze the implementation of ERP in the context of business of the different organization.
21MC205C.3	Analyze and apply ERP for different business modules.
21MC205C.4	Explain ERP marketing with the help of a case study.
21MC205C.5	Analyze the design ERP with future E-commerce and internet.
21MC205C.6	Describe how to modernize and integrate business processes and systems.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	"ERP Demystified"	Alexis Leon,	Tata McGraw Hill, 1999.	
2	"Concepts in Enterprise Resource Planning"	Joseph A. Brady, Ellen F. Monk, Bret J. Wangner	Thomson Learning, 2001.	
Reference Books				
1	"Enterprise Resource Planningconcepts and Planning"	1.Vinod Kumar Garg and N.K Venkata Krishnan	Prentice Hall, 1998.	
2	" The SAP R /3 Hand book"	Jose Antonio Fernandz,	Tata McGraw Hill	

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC205C.1	-	-	-	-	-	-	-	-	-	1	-	-	-
21MC205C.2	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC205C.3	-	-	-	-	-	-	-	-	2	-	-	-	-
21MC205C.4	-	-	-	-	-	-	2	-	2	-	-	-	-
21MC205C.5	-	-	-	-	-	-	-	-	-	-	-	-	1
21MC205C.6	-	-	-	2	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

MACHINE LEARNING

Course Code	**21MC205D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. Develop an appreciation for what is involved in learning models from data.
2. Differentiate supervised and unsupervised learning.
3. Apply neural networks, Bayes classifier and k nearest neighbor, for real world problems.
4. Predict statistical analysis of machine learning techniques.
5. Interpret theory of probability and statistics related to machine learning.
6. Describe wide variety of learning algorithms.

Module-1	8Hrs

Introduction: Well posed learning problems, Designing a Leaming system, Perspective and Issues in Machine Leaming. Concept Leaming: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Module-2	8Hrs

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Module-3	8Hrs

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.

Module-4	8Hrs

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks.

Module-5	8Hrs

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.
Instance Based Learning: Introduction, k-nearest neighbor learning.

Course Outcomes:	
At the end of the course the student will be able to:	
21MC205D.1	Develop an appreciation for what is involved in learning models from data.
21MC205D.2	Differentiate supervised and unsupervised learning.
21MC205D.3	Apply neural networks, Bayes classifier and k nearest neighbor, for real world problems.
21MC205D.4	Predict statistical analysis of machine learning techniques.
21MC205D.5	Interpret theory of probability and statistics related to machine learning.
21MC205D.6	Describe wide variety of learning algorithms.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Machine Learning	Tom M. Mitchell	McGraw Hill Education	India Edition 2013
Reference Books				
1	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer series in statistics.	2nd edition
2	Introduction to machine learning,	Ethem Alpayd1 N	MIT press.	2nd edition

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC205D.1	-	-	-	-	-	-	-	-	2	-	-	-	-
21MC205D.2	-	-	-	1	-	-	-	-	-	-	-	-	-
21MC205D.3	-	-	-	-	-	-	2	-	-	1	-	-	2
21MC205D.4	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC205D.5	-	-	-	1	-	-	-	-	-	-	-	-	-
21MC205D.6	-	-	-	-	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

OPTIMIZATION TECHNIQUES

Course Code	21MC205E	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. Formulate optimization problem as a linear programming problems.
2. Solve optimization problems using simplex method.
3. Formulate and solve transportation and assignment problems.
4. Apply game theory for decision making problems.

Module-1	8Hrs

Introduction, operations research, quantitative approach, features of OR, problem solving, methodology of OR. Linear programming- introduction, structure of linear programming model, advantages, general model of LPP, examples of LP formulation, graphical solutions of LP problem.

Module-2	8Hrs

Linear programming- Simplex method, two-phase method, Big M method.

Module-3	8Hrs

Duality in linear programming, formulation of dual linear programming and examples. Assignment problem- Mathematical model of assignment problem, Hungarian method for solving assignment problem.

Module-4	8Hrs

Transportation problem: Mathematical model of transportation problem, methods of finding initial solution (Northwest corner rule, Least cost method, Vogel's approximation method), test for optimality in TP using MODI Method.

Module-5	8Hrs

Theory of games- introduction, two-person zero sum games, pure strategies (Min Max and Max Min principles), mixed strategies. The rules of principles of dominance, algebraic method to solve games without saddle point, graphical methods to solve games. Sequencing problems: processing n-jobs through two machines (Johnson's procedure).

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

21MC205E.1	Apply problem solving techniques through OR approaches.
21MC205E.2	Formulate the problem using linear programming.

21MC205E.3	Analyze the optimal solution for the given problem by applying Transportation problems.
21MC205E.4	Analyze the strategies with different players through game theory approach.
21MC205E.5	Analyze the sequence of jobs to be executed by machines.
21MC205E.6	Apply the theory of optimization methods and algorithms for solving various types of optimization problems.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Operations Theory and Applications	J.K. Sharma,	5th edition, MacMillan India publisher	
Reference Books				
1	Operations Research	S.D Sharma, Kedarnath, Ramnath and Co, 2002.		
2	Operations Research – An Introduction	Taha H A-	Low price edition	7th edition, 2006
3	Introduction to operation Research	Hiller and Liberman	McGRaw Hill, 5th edition, 2001	
4	Operation Research, Pub., New Delhi	Prem Kumar Gupta, D S Heera S Chand 2007		

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC205E.1	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC205E.2	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC205E.3	-	-	-	-	-	-	-	-	-	-	-	-	2
21MC205E.4	-	-	-	-	-	-	-	-	2	2	-	-	-
21MC205E.5	-	-	-	-	-	-	-	-	-	-	-	-	-
21MC205E.5	-	-	-	1	-	-	-	-	1	-	-	-	-
21MC205E.6	-	-	-		-	-	-	-	-	-	-	-	2

1: Low 2: Medium 3: High

CRYPTOGRAPHY AND NETWORK SECURITY

Course Code	**21MC206A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. Implement encryption techniques for the given problem and analyze the results.
2. Design the cipher technique and analyze the functioning of cipher for any given problem.
3. Execute the public and private key-based cryptography algorithms and investigate the results of the algorithm based on the output.
4. Construct the cryptographic algorithms using programming languages for any given problem.
5. Develop security planning for the given case study with data classification, access control and propose a technical solution.

Module-1	8Hrs

Introduction: OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, model for Network Security.

Classical Encryption Technique: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Module-2	8Hrs

Data Encryption and advanced encryption techniques:
Block Ciphers, Data Encryption Standard and Advanced Encryption Standard Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles and Modes of operation, Evaluation Criteria for AES, AES Cipher-Encryption and Decryption, Data Structure, Encryption Round.

Public Key Cryptography and Key Management:
Principles of Public Key Crypto system, RSA algorithm, Key management, Diffie Hellman Key exchange.

Module-3	8Hrs

Message Authentication and Hash Function: Authentication Requirement, Authentication Functions, Message Authentication Code, Hash Functions, Digital Signatures, Digital Signature Standard.

Authentication Applications: Kerberos, X.509 Authentication Service

Module-4	8Hrs
Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME **IP Security**: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.	
Module-5	**8Hrs**
Web Security: Web security Considerations; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET). **System Security**: Intruders, Intrusion Detection, Firewall Design Principles-Characteristics, Types of Firewall and Firewall Configuration.	

Course Outcomes:	
At the end of the course the student will be able to:	
21MC206A.1	Apply encryption techniques for the given problem and analyze the results.
21MC206A.2	Design the Cipher technique and analyze the functioning of Cipher for the given problem.
21MC206A.3	Implement the Public and Private key based cryptography algorithms and investigate the results of algorithm based on output.
21MC206A.4	Design and implement the cryptographic algorithms using programming languages/tools for the given problem/ context.
21MC206A.5	Design the security planning for the given case study for data classification, access control and propose technical solution, and submit the detailed report with plagiarism check.
21MC206A.6	Describe how to maintain the Confidentiality, Integrity and Availability of data.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	"Cryptography and Network Security – Principles and Practices"	William Stallings	Pearson Education,	4th Edition, 2009.

Reference Books

1	"Cryptography and Network Security",	Behrouz A. Forouzan and Debdeep Mukhopadhyay:	Tata Mc-Graw-Hill, 2010.	2nd Edition
2	"Cryptography and Network Security"	AtulKahate,	2nd Edition TMH.	

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC206A.1	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC206A.2	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC206A.3	-	-	-	-	-	-	-	-	-	2	-	-	-
21MC206A.4	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC206A.5	-	-	-	-	-	-	-	-	-	-	-	-	2
21MC206A.6	-	-	-	-	-	-	-		2	-	-	-	-

1: Low2: Medium 3: High

ARTIFICIAL INTELLIGENCE

Course Code	**21MC206B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. Recognize problems that are amenable to solution by AI methods.
2. Identify appropriate AI methods to solve a given problem.
3. Implement a given problem in the language/framework of different AI methods.
4. Solve basic AI algorithms.
5. Design and carry out an empirical evaluation of different algorithms on a Problem formalization, and state the conclusions that the evaluation supports.

Module-1	8Hrs

INTRODUCTION TO Al AND PRODUCTION SYSTEMS
Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized productions system-Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.

Module-2	8Hrs

REPRESENTATION OF KNOWLEDGE
Game playing – Knowledge representation, Knowledge representation using Predicatelogic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

Module-3	8Hrs

KNOWLEDGE INFERENCE
Knowledge representation -Production based system, Frame based system. Inference –Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning –Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory.

Module-4	8Hrs

PLANNING AND MACHINE LEARNING
Basic plan generation systems – Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

Module-5	8Hrs

EXPERT SYSTEMS
Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge
Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.

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

21MC206B.1	Identify problems that are amenable to solution by AI methods.
21MC206B.2	Identify appropriate AI methods to solve a given problem.
21MC206B.3	Formalize a given problem in the language/framework of different AI methods.
21MC206B.4	Implement basic AI algorithms.
21MC206B.5	Design and carry out an empirical evaluation of different algorithms on Problem formalization, and state the conclusions that the evaluation supports.
21MC206B.6	Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence (SIE)	Kevin Night and Elaine Rich, Nair B.,	McGraw Hill- 2008.	
2	Introduction to AI and ES	Dan W. Patterson	Pearson Education, 2007	

Reference Books

1	Introduction to Expert Systems	Peter Jackson	Pearson Education.	3rd Edition, 2007
2	AI – A Modern Approach	Stuart Russel and Peter Norvig	Pearson Education	2nd Edition, 2007.
3	Artificial Intelligence	Deepak Khemani	Tata McGraw Hill Education	

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC206B.1	-	-	-	-	-	-	-	-	2	-	-	-	-
21MC206B.2	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC206B.3	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC206B.4	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC206B.5	-	-	-	-	-	-	-	-	-	-	-	-	2
21MC206B.6	-	-	-	-	-	-	-	-	-	2	-	-	-

1: Low 2: Medium 3: High

MOBILE APPLICATION DEVELOPMENT

Course Code	**21MC206C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. Develop effective user interfaces that leverage evolving mobile devices
2. Develop applications using software development kits (SDKs), frameworks and toolkits.
3. Implement suitable methods to integrate database and server-side technologies
4. Design and develop open source software based mobile application to the given problem.
5. Build and deploy competent mobile application to solve the societal/ industrial problems.

Module-1	8Hrs

Cost of Development, Importance of Mobile Strategies in the Business World, Mobile Development Today, Mobile Myths, Third-Party Frameworks Effective use of Screen Real Estate, Understanding Mobile Applications Users, Understanding Mobile Information Design, Understanding Mobile Platforms, Using the Tools of Mobile Interface Design.

Module-2	8Hrs

Introduction to Android, Obtaining the Required Tools, Anatomy of an Android Application, Understanding Activities, Developing a basic Android Application.

Module-3	8Hrs

Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Creating the User Interface Programmatically, Listening for UI Notifications, Basic Views, Picker Views, List Views.

Module-4	8Hrs

Displaying Maps, Getting Location Data, Preparing for Publishing, Deploying APK Files.
Developing an application that uses Layout Managers and Event Listeners, Developing an application that draws basic graphical primitives (rectangle, circle) on the screen, Developing an application that implements Multi-threading.

Module-5	8Hrs
The iPhone Craze, Getting the Tools You Need to Develop iOS Applications, iOS Project, Debugging iOS Apps, Objective-C Basics, Other Useful iOS Things, Windows Phone 7-New Kid on the Block, Getting the Tools You Need to Develop Windows Phone Applications, Windows Phone 7 Project, Distribution, Other Useful Windows Phone Things.	

Course Outcomes:

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

21MC206C.1	Interpret the basics of mobile application development across all platforms.
21MC206C.2	Demonstrate the knowledge of Android tools by developing a basic Android application.
21MC206C.3	Design effective user interfaces by leveraging all basic views.
21MC206C.4	Develop Android applications on Android Studio and run them on both Emulator as well as native mobile devices.
21MC206C.5	Create mobile applications on modern development platforms like React Native and Flutter.
21MC206C.6	Differentiate between iOS and Windows Phone 7 application development.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Professional Mobile Application Development	Jeff McWherter and Scott Gowell	John Wiley & Sons, Inc.	2012, ISBN: 978-1-118-20390-3
2	Beginning Android Application Development	Wei-Meng Lee	Wiley Publishing, Inc.	2011, ISBN: 978-1-118 01711-1
Reference Books				
1	Professional Android 4 Application Development	Reto Meier	Wrox Publications	2012

Web links/Video Lectures/MOOCs
1. https://onlinecourses-archive.nptel.ac.in/noc18_cs03/course
2. Build Your First Android App (Project-Centered Course) on Coursera

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC206C.1	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC206C.2	-	-	-	-	-	-	-	-	2	-	-	-	-
21MC206C.3	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC206C.4	-	-	-	2	-	-	-	-	-	2	-	-	-
21MC206C.5	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC206C.6	-	-	-	-	-	-	-	-	-	-	-	-	2

1: Low2: Medium 3: High

DISTRIBUTED OPERATING SYSTEMS

Course Code	**21MC206D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. Discuss design issues and different message passing techniques in DOS, distributed systems.
2. Describe RPC implementation and its performance in DOS.
3. Sketch the major security issues associated with distributed systems and evaluate techniques available for increasing system security.
4. Distinguish the concepts of distributed shared memory and resource management for the given problem/ case study.
5. Organize distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors.
6. Use the modified algorithms from existing algorithms to improve the performance of DOS.

Module-1	**8Hrs**

Fundamentals of Distributed Computing Systems. Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment (DCE). Message Passing: Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

Module-2	**8Hrs**

Remote Procedure Calls: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC.

Module-3	8Hrs

Distributed Shared Memory: Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms.

Module-4	8Hrs

Resource Management: Introduction, Desirable Features of a Good Global Scheduling algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing.
Approach Process Management: Introduction, Process Migration, Threads.

Module-5	8Hrs

Distributed File Systems: Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

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

21MC206D.1	Analyze design issues and different message passing techniques in DOS, distributed systems.
21MC206D.2	Analyze RPC implementation and its performance in DOS
21MC206D.3	Analyze the major security issues associated with distributed systems and evaluate techniques available for increasing system security.
21MC206D.4	Apply the concepts of distributed shared memory and resource management for the given problem/ case study.
21MC206D.5	Analyze distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors.
21MC206D.6	Apply modification to the existing algorithms to improve the performance of DOS.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Distributed Operating Systems: Concepts and Design,	Pradeep. K. Sinha:	PHI, 2007.	
Reference Books				
1	Distributed Operating Systems,	Andrew S.Tanenbaum:	Pearson Education, 2013.	
2	Distributed Computing: Principles, Algorithms and Systems	Ajay D. Kshemkalyani and MukeshSinghal	Cambridge University Press, 2008	
3	Distributed Computing	SunitaMahajan, Seema Shan	Oxford University Press,2015	

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC206D.1	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC206D.2	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC206D.3	-	-	-	-	-	-	-	-	-	2	-	-	-
21MC206D.4	-	-	-	2	-	-	-	-	2	-	-	-	-
21MC206D.5	-	-	-	-	-	-	-	-	-	2	-	-	-
21MC206D.6	-	-	-	-	-	-	2	-	-	-	-	-	2

1: Low 2: Medium 3: High

NATURAL LANGUAGE PROCESSING

Course Code	**21MC206E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:
1. Discuss the current and likely future performance of several NLP applications.
2. Describe briefly a fundamental technique for processing language for several subtasks, such as morphological processing, parsing, summarization etc.
3. Describe how these techniques draw on and relate to other areas of computer science
4. Use parsing technique to the given problem and verify the output and give valid Conclusions.

Module-1	8Hrs

Introduction, Morphology: Knowledge in Speech & Lang Processing, Ambiguity, Models & Algorithms, Language, Thought & Understanding, Some Brief History, The State of the Art & Near-Term Future, Summary Morphology and Finite State Transducers: Survey of English Morphology, Finite state Morphological Parsing, Lexicon-Free FST: The Porter Stemmer, Human Morphological Parsing, Summary, Combining FST Lexicon and Rules.

Module-2	8Hrs

N-Grams: Counting Words in Corpora, Simple N-Grams, Smoothing, Back off, Deleted Interpolation, N-Grams for Spelling and Pronunciation, Entropy, Summary. Word Classes and Part-of- Speech Tagging: English Word Classes, Tag sets for English, Part-of-Speech Tagging.

Module-3	8Hrs

Context-Free Grammars and Predicate Calculus for English: Constituency, Context-Free Rules and Trees, Sentence Level Constructions, Coordination, Agreement, The Verb Phrase Sub Categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence and Normal Form, Finite –State and Context- Free Grammars, Grammars and Human Processing, The Early Algorithm, Finite-State Parsing Method, Summary Representing Meaning.

Module-4	8Hrs
Semantic Analysis: Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Early Parser, Idioms and Compositionality, Robust Semantic Analysis, Summary. Lexical Semantics: Relations Among Lexemes and Their Senses, Word Net: A Database of Lexical Relations, The Internal Structure of Words, Creativity and the Lexicon, Summary Word Sense Disambiguation and Information.	
Module-5	8Hrs
Retrieval: Selection Restriction Based Disambiguation, Robust Word Sense Disambiguation, Information Retrieval, Other Retrieval Tasks, and Summary. Case Study of Simple Text Recognition or Content Based Text Extraction System. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.	

Course Outcomes:	
At the end of the course the student will be able to:	
21MC206E.1	Describe the fundamental concepts and techniques of natural language processing.
21MC206E.2	Apply parsing technique to the given problem and verify the output and give valid conclusions.
21MC206E.3	Illustrate the approaches to syntax and semantics in NLP.
21MC206E.4	Formulate solutions for a range of natural language components using existing algorithms, techniques and frameworks, including part-of-speech tagging, language modeling, parsing and semantic role labeling.
21MC206E.5	Evaluate NLP solutions of the given problem and arrive at valid conclusions.
21MC206E.6	Illustrate information retrieval techniques.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition,	Daniel Jurafsky and James H Martin,	Prentice Hall, 2009.	2nd Edition

Reference Books			
1	"Foundations of Statistical Natural language Processing"	Christopher D.Manning and Hinrich Schutze	MIT Press, 1999.
2	Natural Language Processing and Information Retrieval	Tanveer Siddiqui, U.S. Tiwary	Oxford University Press, 2008.
3	Natural Language Processing and Text Mining	Anne Kao and Stephen R. Poteet (Eds)	Springer Verlag London Limited 2007

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MC206E.1	-	-	-	-	-	-	-	-	2	-	-	-	-
21MC206E.2	-	-	-	2	-	-	-	-	-	-	-	-	-
21MC206E.3	-	-	-	-	-	-	2	-	-	-	-	-	-
21MC206E.4	-	-	-	2	-	-	-	-	-	2	-	-	-
21MC206E.5	-	-	-	-	-	-	-	-	-	-	-	-	2
21MC206E.6	-	-	-	-	-	-	2	-	2	-	-	-	-

1: Low 2: Medium 3: High

SOFTWARE ENGINEERING LAB

Course Code	**21MCL207**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**(1:0:2)**	SEE Marks	50
Credits	**02**	Exam Hours	03

Course Learning Objectives:
1. Identify a problem statement.
2. Write the SRS document for a specific problem.
3. Draw UML diagrams for the stated requirements.
4. Implement automatic code generation using Controller design pattern.

PART- A

1. Write down the problem statement for a suggested system of relevance.

2. Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.

PART- B

Tools Required: Rational Rose/ Any other open source tool.
1. Perform the user's view analysis for the suggested system: Use case diagram.
2. Draw the structural view diagram for the system: Class diagram, object diagram.
3. Draw the behavioral view diagram : State diagram and Activity diagram
4. Perform the behavioral view diagram for the suggested system : Sequence diagram.
5. Draw the necessary UML diagrams using any suitable UML drawing tool and implement in Java/ C++/ C# program to demonstrate the Controller design pattern.

Note: Each student has to execute one program from Part B during the semester end examination.

Course Outcomes:	
At the end of the course the student will be able to:	
21MCL207.1	Identify a problem statement.
21MCL207.2	Write the SRS document for a specific problem.
21MCL207.3	Draw class diagrams for the stated requirements.

21MCL207.4	Draw state diagrams for the stated requirements.
21MCL207.5	Draw activity diagrams for the stated requirements
21MCL207.6	Implement automatic code generation using Controller design pattern

Web links/Video Lectures/MOOCs
http://vlabs.iitkgp.ernet.in/se/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCL207.1	-	-	-	-	-	-	-	2	-	-	-	-	-
21MCL207.2	-	-	-	-	-	-	-	2	-	-	-	-	-
21MCL207.3	-	-	-	-	2	-	-	-	-	-	-	-	-
21MCL207.4	-	-	-	-	2	-	-	-	-	-	-	-	-
21MCL207.5	-	-	-	-	2	-	-	-	-	-	-	-	-
21MCL207.6	-	-	-	-	2	-	-	2	-	-	2	2	-

1: Low 2: Medium 3: High

DATA ANALYTICS LAB WITH MINI PROJECT

Course Code	**21MCL208**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**(1:0:2)**	SEE Marks	50
Credits	**02**	Exam Hours	03

Course Learning Objectives:
1. Apply control structures to the given problems and write Python programs for search/sort on a given data set.
2. Implement object oriented principles in Python.
3. Demonstrate data visualization using matplotlib and seaborn for a given problem.
4. Demonstrate regression model for a given problem.
5. Demonstrate Time series analysis with Pandas.
6. Develop a project by applying the data analytics concepts.

PART- A

1. Write a Python program to perform linear search.

2. Write a Python program to insert an element into a sorted list.

3. Write a python program using object oriented programming to demonstrate encapsulation, overloading and inheritance.

4. Implement a python program to demonstrate 1) Importing Datasets 2) Cleaning the Data 3) Data frame manipulation using Pandas.

5. Implement a python program to demonstrate the following using numpy a) Array manipulation, Searching, Sorting and splitting. b) broadcasting and Plotting numpy arrays.

6. Implement a python program to demonstrate Data visualization with various Types of Graphs using numpy.

7. Write a Python program that creates a mXn integer array and Prints its attributes using matplotlib.

8. Write a Python program to demonstrate the generation of linear regression models.

9. Write a Python program to demonstrate the generation of logistic regression models using Python.

10. Write a Python program to demonstrate Time series analysis with Pandas.

11. Write a Python program to demonstrate Data Visualization using Sea born.

Part- B

- Students shall carryout a mini project using Python to demonstrate data analysis.
- A team of two students must develop the mini project and during the examination each student must demonstrate the project individually
- The team must submit a brief report (20-25 pages) as per the format given.
- Rubrics may be used to evaluate the mini project.

Note: Each student has to execute one program from Part A during the semester end examination. Part A and Part B shall be given 50% weightage each.

Course Outcomes:	
At the end of the course the student will be able to:	
21MCL208.1	Implement python programming concepts.
21MCL208.2	Effectively use numpy and pandas libraries for data handling.
21MCL208.3	Demonstrate regression model for a given problem.
21MCL208.4	Demonstrate Time series analysis with Pandas.
21MCL208.5	Demonstrate data visualization using matplotlib and seaborn libraries.
21MCL208.6	Develop critical-thinking, problem-solving and decision making skills by designing project.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCL208.1	2	-	-	-	-	-	-	-	-	-	-	-	-
21MCL208.2	-	-	-	-	2	-	-	-	-	-	-	-	-
21MCL208.3	1	-	-	-	2	-	-	-	-	-	-	-	-
21MCL208.4	1	-	-	-	-	-	-	-	-	-	-	-	-
21MCL208.5	-	-	-	-	2	-	-	-	-	-	-	-	-
21MCL208.6	-	-	-	-	-	2	-	-	-	2	2	2	-

1: Low 2: Medium 3: High

JAVA PROGRAMMING LAB

Course Code	**21MCL209**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**(1:0:2)**	SEE Marks	50
Credits	**02**	Exam Hours	03

Course Learning Objectives:

1. Implement the fundamental concept of java programming by writing a executable programs.
2. Solve the object oriented principles with the help of java programs.
3. Demonstrate client-side programming and networking concepts to develop distributed applications.
4. Construct reusable and efficient applications using inheritance and multi-threading concepts of java and design user friendly interfaces.
5. Execute java programs to show the concepts of interfaces, inner classes and I/O streams.

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1. Write a JAVA program to demonstrate Constructor Overloading and Method Overloading.

2. Write a JAVA program to implement Inner class and demonstrate its Access protection.

3. Write a program in Java for String handling which performs the following:
   a. Checks the capacity of String Buffer objects.
   b. Reverses the contents of a string given on console and converts the resultant string in upper case.
   c. Reads a string from console and append it to the resultant string of (b).

4. Write a JAVA program to demonstrate Inheritance.
   Simple Program on Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.

5. Write a JAVA program which has:
   a. A Class called Account that creates account with Rs. 500 minimum balance, a deposit() method to deposit amount, a withdraw() method to withdraw amount and also throws Less Balance Exception if an account holder tries to withdraw money which makes the balance become less than Rs. 500.
   b. A Class called Less_ Balance_ Exception which returns the statement that says withdraw amount (Rs.) is not valid.
   c. A Class which creates 2 accounts, both account deposit money and one account tries to withdraw more money which generates a Less Balance Exception take appropriate action for the same.

6. Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept.

7. Write a JAVA program to implement a Queue using user defined Exception Handling (also make use of throw, throws).

   a. Complete the following:

   b. Create a package named shape.

   c. Create some classes in the package representing some common shapes like Square, Triangle, and Circle.

   d. Import and compile these classes in other program.

8. Write a java program that allows conduction of object type examination containing multiple choice questions, and true/false questions. At the end of the examination when the user clicks a button the total marks have to be displayed in the form of the message.

9. Write a JAVA program to create an enumeration Day of Week with seven values SUNDAY through SATURDAY. Add a method is Workday() to the Day of Week class that returns true if the value on which it is called is MONDAY through FRIDAY. For example, the call Day Of Week. SUNDAY .is Work Day () returns false.

10. Write a JAVA program which has:

    a. An Interface class for Stack Operations

    b. A Class that implements the Stack Interface and creates a fixed length Stack.

    c. A Class that implements the Stack Interface and creates a Dynamic length Stack.

    d. A Class that uses both the above Stacks through Interface reference and does the Stack

    e. Operations that demonstrates the runtime binding.

11. Write a JAVA program which uses File Input Stream / File Out Put Stream Classes.

12. Write JAVA programs which demonstrate utilities of Linked List Class.

Course Outcomes:	
At the end of the course the student will be able to:	
21MCL209.1	Demonstrate the fundamental data types and constructs of Java Programming by writing executable/interpretable programs.
21MCL209.2	Illustrate the object oriented principles with the help of java programs.
21MCL209.3	Implement user defined exceptions.
21MCL209.4	Develop reusable and efficient applications using inheritance and multi-threading concepts of java as well as design user friendly interfaces
21MCL209.5	Apply client-side programming and networking concepts to develop distributed applications.
21MCL209.6	Write java programs to demonstrate the concepts of interfaces, inner classes and I/O streams.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21MCL209.1	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL209.2	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL209.3	-	-	2	-	-	-	-	-	-	-	-	-	-
21MCL209.4	-	-	2	-	2	-	-	-	-	-	-	-	-
21MCL209.5	-	-	-	-	2	-	-	-	-	-	2	-	-
21MCL209.6	-	-	2	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

INDUSTRY ORIENTED TRAINING-II
(Problem Solving Skills)

Course Code	21ITP210	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	-
Credits	-	Exam Hours	2

Course Learning Objectives:

1. Develop thinking capacity in solving simple problems.
2. Learn the fundamentals of skill development.
3. Articulate the nuances of effective communication.
4. Perform a SWOT analysis to estimate the personality traits.
5. Learn to be a part of the team and become effective team players.
6. Discuss the importance of developing problem-solving skills.

Module-1	4 Hrs

How to pick up Skills faster? Knowledge v/s Skill, Skill introspection, Skill acquisition, Engineering Graduate v/s Engineer.
Building Interpersonal & Intrapersonal Skills: Peer communication, Social interactions, Bonding Emotional Management, Moral, social & personal responsibilities.

Module-2	4 Hrs

Professional Etiquettes: Workplace etiquette, Dining etiquettes, Telephone etiquettes, E-mail etiquettes.
Change Management: Tolerance of change and uncertainty, Joining the bandwagon, Adapting change for growth-overcoming inhibition, Adapt to changes**.**

Module-3	4 Hrs

Self-Awareness & Goal Setting: Identifying your Unique Selling proposition, SWOT, Nurture strengths, Fixing weaknesses, Overcoming complacency, Building confidence, Ambition/SMART Goals, Managing Failures.
Leadership & Motivation: Types of leadership styles, Case studies, Motivation, Qualities of a leader.

Module-4	4 Hrs

Team Building: Difference between team and group, Qualities of an effective team player, Stages of team building, Problem-solving among team members, Building winning teams.

Module-5	4 Hrs

Problem Solving: Styles of problem solvers, Effective problem solving, Case studies, Individual/teams.
Creative Thinking: Examples of creative thinking, Tools of creativity, Creative/critical thinking.

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

21ITP210.1	Apply rational thinking abilities in solving real life problems.
21ITP210.2	Identify the science behind picking up any skill quickly.
21ITP210.3	Develop the required skills to effectively interact with people and to articulate the ideas.
21ITP210.4	Discover one's strengths and weaknesses, and apply them effectively for career growth.
21ITP210.5	Recognize the dynamics of a team and achieve synergy.
21ITP210.6	Articulate leadership and problem-solving skills.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher
Textbooks			
1	Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills	Michael Kallet	Wiley
2	The Road Less Traveled	M Scott Peck	Simon & Schuster
3	The Five Dysfunctions of a Team	Patrick Lencioni	Jossey-Bass
Reference Books			
1	Stop Guessing: The 9 Behaviors of Great Problem Solvers	Nat Greene	Berrett-Koehler
2	The 7 Habits of Highly Effective People	Stephen R Covey	Free Press

| 3 | Problem Solving 101: A Simple Book for Smart People | Ken Watanabe | Penguin Group |

Web links/Video Lectures/MOOCs
1. https://www.youtube.com/watch?v=A9Q20hZ5ZX4
2. https://www.youtube.com/watch?v=L4N1q4RNi9I
3. https://www.coursera.org/search?query=problem%20solving%20 and%20critical%20thinking
4. https://www.coursera.org/learn/visionary-leadership-meaning-maker
5. https://www.coursera.org/learn/interpersonal-communication

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
21ITP210.1	-	3	-	-	-	2	-	-	-	3	-	-	-
21ITP210.2	-	2	-	-	-	2	-	-	-	-	-	-	-
21ITP210.3	-	-	-	-	-	2	-	-	3	3	-	-	-
21ITP210.4	-	-	-	-	-	-	-	1	3	-	-	-	-
21ITP210.5	-	-	-	-	-	2	-	1	3	3	-	-	-
21ITP210.6	-	-	-	-	-	2	-	1	3	3	-	-	-

1: Low 2: Medium 3: High

St Joseph Engineering College

AN AUTONOMOUS INSTITUTION

(Affiliated to VTU, Belagavi and recognised by the AICTE, New Delhi.
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