MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102

MBU
MOHAN BABU
UNIVERSITY
DREAM. BELIEVE. ACHIEVE

SCHOOL OF LIBERAL ARTS AND SCIENCES

M.Sc. - Computer Science

CURRICULUM AND SYLLABUS

(From 2025-26 Admitted Students)

FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM (FFCBCS)

MOHAN BABU UNIVERSITY

Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

Mission

- Develop industry-focused professionals with a global perspective.
- Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.
- Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises.
- Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

SCHOOL OF LIBERAL ARTS AND SCIENCES

Vision

To be the ideal culmination for the edification of liberal arts and sciences recognised for excellence, innovation, entrepreneurship, environment and social consciousness.

Mission

- Infuse the essential knowledge of liberal arts and sciences, skills and an inquisitive attitude to conceive creative and appropriate solutions to serve industry and community.
- Proffer a know-how par excellence with the state-of-the-art research, innovation, and incubation ecosystem to realise the learners' fullest entrepreneurial potential.
- Endow continued education and research support to working professionals in liberal arts and sciences to augment their domain expertise in the latest technologies
- Entice the true spirit of environment and societal consciousness in citizens of tomorrow in solving challenges in liberal arts and sciences.

DEPARTMENT OF MATHEMATICAL SCIENCES

Vision

To become a Nation's center of excellence in the field Mathematical Sciences and its allied areas through teaching, training, and research.

Mission

- Disseminate the knowledge of a diverse group of students by providing solutions through contemporary curriculum.
- Creating a talent pool of faculty in diverse domains through continuous training.
- Domain and transferable skill development for holistic personality of students and employability.
- Inculcating values and Ethics for effective professional practice.

M.Sc. - Computer Science

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of M.Sc. Computer Science will:

PEO1. Pursue higher education in their core or allied areas of specialization.

PEO2. Employed as a productive and valued professional in industry/teaching/ research.

PEO3. Engaged in innovation and deployment as a successful entrepreneur.

PEO4. Adapt evolving technologies in the core or allied areas by participating in continuing education programs for lifelong learning.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of M.Sc. Computer Science will be able to:

PO1 **Knowledge:** To study as well as apply concepts, theories, and practices across the disciplines to gain the foundational knowledge.

PO2 **Problem Analysis:** To identify, analyze and evaluate various experiences and perspectives using foundational disciplinary knowledge for substantiated conclusions.

PO3 **Design/Development of solutions:** To design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Modern tool usage:** To create, select, and apply appropriate techniques, resources and modern tools with an understanding of the limitations.

PO5 **Environment and Sustainability:** Understand the issues of environmental contexts and demonstrate the knowledge for sustainable development.

PO6 **Ethics and Society:** Apply the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities under moral dimensions.

PO7 **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, to manage projects and finance in multidisciplinary settings.

PO8 **Effective Communication:** To develop proficiency and efficiency in communicating by connecting people, ideas, books, media, and technology.

PO9 **Life-long learning:** Recognize the need for and acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of M.Sc. Computer Science program students will be able to:

PSO1. Apply the knowledge of Mathematical foundation, Business Management and Information Technology to the solutions of real world problems.

PSO2. Analyze, Design and Develop solutions in real time in the domains of technical, managerial, economical and social constraints by using current technologies in Information Management, Software Engineering, Platform Based Development, and Computer Networks skills.

PSO3. Use innovative ideas to create better environment in order to solve complex problems in the domains of Information Management, Software Engineering, Platform Based Development and Computer Networks for the excellence of an individual and society and apply appropriate techniques, resources, and modern tools to complex real time problems in the domains of Information Management, Software Engineering, Platform Based Development and Computer Networks.

M.Sc. – Computer Science

Basket Wise - Credit Distribution

Sl. No.	Baskets	Credits (Min.- Max.)
1	SCHOOL CORE	24-30
2	PROGRAM CORE	21-26
3	PROGRAM ELECTIVE	33-42
4	UNIVERSITY ELECTIVE	6-9
	TOTAL CREDITS	**Min. 90**

School Core (24 - 30 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25MM201005	Discrete Mathematics	3	-	-	-	3	-
25MM201001	Design and Analysis of Algorithms	3	-	-	-	3	-
25MM202001	Operating Systems	3	-	2	-	4	-
25CA201001	Computational Statistics	3	-	-	-	3	-
25EE201001	Research Methodology	3	-	-	-	3	-
25MM201007	Operation Research	3	-	-	-	3	-
25MM211001	Internship	-	-	-	-	2	-
25MM208001	Capstone Project	-	-	-	-	10	-
Mandatory Courses (Min. 4 Credits to be earned, Earned Credits will not be considered for CGPA)							
25CB207601	Essentials of Cyber Security *	2	-	-	-	2	-
25AI207601	Statistics with R	2	-	-	-	2	-
25LG207601	Technical Report Writing	2	-	-	-	2	-
25MG207601	Project Management	2	-	-	-	2	-
25MG207602	Essentials of Business Etiquettes	2	-	-	-	2	-

*Compulsory Course

Program Core (21 – 26 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25MM202002	Object Oriented Programming through JAVA	3	-	2	-	4	-
25MM202003	Database Management Systems	3	-	2	-	4	-
25MM201003	Computer Networks	3	-	-	-	3	-
25MM202004	Software Engineering	3	-	2	-	4	-
25MM202005	Python Programming	3		2		4	-
25MM201002	Cloud Computing	3	-	-	-	3	-
25MM202006	Data Structures	3	-	2	-	4	-

Program Elective (33 – 42 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25MM201004	Computer Organization and Architecture	3	-	-	-	3	-
25MM202007	Mobile Application Development	3	-	2	-	4	Object Oriented Programming through JAVA
25MM201008	Data Warehousing and Data Mining	3	-	-	-	3	-
25MM201009	Software Project Management	3	-	-	-	3	Software Engineering
25MM202008	Big Data Analytics	3	-	2	-	4	-
25MM201010	Information Retrieval Techniques	3	-	-	-	3	Data Warehousing and Data Mining
25MM201011	Object Oriented Modeling and Design	3	-	-	-	3	Software Engineering
25MM201012	Internet of Things	3	-	-	-	3	-
25MM202009	Web Applications Development Using PHP	3	-	2	-	4	-
25MM201013	Cryptography and Network Security	3	-	-	-	3	-
25MM201014	Computer Graphics	3	-	-	-	3	-
25MM201015	Introduction to Machine Learning	3	-	-	-	3	Python Programming
25MM202010	Cloud Architecture and Design	3	-	2	-	4	Cloud Computing
25MM201016	Artificial Intelligence	3	-	-	-	3	
25MM201017	Deep Learning	3	-	-	-	3	Introduction to Machine Learning

University Elective (6-9 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25AI201701	Business Analytics	3	-	-	-	3	-
25AI201702	Ethics for AI	3	-	-	-	3	-
25CM201701	Cost Management of Engineering Projects	3	-	-	-	3	-
25CE201701	Disaster Management	3	-	-	-	3	-
25SS201701	Value Education	3	-	-	-	3	-
25SS201702	Pedagogy Studies	3	-	-	-	3	-
25LG201701	Personality Development through Life Enlightenment Skills	3	-	-	-	3	-
25MG201701	Entrepreneurship and Innovation Management	3	-	-	-	3	-

Note:

If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.

The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MM201005	**DISCRETE MATHEMATICS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course addresses the challenges of the relevance of Boolean, Lattice and algebraic systems to computer science and their corresponding systems. To apply number theory, graph theory and their related concepts and algorithm to develop security levels and intelligent systems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply mathematical logic and predicate calculus to validate precise statements

CO2. Analyze the basic structures of lattice and Boolean algebra.

CO3. Demonstrate the importance of algebraic properties with regard to working within various number systems.

CO4. Formulate recurring Problems and solve their recurrence relations.

CO5. Apply the concepts of graph theory and trees to implement computer algorithms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	1	-	-	-	-	-	-	-	3
CO2	3	3	-	2	2	-	-	-	-	2	-	3
CO3	3	2	-	2	2	-	-	-	-	1	-	3
CO4	3	2	-	2	-	-	-	-	-	3	-	2
CO5	3	3	-	2	-	-	-	-	-	2		3
Course Correlation Mapping	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: MATHEMATICAL REASONING ***(07 Periods)***

Concepts of mathematical logic, Normal Forms, The Predicate Calculus, Rule of Inference, Consistency, Proof of Contradiction, quantifiers.

Module 2: LATTICES AND BOOLEAN ALGEBRA ***(09 Periods)***

Lattices: Partially Ordered Relations, Hasse Diagram, Lattices as Posets, Properties of Lattices

Boolean Algebra: Basic Definitions, Truth Tables, Boolean Functions, Representation and Minimization of Boolean Functions.

Module 3 ALGEBRAIC STRUCTURES AND NUMBER THEORY ***(11 Periods)***

Algebraic Structures: Binary Operations and Algebraic Structures Groups, Subgroups.

Number Theory: Division Algorithm, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Euler Totient Function, Modular Arithmetic (Fermat's Theorem and Euler's Theorem (without proof))

Module 4 RECURRENCE RELATIONS ***(09 Periods)***

Generating Functions of Sequences, calculating coefficients of generating function, Homogeneous Recurrence relation, solving recurrence relations by substitution and Generating functions, Methods of Characteristic Roots.

Module 5 GRAPHS AND TREES ***(09 Periods)***

Graphs: Representation of Graphs and Graph Isomorphism, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Planar Graphs, Euler's Formula and Graph Coloring.
Trees: Introduction to Trees, Properties of Trees, Spanning Trees, Counting trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Let a > 1 be a positive integer. Pretend you want to divide n people into some number of teams, each of size a or a + 1. Show that this is possible provided n is larger than values in the Fibonacci polynomial a2 −a−1 = a(a−1)−1.
2. Identify the relations on the set of bits B = {0, 1} that are partial orders and those that are equivalence relations.
3. Pretend you are writing traffic accident software and want to categorize accidents by the day of the week on which they occur. Pretend there are n accident reports to categorize.
   (a) What is the size of the sample space? That is, in how many ways can the accident reports be distributed over 7 days?
   (b) In how many ways can all n accidents occur on one single day?
   (c) In how many ways can all n accidents occur on only two days?
   (d) Let's looks at the other end: In how many ways can all n accidents occur on seven, and no less, days.

RESOURCES

TEXT BOOKS:

1. Kenneth H. Rosen,Discrete Mathematics and its Applications, Tata McGraw Hill, 8th Edition, 2019.
2. Jon Pierre Fortney, Discrete Mathematics for Computer Science, CRC Press, Taylor & Francis Group, 1st Edition, 2021.

REFERENCE BOOKS:

1. Richard Johsonbaugh, Discrete Mathematics , Prentice Hall,8th Edition, 2019.
2. NarasingDeo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India 2016.
3. J.P. Trembly and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science,*Tata McGraw Hill, 37th Edition, 2017

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106183
2. https://nptel.ac.in/courses/106106094

WEB RESOURCES:

1. https://www.coursera.org/learn/discrete-mathematics
2. https://people.cs.pitt.edu/~milos/courses/cs441/
3. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MM201001	**DESIGN AND ANALYSIS OF ALGORITHMS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Algorithms and asymptotic notations; Algorithm performance analysis; Amortized analysis; Recurrences; Disjoint sets; Divide and Conquer; Dynamic programming; Greedy algorithms; Back tracking; Branch and bound; NP-hard and NP complete problems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the complexity of algorithms by applying the knowledge of asymptotic notations and recurrence methods.

CO2. Analyze the given problem and identify appropriate algorithm design technique for problem solving.

CO3. Perceive and apply different algorithm design paradigms to find solutions for computing problems.

CO4. Apply the knowledge of NP-hard and NP-Complete complexity classes to classify decision problems.

CO5. Design algorithms using Backtracking and Brach and bound approach and learn about Class P, NP, NP-complete and NP-hard.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	3	2	-
CO3	2	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	3	2	-
CO5	3	3	3	-	-	-	-	-	-	3	2	-
Course Correlation Mapping	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	-	**3**	**2**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION TO ALGORITHMS ***(09 Periods)***

The Role of Algorithms in Computing: Algorithms as a technology - Fundamentals of algorithmic problem solving – Analysis framework – Growth of functions: Asymptotic notation – Standard notations and common functions. Mathematical analysis of Non recursive and recursive algorithms- Insertion Sort algorithm and analysis – Brute force approach: Sequential search, Traveling Salesman Problem, Knapsack problem

Module 2: DIVIDE AND CONQUER ***(09 Periods)***

The Substitution Method for Solving Recurrences – The Recursion-Tree method for Solving RecurrencesThe Master Method for Solving Recurrences – Merge sort, Quick sort algorithm and analysis – The maximum-sub array problem – Finding Closest Pair of Points.

Module 3: DYNAMIC PROGRAMMING, GREEDY TECHNIQUE AND STRING MATCHING ALGORITHMS ***(09 Periods)***

Dynamic Programming: Knapsack Problem and memory functions, Longest common subsequence, Optimal Binary Search Tree, Warshall's and Floyd's Algorithm.
Greedy Technique: Minimum Spanning Trees – Kruskal's and Prim's Algorithms, Single source Shortest Paths - Dijkstra's Algorithm, Huffman Trees.
String Matching algorithms: The naïve approach, Rabin-Karp algorithm, Knuth- Morris-Pratt algorithm

Module 4: BACKTRACKING AND BRANCH AND BOUND ***(09 Periods)***

BACKTRACKING: General method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles.
BRANCH AND BOUND: General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

Module 5: NP-HARD AND NP-COMPLETE PROBLEMS ***(09 Periods)***

NP-HARD AND NP-COMPLETE PROBLEMS: Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes, Cook's theorem.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Design and develop shortest path algorithm using graphs.
2. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm
3. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. Demonstrate Tree Traversal and Graph Traversal.

RESOURCES

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, 2 nd Edition, Universities Press, 2008.

2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms,3rd Edition, MIT Press, 2012.

REFERENCE BOOKS:

1. Michael T. Goodrich and Roberto Tamassia, Algorithm Design and Applications, Wiley, 2014.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of ComputerAlgorithms, Pearson, 2006.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://archive.nptel.ac.in/courses/106/101/106101060/
3. https://onlinecourses.nptel.ac.in/noc19_cs47/preview

WEB RESOURCES:

1. https://www.coursera.org/lecture/analysis-of-algorithms/resources-jMWPy
2. https://www.udemy.com/course/design-and-analysis-of-algorithms/
3. https://courses.cs.duke.edu/fall08/cps230/Book.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MM202001	**OPERATING SYSTEMS**	**3**	**-**	**2**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Operating Systems Operations; Process Scheduling; Process Synchronization, Deadlocks; Paging and Segmentation, Disk Scheduling; File Concepts, I/O Interface; Concepts of Protection and Security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze performance of CPU scheduling algorithms.

CO2. Design solutions for process synchronization problems by using semaphores and monitors.

CO3. Devise solutions for deadlocks using deadlock handling mechanisms.

CO4. Solve memory management problems using page replacement and disk scheduling algorithms.

CO5. Identify efficient file allocation methods for optimal disk utilization and Analyze services of I/O subsystems and mechanisms of security & protection and Work Independently and Communicate Effectively in Oral and Written forms

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	3	-	3
CO2	3	2	-	3	-	-	-	-	-	3	-	3
CO3	3	2	-	2	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	2	3	-	-	-	-
Course Correlation Mapping	**3**	**2**	**2**	**3**	**-**	**2**	**2**	**3**	-	**3**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO OPERATING SYSTEM AND SYSTEM STRUCTURE ***(08 Periods)***

OPERATING SYSTEMS OVERVIEW: Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems.
OPERATING SYSTEMS STRUCTURES: Operating system services and systems calls, system programs, operating system structure, operating systems generations.

Module 2: PROCESS SYNCHRONIZATION AND DEADLOCKS ***(10 Periods)***

PROCESS MANAGEMENT: Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming, threads in UNIX, comparison of UNIX and windows.
CONCURRENCY AND SYNCHRONIZATION: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosophers problem, monitors, synchronization examples(Solaris), atomic transactions. Comparison of UNIX and windows.

Module 3: DEADLOCKS AND MEMORY MANAGEMENT ***(07 Periods)***

DEADLOCKS: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm.

MEMORY MANAGEMENT: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, allocation of frames, thrashing, case study - UNIX

Module 4: FILE SYSTEMS AND FILE SYSTEM IMPLEMENTATION ***(10 Periods)***

FILE SYSTEM: Concept of a file, access methods, directory structure, file system mounting, file sharing, protection.
File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance, comparison of UNIX and windows.
I/O SYSTEM: Mass storage structure - overview of mass storage structure, disk structure, disk attachment, disk scheduling algorithms, swap space management, stable storage implementation, tertiary storage structure.

Module 5: PROTECTION AND SECURITY ***(10 Periods)***

I/O: Hardware, application I/O interface, kernel I/O subsystem, transforming I/O requests to hardware operations, streams, performance.
Protection: Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.
Security: Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

Total Periods: 45

EXPERIENTIAL LEARNING

List of Experiments:

1. Simulate the following CPU scheduling algorithms.
   a) FCFS b) SJF c) Round Robin d) Priority
2. Write a C program to simulate producer-consumer problem using Semaphores
3. Write a C program to simulate the concept of Dining-philosophers problem.
4. Simulate MVT and MFT.
5. Write a C program to simulate the following contiguous memory allocation Techniques.
   a) Worst fit b) Best fit c) First fit.
6. Write a C program to Simulate all page replacement algorithms
   a)FIFO b) LRU c) OPTIMAL
7. Write a C program to simulate the File Organization Techniques
   a) Single level directory b) Two level directory
8. Write a C program to Simulate the following file allocation strategies
   a) Sequential b) Indexed c) Linked.
9. Write a C program to simulate Bankers Algorithm for Dead Lock Avoidance.
10. Write a C program to simulate Bankers Algorithm for Dead Lock Prevention.
11. Write a C program to simulate disk scheduling algorithms.
    a) FCFS b) SCAN c) C-SCAN

RESOURCES

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Wiley India Edition, 10th Edition, 2018.

SOFTWARE TOOLS:

1. Dev C++/C

REFERENCE BOOKS:

1. William Stallings, Operating Systems, Internals and Design Principles, Pearson Education, 7th Edition, 2013.
2. Andrew S. Tanenbaum, Modern Operating Systems, PHI, 3rd Edition, 2009.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs78/preview
2. https://www.cse.iitb.ac.in/~mythili/os/
3. https://www.youtube.com/watch?v=vBURTt97EkA

WEB RESOURCES:

1. https://www.tutorialspoint.com/operating_system/os_useful_resources.htm
2. https://www.techtarget.com/whatis/definition/operating-system-OS
3. https://www.studytonight.com/operating-system/introduction-operating-systems
4. https://www.geeksforgeeks.org/web-operating-system/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA201001	**COMPUTATIONAL STATISTICS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course covers measures of Central Tendency, measures of Dispersion and basics of 'R' language. Fitting the Probability distributions of Discrete Probability Distributions, Continuous Probability Distributions and implementing the probability distributions in R. Correlation and Regression Analysis is done and able to calculate Correlation and Regression Coefficients along with fitting lines of Regression in R tool. Testing of hypothesis can be done for Large sample Tests and Small sample tests.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of descriptive statistics, basics in R, Probability Distributions, Testing of Hypothesis, Correlation and Regression.

CO2. Apply testing of hypothesis on small and large sample testing using Z-test, t-test, F-test and chi-square test and to draw the valid inferences and solve the problems on probability distributions.

CO3. Use R programming tools to Simulate Binomial, Poisson and Normal distributions, and calculate Correlation and Regression Coefficients, Fitting lines of Regression.

CO4. Analyze the relationship between variables using Correlation and Regression.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	2	3	-	-	-	-	-
CO2	3	3	2	3	3	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**2.5**	**3**	**3**	**-**	**-**	**-**	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO DESCRIPTIVE STATISTICS (10 Periods)

Measures of Central Tendency: The Arithmetic Mean, The Arithmetic Mean Computed from Grouped data, Median, Mode, Empirical Relation Between the Mean, Median, and Mode, Geometric Mean, Harmonic Mean.

Measures of Dispersion: The Range, The Mean Deviation, The Semi- Interquartile Range, The Standard Deviation, The Variance, coefficient of variation and Moments, measures of Skewness and Kurtosis.

Module 2: BASICS IN R (09 Periods)

Basic concepts of R, R Studio, run R, Variables, Data Types, Vectors, Data Frames, Lists, Matrices, Arrays, Classes, Functions, and diagrammatical presentations in R.

Module 3: PROBABILITY DISTRIBUTIONS (09 Periods)

Discrete Probability Distributions: Binomial Distribution- Mean and variance and fitting of Binomial distribution; Poisson distribution -Mean and variance and fitting of Poisson distribution.

Continuous Probability Distributions: Normal Distribution- Mean, variance and area properties of Normal distribution.

Implementing in R: Simulate Binomial, Poisson and Normal distributions

Module 4: CORRELATION AND REGRESSION ANALYSIS (08 Periods)

Correlation Analysis: Linear Correlation, scatter diagram, Karl Pearson's coefficient of Correlation and Spearman's Rank correlation coefficient (with and without tied ranks).

Regression Analysis: Regression Lines, Fitting of two lines of Regression, Regression coefficients and multiple regression.

Implementing in R: Calculate Correlation and Regression Coefficients and Fitting lines of Regression.

Module 5: TESTING OF HYPOTHESIS (09 Periods)

Large sample Tests: Null hypothesis and Alternative hypothesis, Type-I and Type-II errors, Level of significance, Critical Region, one tailed and two tailed tests; Test of Significance of single proportion, Difference of two Proportions, Single mean, Difference of two Means.

Small sample tests: t-test: Single mean, Difference of two Means; F-test; chi-square test**:** chi-square test for independence of attributes, chi-square test for goodness of fit.

Total Periods: 45

EXPERIENTIAL LEARNING

I. For **Covid 19 scenario,** do the following using R Programming tool:

Globally, the number of new weekly cases has continued to decline since the peak in January 2022. During the week of 30 May to 5 June 2022, over three million cases were reported, a 12% decrease as compared to the previous week. The number of new weekly deaths also continues to decline, with over 7,600 fatalities reported, representing a 22% decrease as compared to the previous week. As of 5 June 2022, over 529 million confirmed cases and over six million deaths have been reported globally.

a. Requirement gathering

i. Identify the variables and methods

ii. Draw Histogram for statistical analysis
iii. Write use cases for Patient information & Recovery percentage

b. Analysis

i. Fit the Linear Regression model for the system
ii. Draw Mathematical relationship to find the Patient information
iii. Identify the Patient current condition and to provide right Medication

C. Design

i. Design Data Visualization for "patient entry "and conditions
ii. Draw R-Chart based on the Statistical analysis.

d. Evaluate quality of design

I. Given R-Chart, diagrammatic Representation of Histogram, evaluation of mathematical relationships will provide the patient recovery percentage in Visualization

II. **Do a MOOC on** Computational Statistics: https://www.my-mooc.com/en/categorie/statistics-and-probability

RESOURCES

TEXT BOOKS:

1. T. K. V. Iyengar, B. Krishna Gandhi etal., "*Probability and Statistics*," S. Chand and Company ltd: New Delhi, 3rd Edition, 2011.
2. Allerhand M. "*Tiny Handbook of R,*" Springer Briefs in Statistics, 2011.

REFERENCE BOOKS:

1. Shanaz Bhatul, "*Probability and Statistics"*, RIDGE Publications, 2nd Edition, 2006.
2. S.C. Gupta and V.K. Kapoor, "*Fundamentals of Applied Statistics,"* S.Chand and Sons, New Delhi, 2010.
3. Baayen R. "*Analyzing Linguistic Data - A Practical Introduction to Statistics using R,*" 2008.
4. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, "*Beginner's Guide to R,*" Springer, 2009.

SOFTWARE/TOOLS:

1. R Programming
2. R studio

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=GuTd8Yb2jUk
2. https://www.youtube.com/watch?v=_V8eKsto3Ug

WEB RESOURCES:

1. http://www.nptelvideos.in/2012/11/probability-and-statistics.html.
2. https://www.classcentral.com/course/swayam-probability-and-statistics-5228.
3. https://www.coursera.org/browse/data-science/probability-and-statistics.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25EE201001	RESEARCH METHODOLOGY	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:
The course is developed for the students' to understand the underlying concepts of research methodology and a systematic approach for carrying out research in the domain of interest. The course is emphasized on developing skills to recognize and reflect the strength and limitation of different types of research; formulation of the research hypothesis and its systematic testing methods. The course also emphasizes on interpreting the findings and research articulating skills along with the ethics of research.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Demonstrate the underlying concepts of research methodology, types of research and the systematic research process.

CO2. Demonstrate the philosophy of research design, types of research design and develop skills for a good research design.

CO3. Demonstrate the philosophy of formulation of research problem, methods of data collection, review of literature and formulation of working hypothesis.

CO4. Analyse the data and parametric tests for testing the hypothesis.

CO5. Interpret the findings and research articulating skills along with the ethics of research.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	-	-	-	3	-	-	3	-	-
CO2	-	-	-	3	-	-	3	-	-
CO3	-	-	-	3	-	-	3	-	-
CO4	-	-	-	3	-	-	3	-	-
CO5	-	-	-	-	3	-	-	3	-
Course Correlation Mapping	-	-	-	3	3	-	3	3	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Research Methodology (08 Periods)

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, Research Process, Criteria of Good Research.

Module 2: Research Design (08 Periods)

Research design—Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Different research designs, Basic principles of experimental designs, Developing a research plan.

Module 3: Research Formulation (08 Periods)

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Data collection – Primary and secondary sources; Critical literature review – Identifying gap areas from literature review; Hypothesis— Types of hypothesis, Development of working hypothesis.

Module 4: Analysis of Data and Hypothesis Testing (14 Periods)

Quantitative Tools: Testing and Significance of Measures of Central Tendency, Dispersion; correlation, Principles of least squares—Regression; Errors-Mean Square error, Mean absolute error, Mena absolute percentage errors.
Testing of Hypothesis: Hypothesis Testing Procedure, Types of errors, Parametric testing (t, z and F), Chi-Square Test as a Test of Goodness of Fit; Normal Distribution- Properties of Normal Distribution; Analysis of Variance.

Module 5: Interpretation and Report Writing (07 Periods)

Interpretation: Meaning of interpretation; Techniques of interpretation; Precautions in Interpretation.
Report Writing –Significance, Different Steps, Layout, Types of reports, Mechanics of Writing a Research Report, Precautions in Writing Reports; Research ethics—Plagiarism, Citation and acknowledgement.

Total Periods: *45*

EXPERIENTIAL LEARNING

1. Should conduct a survey based on a hypothesis, analyze the data collected and draw the inferences from the data.

2. Should review the literature on the given topic and should identify the scope/gaps in the literature and develop a research hypothesis.

3. Should study a case, formulate the hypothesis and identify an appropriate testing technique for the hypothesis.

4. Study an article and submit a report on the inferences and should interpret the findings of the article.

RESOURCES

TEXT BOOKS:

1. C.R. Kothari, Research Methodology: Methods and Techniques, New Age International Publishers, 2nd revised edition, New Delhi, 2004.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.

REFERENCE BOOKS:

1. R. Panneerselvam, Research Methodology, PHI learning Pvt. Ltd., 2009.
2. Singh, Yogesh Kumar. *Fundamental of research methodology and statistics*. New Age International, 2006.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/121106007
2. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
3. https://www.youtube.com/watch?v=VK-rnA3-41c

WEB RESOURCES:

1. https://www.scribbr.com/category/methodology/
2. https://leverageedu.com/blog/research-design/
3. https://prothesiswriter.com/blog/how-to-formulate-research-problem
4. https://www.formpl.us/blog/hypothesis-testing
5. https://www.datapine.com/blog/data-interpretation-methods-benefits-problems/
6. https://leverageedu.com/blog/report-writing/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201007	**OPERATION RESEARCH**	3	-	-	-	3

Pre-Requisite--

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Requirements of Linear Programming Problem, Formulation, Graphical solution, Simplex method, Big-M method, Two Phase Method; Vogel"s approximation method; Modified distribution (MODI) method to find optimal solution; Two person zero sum games; Saddle point; Inventory costs and deterministic inventory control models; Project management
through network analysis.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply linear programming techniques to solve complex problems and obtain Optimal solutions.

CO2. Analyze games through appropriate strategies to influence the game outcome.

CO3. Apply suitable inventory control models for cost reduction and simulate them.

CO4. Develop network models and solve project management issues involving diverse Resources.

CO5. Apply queuing models to compute the relevant characteristics and simulate them.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-			-
CO2	3	3	-	-	-	-	-	-	-			-
CO3	2	3	3	-	-	-	-	-	-			-
CO4	3	3	-	-	-	-	-	-	-			-
CO5	3	3	-	-	-	-	-	-	-			
Course Correlation Mapping	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	-			**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: LINEAR PROGRAMMING PROBLEM ***(10 Periods)***

Requirements of Linear Programming Problem, Formulation, Graphical solution, Simplex method, Big-M method, Two Phase Method, Dual formulation, Dual Simplex Method, Linear Programming special cases- Infeasible solution, Unboundedness, Redundancy, Alternate Optimal solutions.

Module 2: TRANSPORTATION AND ASSIGNMENT MODELS ***(08 Periods)***

Transportation model: Methods to find Basic Feasible Solution- North-West corner rule, Least cost method, Vogel's approximation method; Modified distribution (MODI) method to Find optimal solution, Special cases of transportation problems, Transshipment problem.
Assignment model: Hungarian method, Travelling Salesman Problem

Module 3: GAME THEORY AND INVENTORY MODELS ***(09 Periods)***

Game Theory – Two person zero sum games, Saddle point, Pure strategy, Mixed strategy – Dominance, Algebraic method and Graphical method.
Inventory Models – Functions, Types, Associated costs, Factors involved in inventory problem analysis, Inventory costs and deterministic inventory control models - single item Inventory control models without shortages and with shortages, with quantity discounts.

Module 4: NETWORK MODELS ***(10 Periods)***

Network Flow models – Minimal Spanning Tree, Shortest Path Problem and Maximal Flow Problem, Project management through network analysis- Critical Path Method, Program Evaluation Review Technique, Cost analysis and Crashing.

Module 5: QUEUING AND SIMULATION ***(08 Periods)***

Queuing: Infinite queue length model, Poisson arrivals and Exponential service times - Single server and multi-server.
Simulation: Monte Carlo simulation, Simulation of a waiting line problem, Simulation of Inventory model.

Total Periods: 45

EXPERIENTIAL LEARNING

1. IBFS of Transportation problem by using North- West corner rule
2. IBFS of Transportation problem by using Matrixminimum method
3. IBFS of Transportation problem by using VAM
4. Solution of Assignment problem using Hungarian method
5. Traveling salesman problem
6. Solution of sequencing problem—processing of n jobs through two machines
7. Solution of sequencing problem - processing of n jobs through three machines
8. To perform Project scheduling of a given project (Deterministic case-CPM).
9. To perform Project scheduling of a given project (Probabilistic case-PERT).

RESOURCES

TEXT BOOKS:

1. Hamdy A Taha, *Introduction to Operations Research*, Pearson India, 10th Edition, 2017
2. J.K. Sharma, *Operations Research: Theory and Applications*, Macmillan, New Delhi, 5th Edition, 2013.

REFERENCE BOOKS:

1. Hillier, Libermann, *Introduction to Operations Research*, McGraw Hill Education(India) Private Limited, 10th Edition, 2017.
2. KantiSwarup, P.K. Gupta, Manmohan, *Operations Research*, Sultan Chand & Sons, 2019.

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/112106134/L01.html
2. https://www.youtube.com/watch?v=OwNPKGQ3UDY

WEB RESOURCES:

1. https://libguides.mines.edu/orwe/orgsandwebsources
2. https://www.bbau.ac.in/dept/UIET/EMER-601%20Operation%20Research%20Queuing%20theory.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CB207601	**ESSENTIALS OF CYBER SECURITY**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Cyber Security Fundamentals, Cyber Security Fundamentals, Attacker techniques and motivations, Fraud techniques, Threat infrastructure, Exploitation, Malicious code, Defense and analysis techniques, Intrusion detection techniques

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understanding the fundamental concepts of cyber security concepts

CO2. Identify the pattern of launching attacker and fraud techniques to reduce risk and impact of cyber-attacks.

CO3. Identify the vulnerabilities using the SQL injection and web exploitation techniques in a system for securing data.

CO4. Apply code obfuscation techniques to prevent any unauthorized party from accessing logic of an application

CO5. Apply honey pots and malicious code-naming techniques to defend against attacks in memory.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-
CO5	3	2	3	2	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: CYBER SECURITY FUNDAMENTALS ***(05 Periods)***

Network Security Concepts: Information assurance fundamentals, Basic cryptography, Symmetric encryption, Public key encryption, The Domain Name System (DNS), Firewalls, Virtualization, Radio-Frequency Identification.

Module 2: ATTACKER TECHNIQUES ***(07 Periods)***

Attacker techniques and motivations: Anti forensics, proxy usage, Tunneling techniques: HTTP, DNS, ICMP, Intermediaries, Steganography and other concepts, Detection and prevention.
Fraud techniques: Phishing, smishing, vishing and mobile malicious code, rogue antivirus, click fraud.
Threat infrastructure: Botnets, Fast Flux, Advanced Fast Flux.

Module 3: EXPLOITATION ***(06 Periods)***

Shellcode, Integer overflow vulnerabilities, Stack based buffer overflows, Format string vulnerabilities, SQL injection, Malicious PDF files, Race conditions, Web exploit tools, DoS conditions, Brute force and dictionary attacks.

Module 4: MALICOUS CODE ***(06 Periods)***

Worms, viruses, Evading detection and elevating privileges: obfuscation, Virtual Machine obfuscation Persistent software techniques, Token kidnapping, Virtual machine Detection, Rootkits, Spyware, Attacks against privileged user accounts and escalation of privileges, Stealing information and Exploitation.

Module 5: DEFENSE AND ANALYSIS TECHNIQUES ***(06 Periods)***

Importance of memory forensics, Capabilities of memory forensics, Memory analysis frameworks, Dumping physical memory, Installing and using volatility, Finding hidden processes, Volatality analyst pack.
Honeypots, Malicious code naming, Automated malicious code analysis systems, Intrusion detection techniques

Total Periods:30

EXPERIENTIAL LEARNING

1. Observe the firewall settings on your personal computer or smartphone.
    - What configurations are enabled?
    - How does this firewall protect your device from threats?
2. Compare phishing, smishing, and vishing using real-life examples. Which of these do you think people are most vulnerable to, and why?
3. Research a recent DoS attack in the news.
    - What services were affected?
    - What preventive measures could have reduced the impact?
4. Explore your antivirus software logs.
    - What types of threats were blocked recently?
    - Were any of them worms, viruses, or spyware?
5. Reflect on the importance of intrusion detection systems (IDS).
    - How does an IDS differ from a firewall?
    - Why are both needed in an organisation's security framework?

RESOURCES

TEXT BOOKS:

1. James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials", CRC Press, 2011.
2. Chwan-Hwa(john) Wu,J. David Irwin, "Introduction to Cyber Security", CRC Press T&F Group.

REFERENCE BOOKS:

1. Nina Godbole and SunitBelpure, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley publications.
2. B.B.Gupta, D.P.Agrawal, HaoxiangWang, "Computer and Cyber Security: Principle s, Algorithm, Applications, and Perspectives", CRC Press, ISBN 9780815371335, 2018.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106129
2. https://www.coursera.org/professional-certificates/ibm-cybersecurity-analyst

WEB RESOURCES:

1. https://www.interpol.int/en/Crimes/Cybercrime
2. https://www.geeksforgeeks.org/ethical-hacking/cyber-security-tutorial/
3. https://owasp.org/www-project-top-ten/
4. https://www.netacad.com/courses/cybersecurity-essentials?courseLang=en-US

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25AI207601	**STATISTICS WITH R**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course introduces the basic concepts of statistics using R language. The course also deals with various types of sampling methods and its impact in the scope of inference through the computation of confidence intervals. The topics covered in the course also includes descriptive statistics, marginal and conditional distribution, statistical transformations, chi-squared test and ANOVA.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Import, manage, manipulate, structure data files and visualize data using R programming.

CO2. Identify trends and patterns in data using Marginal, Conditional distributions and Statistical transformations.

CO3. Analyse data using sampling and probability distribution methods and compute confidence intervals for statistical inference.

CO4. Apply chi-squared goodness-of-fit test, Pearson's 2-statistic and ANOVA to investigate the distribution of data.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION ***(05 Periods)***

Data, R's command line, Variables, Functions, The workspace, External packages, Data sets, Data vectors, Functions, Numeric summaries, Categorical data.

Module 2: BIVARIATE AND MULTIVARIATE DATA ***(07 Periods)***

Lists, Data frames, Paired data, Correlation, Trends, Transformations, Bivariate categorical data, Measures of association, Two-way tables, Marginal distributions, Conditional distributions, Graphical summaries, Multivariate data - Data frames, Applying a function over a collection, Using external data, Lattice graphics, Grouping, Statistical transformations.

Module 3: POPULATIONS ***(06 Periods)***

Populations, Discrete random variables, Random values generation, Sampling, Families of distributions, Central limit theorem, Statistical Inference - Significance tests, Estimation, Confidence intervals, Bayesian analysis.

Module 4: CONFIDENCE INTERVALS ***(06 Periods)***

Confidence intervals for a population proportion, p - population mean, other confidence intervals, Confidence intervals for differences, Confidence intervals for the median, Significance test - Significance test for a population proportion, Significance test for the mean (t-tests), Significance tests and confidence intervals, Significance tests for the median.

Module 5: GOODNESS OF FIT ***(06 Periods)***

The chi-squared goodness-of-fit test, The multinomial distribution, Pearson's □ 2-statistic, chi-squared test of independence and homogeneity, Goodness-of-fit tests for continuous distributions, ANOVA - One-way ANOVA, Using *lm* for ANOVA.

Total Periods: 30

EXPERIENTIAL LEARNING

1. The data set baby boom (Using R) contains data on the births of 44 children in a one- day period at a Brisbane, Australia, hospital. Compute the skew of the wt variable, which records birth weight. Is this variable reasonably symmetric or skewed? The variable running.time records the time after midnight of each birth. The command diff(running.time) records the differences or inter-arrival times. Is this variable skewed?

2. An elevator can safely hold 3, 500 pounds. A sign in the elevator limits the passenger count to 15. If the adult population has a mean weight of 180 pounds with a 25-pound standard deviation, how unusual would it be, if the central limit theorem applied, that an elevator holding 15 people would be carrying more than 3, 500 pounds?

3. The data set MLB Attend (Using R) contains attendance data for Major League Baseball between the years 1969 and 2000. Use lm to perform a t-test on attendance for the two levels of league. Is the difference in mean attendance significant? Compare your results to those provided by t-test.

RESOURCES

TEXT BOOKS:

1. John Verzani, *Using R for Introductory Statistics*, CRC Press, 2nd Edition, 2014.
2. Sudha G Purohit, Sharad D Gore, Shailaja R Deshmukh, *Statistics Using R*, Narosa Publishing house, 2nd Edition, 2021.

REFERENCE BOOKS:

1. Francisco Juretig, *R Statistics Cookbook*, Packt Publishing, 1st Edition, 2019.
2. Prabhanjan N. Tattar, Suresh Ramaiah, B. G. Manjunath, *A Course in Statistics with R*, Wiley, 2018.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_ma76/preview
2. https://onlinecourses.nptel.ac.in/noc19_ma33/preview
3. https://youtu.be/WbKiJe5OkUU?list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz
4. https://youtu.be/svDAkvh6utM?list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz
5. https://nptel.ac.in/courses/111104120

WEB RESOURCES:

1. https://www.geeksforgeeks.org/r-statistics/
2. https://www.geeksforgeeks.org/r-programming-exercises-practice-questions-and- solutions/
3. https://www.w3schools.com/r/r_stat_intro.asp
4. https://www.w3schools.com/r/r_stat_intro.asp
5. https://statsandr.com/blog/descriptive-statistics-in-r/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MG207601	**PROJECT MANAGEMENT**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite

COURSE DESCRIPTION: To understand the importance of decision-making while implementing any project and interpret and discuss the results of qualitative and quantitative analysis

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the basic introduction to project management

CO2. Apply the methods of project identification and selection.

CO3. Understand project allocation methods and evaluation.

CO4. Analyse the techniques for project time, review, and cost

CO5. Understand the factors of risk and quality of a project.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	2	1	2	1	-	-	-	-	-
CO2	1	1	2	2	-		-	-	-
CO3	2	2	1	2	1	-	-	-	-
CO4	3	1	2	2	1	-	-	-	-
CO5	2	2	1	2	1	1	-	-	-
Course Correlation Mapping	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION ***(05 Periods)***

Concept of project management, project definition and key features of projects, project life cycle phases, typical project management issues, basic project activities

Module 2: PROJECT IDENTIFICATION AND SELECTION ***(06 Periods)***

Identification and screening (brainstorming, strength and weakness in the system, environmental opportunities and threats), Project evaluation methods- Payback period, Net present value, Internal rate of return and project evaluation under uncertainty.

Module 3: PROJECT RESOURCE MANAGEMENT ***(07 Periods)***

Scheduling resources, resource allocation methods, project crashing and resource leveling, working of systems, design of systems, project work system design, project execution plan, project procedure manual project control system, planning scheduling and monitoring

Module 4: TIME AND COST MANAGEMENT ***(05 Periods)***

Time Management-Network diagram, forward and backward pass, critical path, PERT and CPM, AOA and AON methods, tools for project network, Cost management-earned value method

Module 5: RISK AND QUALITY MANAGEMENT ***(07 Periods)***

Risk identification, types of risk, risk checklist, risk management tactics, risk mitigation and contingency planning, risk register, communication management, Quality assurance and quality control, quality audit, methods of enhancing quality

Total Periods: 30

EXPERIENTIAL LEARNING

1. Refer to any video lecture on project evaluation methods and give a brief seminar using PPT

2. Select any company wherein you will get the details of activities and time and draw the project network diagram and submit a report.

3.

Activity	Predecessor Activity	Normal Time (Weeks)	Crash Time (Weeks)	Normal Cost (Rs.)	Crash Cost (Rs.)
A	-	4	3	8,000	9,000
B	A	5	3	16,000	20,000
C	A	4	3	12,000	13,000
D	B	6	5	34,000	35,000
E	C	6	4	42,000	44,000
F	D	5	4	16,000	16,500
G	E	7	4	66,000	72,000
H	G	4	3	2,000	5,000

Determine a crashing scheme for the above project so that the total project time is reduced by 3 weeks.

4. Collect any case study that discusses the process of probability calculation of success of the project and submit a report.

RESOURCES

TEXT BOOKS:

1. R.Panneerselvam and P.Senthil Kumar (2013), Project Management, PHI Learning Private Limited.
2. Prasanna Chandra (2014), Projects: Planning, Analysis, Selection, Financing, implementation, and Review.

REFERENCE BOOKS:

1. A Guide to the Project Management Body of Knowledge: (PMBOK Guide) by Project Management Institute, 2013.
2. Gopala Krishnan & Rama Murthy, A Text book of Project Management, McMillan India.
3. S. Choudhary (2004), Project Management, Tata McGraw Hill Publication.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_mg30/preview
2. https://archive.nptel.ac.in/courses/110/104/110104073/

Web Resources:

1. https://www.pmi.org/about/learn-about-pmi/what-is-project-management
2. https://www.manage.gov.in/studymaterial/PM.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MG207602	ESSENTIALS OF BUSINESS ETIQUETTE	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course develops the concept of business etiquette and the proper etiquette practices for different business scenarios. It builds student awareness of professional conduct and cultural sensitivity, preparing them to navigate diverse global environments with confidence, respect, and appropriate etiquette for every scenario.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. To understand the concept of Etiquette.

CO2. Develop life skills or etiquette in order to succeed in corporate culture.

CO3. Present oneself with finesse and making others comfortable in a business

CO4. Adopt behaviors consistent with standard workplace expectations

CO5. Demonstrate an understanding of professionalism in terms of workplace behaviors and lace relationships.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-
CO4	1	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	2	2	3	-	3	-	-	-	3

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION TO ETIQUETTE ***(06 Periods)***

Introduction to etiquette, benefits- Business etiquette – ABCs of etiquette- Manners, poor manners and good manners- - Role of good manners in business –Professional conduct and personal spacing.

Module 2: CLASSIFICATION OF ETIQUETTE ***(06 Periods)***

Telephone Etiquette - Email etiquette - Dining Etiquette - Dress Etiquette, - Online chat etiquette - Virtual Etiquette - Work place Etiquette

Module 3: MULTI-CULTURAL ETIQUETTE ***(06 Periods)***

Inclusivity and Diversity - cultural awareness –cultural sensitivity - Adaptability and Flexibility - Inter-cultural communication - Ethical Considerations -Taboos and practices

Module 4: WORKPLACE COURTESY AND BUSINESS ETHICS ***(06 Periods)***

Workplace Courtesy - Business Ethics - Hierarchy and Protocol - Developing good relations with peers, superiors, subordinates - Offering compliments and criticism- Preventing Sexual Harassment - Conflict Resolution Strategies

Module 5: NEW ISSUES IN ETIQUETTE & WORKPLACE SUCCESS *(**06Periods**)*

Ethical Issues in Business Etiquette - Cultural Differences and their Effects on Business Etiquette - Sexual Etiquette in the Workplace - Preventing Sexual Harassment- Professionalism - Interpersonal relations- Following Company Policy for Business Etiquette

Total Periods: 30

EXPERIENTIAL LEARNING

1 Role play activity in Telephone etiquette practices.

2 As a new employee, how do you follow workplace courtesies?

3 Group presentation of Etiquette in different countries.

4 Imagine you are a supervisor and explain your subordinates the importance of business etiquette.

5 You came to know that one of male employees in your company sexually harassed a female employee. As a boss of a company, how do you handle the situation and suggest steps to prevent sexual harassment at work place.

RESOURCES

TEXTBOOK:

1. Dhanavel, S.P. English and Soft Skills. Hyderabad: Orient Black Swan, 2021.

2 Pachter Barbara & Cowie Denis (2013) Essentials of Business Etiquette, New York: McGraw Hill Education.

REFERENCE BOOKS:

1 2. Fox Sue (2010) Business Etiquette for Dummies, New Jersey: Wiley Publications.

2 Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014

3 Kumar Suresh E, Shreehari P, Savithri J (2010) Communication Skills and Soft Skills: An Integrated Approach, Chennai: Pearson Education.

VIDEO LECTURES:

1 https://in.video.search.yahoo.com/yhs/search?fr=yhs-sz-002&ei=UTF-8&hsimp=yhs-002&hspart=sz&param1=2723087361&p=cultural+awareness+%E2%80%93cultural+sensitivity+video&type=type80160-2362144563#id=8&vid=11d76fd8f4c9b5419344ccfd30f291c1&action=click

2 https://in.video.search.yahoo.com/yhs/search?fr=yhs-sz-002&ei=UTF-8&hsimp=yhs-002&hspart=sz&param1=2723087361&p=cultural+awareness+%E2%80%93cultural+sensitivity+video&type=type80160-2362144563#id=9&vid=ea7c85dbd21b03e8dec303c23c6bcb7b&action=view

WEB RESOURCES:

1 https://theengine.biz/wp-content/uploads/2020/12/Business-Etiquette-ebook.pdf

2 https://insights.si/wp-content/uploads/hunt-chaney-l.-i-st.-clair-martin-j.-2007.-the-essential-guide-to-business-etiquette.pdf

3 https://www.scribd.com/document/732526337/Types-of-Business-Etiquette-and-its-Importance

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25LG207601	**TECHNICAL REPORT WRITING**	**2**	**-**	**-**	**-**	**2**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with preparing effective technical documents for both written and digital media, with particular emphasis on technical memos, problem-solving and decision-making reports, and organizational, product-support, and technical-information webs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate knowledge of Technical Report Writing and structures with a scientific attitude.

CO2. Analyze the process of writing in preparing effective reports.

CO3. Demonstrate styles of writing for Publication in a Scientific Journal.

CO4. Apply the process of referencing and editing techniques for effective communication in written documents.

CO5. Analyze the strategies in the technical report presentation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	-	-	-	-	-	2	-	3
CO2	2	3	2	-	-	-	2	-	3
CO3	3	-	-	-	-	-	2	-	3
CO4	2	-	-	-	3	-	2	-	3
CO5	2	3	2	-	2	-	2	-	3
Course Correlation Mapping	2	3	**-**	**-**	3	**-**	2	**-**	3

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION TO TECHNICAL REPORT WRITING ***(06 Periods)***

Concepts of Technical Report, Types of Reports, Planning Technical Report Writing, Components of a Technical Report, Report Writing in Science and Technology, Selecting and Preparing a Title, Language Use

Module 2: PROCESS OF WRITING ***(06 Periods)***

Writing the 'Introduction', Writing the 'Materials and Methods, Writing the Findings/Results, Writing the 'Discussion', Preparing and using "Tables'.

Module 3: STYLE OF WRITING ***(06 Periods)***

Preparing and using Effective 'Graphs', Citing and Arranging References, Writing for Publication in a Scientific Journal.

Module 4: REFERENCING ***(06 Periods)***

Literature citations, , Bibliographical data according to ISO standards, Citations in the text, Copyright, and copyright laws, the text of the Technical Report, Using a word processing and desktop publishing (DTP) systems, Document or page layout, hints on editing Typographic details, Cross-references.

Module 5: PRESENTATION ***(06 Periods)***

Presentation with appropriate pointing, Dealing with intermediate questions, Review and analysis of the presentation, Rhetoric tips from A to Z.

Total Periods: 30

EXPERIENTIAL LEARNING

1 Prepare a report on technologies of modern times that enriched the originality of research works and their impacts on society concerning plagiarism.

2 Make PowerPoint presentations on the various style of writing academic reports.

3 Error-free Reports are so important for successful communication and sharing of information. Prepare a detailed chart on proofreading techniques to make a report effective and error-free.

4 Design a logo for a company and write down the copy-right laws for that.

5 Read research articles from any international journal of science and technology and differentiate research writing from other academic and non-academic writings.

6. Write an organizational memo Include a heading, introduction, and summary at the beginning of your memo, and present the details of your discussion in a logical order. Use headings and topic or main-idea sentences to clarify the organization.

7. Prepare an appraisal report on the staff performance of your company.

8. Prepare a PowerPoint presentation on the annual performance report of a company.

9. Critically review and write a report on any one of the recently released products.

10. Read the newspaper and write a detailed report about the content coverage and analyse the factors for the popularity of the newspaper.

RESOURCES

TEXTBOOK

1. RC Sharma Krishna Mohan, *"Business Correspondence and Report"* McGraw-Hill Publishing. Writing," *Tata Company Limited, New Delhi"*, 3rd Edition, 2005 (reprint).
2. Patrick Forsyth, *"How to Write Reports and Proposals",* THE SUNDAY TIMES (Kogan Page), New Delhi, Revised 2ndEdition, 2010.

REFERENCE BOOKS:

1. John Seely, *"The Oxford Writing & Speaking",* Oxford University Press, Indian Edition
2. Anne Eisenberg, "*A Beginner's Guide to Technical Communication"*, McGraw-Hill Education (India) Private Limited, New Delhi, 2013.

VIDEO LECTURES:

1. https://vimeo.com/143714818
2. https://digitalmedia.sheffield.ac.uk/media/002.+The+Anatomy+of+a+Technical+Report/1_u8wntcge

WEB RESOURCES:

1. http://www.resumania.com/arcindex.html
2. http://www.aresearchguide.com/writing-a-technical-report.htm
3. http://www.sussex.ac.uk/ei/internal/forstudents/engineeringdesign/studyguides/tec report writing

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM202002	OBJECT ORIENTATED PROGRAMMING THROUGH JAVA	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction to Object Oriented Programming, Classes and Objects; Inheritance, Packages, Interfaces; Exception handling, Multithreading; Collection Classes; Files, Connecting to a Database, Swings, Event handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the basic programming constructs of Java and OOP concepts to developJava programs for a given scenario.

CO2. Design solutions to the problems by using control statements, interfaces, utility classes and Packages.

CO3. Solve real time problems using object oriented programming features – polymorphism, inheritance, exception handling and multithreading.

CO4. Apply multithreading mechanism to enhance the performance of a system.

CO5. Develop user interfaces using GUI programming techniques and Work Independently and Communicate Effectively in Oral and Written forms.

CO-PO-PSO Mapping Table:

Cours Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	-	3	-	-	3	-	3	3	-
CO2	3	3	3	-	3	-	-	3	-	3	3	-
CO3	3	3	3	-	3	-	-	3	-	3	3	-
CO4	3	3	3	-	3	-	-	3	-	3	3	-
CO5	3	3	3	-	3	-	-	3	-	3	3	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**3**	-	**3**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO JAVA PROGRAMMING ***(09 Periods)***

Basics of Java: History and Basics of Java, Java Environment, JDK Tools, Java Virtual Machine, Java Program Structure, Java Language- Tokens, Keywords, Constants, Variables, and Data Types. Operators and Expressions, Control Statements, Decision Making, Branching and Looping, Labeled Loops Statement, Jump Statements: Break, Continue, and Return, Command Line Argument.

Module 2: CLASSES AND OBJECTS, INHERITANCE,ARRAYS ***(09 Periods)***

Classes and Objects: Classes, Objects, Defining a Class, Adding Variables and Methods, Creating Objects, Accessing Class Members, Constructors, Static Members, Nesting of Methods,
Inheritance: Basics Types, Extending a Class, Using Super, Method Overloading, Method Overriding, Final Variables and Methods, Final Classes, Finalize Method, Abstract Methods and Classes, Visibility Control.
Arrays: One and Two Dimensional Arrays, String Array, String and String Buffer Classes.

Module 3: INTERFACES , PACKAGES AND EXCEPTION HANDLING ***(09 Periods)***

Interfaces: Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables.
Packages: System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using Package, Adding a Class to a Package.
Exception Handling: Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally.

Module 4: THREADS, MULTITHREADING AND EVENT HANDLING ***(09 Periods)***

Java Thread Model: Life Cycle of a Thread, Thread Class, Runnable Interface.
Multithreading: Concepts of multithreading , Differences between process and thread, Creating multiple threads using Thread class ,Synchronization, Thread priorities, Inter thread communication.
Event Handling- Events, Event sources, Event classes, Event Listeners, Examples: handling a button click, handling mouse and keyboard events, Adapter classes.

Module 5 Applets,JAVA SWING ,I/O STREAM ***(09 Periods)***

GUI Programming With Applets: Applets - Applet Class, Applet skeleton, Simple Applet,Applets Life Cycle; Delegation event model - Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events.
Exploring Swing Controls:JLabel and Image Icon, JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.
I/O Stream: Introduction of I/O Stream, Types of Streams, Stream Class Hierarchy, Using File Class, Byte Streams Vs Character Streams, Text file Vs Binary File.

Total Periods: 45

LIST OF EXERCISES:

1. Write a Program in Java to Display Odd Number from 1 to 100.
2. Write a Program in Java to Determine Whether a Number Input from Keyboard is Prime Number Or Not
3. Write a Program in Java to Calculate the Factorial of a Number.
4. Write a program on class and object in java
5. Write a Program in Java to Show Multilevel Inheritance.

6. Write a Program in Java to Check Given String is Palindrome String Or Not in Java
7. Write a program to illustrate Function Overloading & Function Overriding methods in Java
8. Write a program to illustrate the implementation of abstract class
9. Write a program to implement Exception handling
10. Write a program to create packages in Java
11. Write a program on interface in java
12. Write a program to Create Multiple Threads in Java
13. Create a Java GUI Application Using Labels and Text fields.
14. Create a Java GUI Application Using Radio buttons.
15. Create a Java GUI Application Using Check boxes.

Resources:
TEXT BOOKS:

1. Core Java: An Integrated Approach, Authored by Dr. R. Nageswara Rao & Kogent Learning Solutions Inc.
2. E.Balaguruswamy, Programming with JAVA, A primer, 3e, TATA McGraw- Hill Company.
3. John R. Hubbard, Programming with Java, Second Edition, Schaum's outline Series, TMH.
4. Deite and Deitel. Java TM: How to Program, PHI (2007)

REFERENCE BOOKS:

1. Y. Daniel Liang ,2003, An Introduction to JAVA Programming, Prentice-Hall of India Pvt., Ltd.
2. Cay S. Horstmann and Gary Cornell,2005, Core JavaTM2 Volume I-Fundamentals, 7th Edition- Pearson Education.
3. Ken Arnold, James Gosling and David Holmes,2003, The JavaTM Programming Language,3rd Edition, Pearson Education
4. Peter Norton, "Java Programming", Techmedia Publications.
5. Joseph Weber, "Using Java 1.2", PHI, ISBN -81-203-1558-8.

VIDEO LECTURES:

1. https://docs.oracle.com/javase/tutorial/index.html.
2. https://nptel.ac.in/courses/106105191
3. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

WEB RESOURCES:

1. https://www.w3schools.com/java/
2. https://www.javatpoint.com/java-tutorial
3. https://www.tutorialspoint.com/java/index.htm
4. https://docs.oracle.com/javase/tutorial/
5. https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM202003	DATA BASE MANAGEMENT SYSTEMS	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction to database systems; Database design; Relational model; Relational algebra; SQL queries; Constraints and triggers; PL/SQL;Schema refinement and normal forms; Transaction management; Concurrency control; Overview of storage and indexing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the concepts of ER-modeling and normalization to design viable data models for a given problem.

CO2. Formulate relational database schemas, apply suitable integrity constraints, for querying databases.

CO3. Use SQL to store, query, and manipulate data in relational databases

CO4. DevelopPL/SQLblockstocentralizedatabaseapplicationsformaintainabilityand reusability

CO5. Analyzetransactionprocessing,concurrencycontrolandstoragemethodsfordatabase management

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO 5	PO6	PO 7	PO 8	PO 9	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	3	-	-	-	3
CO2	1	2	-	-	-	-	-	3	-	2	-	3
CO3	3	2	-	-	-	-	-	3	-	1	-	3
CO4	1	2	3	2	-	-	-	3	-	3	-	2
CO5	3	3	-	-	-	-	-	3	-	2		3
Course Correlation Mapping	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**3**	-	**2**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO DATABASE SYSTEMS AND DATABASE DESIGN ***(09 Periods)***

Introduction to Database Systems: Database system applications, Purpose of database systems, View of data , Data abstraction, Instances and schemas, Data models; Database languages- Data Definition Language, Data Manipulation Language; Database architecture, Database users and administrators.

Introduction to Database design: Database design and ER diagrams, Entities, attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual Design with ER model.

Module 2: RELATIONAL MODEL AND RELATIONAL ALGEBRA ***(09 Periods)***

Relational Model: Creating and modifying relations, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views.
Relational Algebra: Preliminaries, Relational Algebra operators

Module 3: SQLAND PL/SQL ***(09 Periods)***

SQL: Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complex integrity constraints in SQL, Triggers and active databases.
PL/SQL: Generic PL/SQL block, PL/SQL data types, Control structure, Procedures and functions ,Cursors, Database triggers

Module 4: Design using Normalization ***(09 Periods)***

Data Redundancy and Update Anomalies, Functional Dependencies, Process of Normalization:, Lossless-Join algorithms of Normal Forms First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multi valued dependencies, Fourth normal form, Join dependencies, Fifth normal form

Module 5: TRANSACTIONS AND CONCURRENCY CONTROL ***(09 Periods)***

Properties of Transaction, Concurrency Control, The Need for Concurrency Control ,Serializability and Recoverability Locking and **Timestamp** Methods ,Multi version Techniques, Recovery – Need, Techniques.
Concurrency Control: Lock Based Protocols, Timestamp Based Protocols, Validation BasedProtocols, Multiple Granularity, Deadlock Handling.

Total Periods: 45

LIST OF EXERCISES:

1. Design and analyze an ER Model for the following use case. Roadway Travels‖ is in business since 1977 with several buses connecting different places in India. Its main office is located in Hyderabad. The company wants to computerize its operations in the following areas:

   - Reservations.
   - Ticketing.
   - cancellations

   Reservations: Reservations are directly handled by booking office. Reservations can be made 60 days in advance in either cash or credit. Incase the ticket is not available ,a wait listed ticket is issued to the customer. This ticket is confirmed against the cancellation. Cancellation and Modification:

   Cancellations are also directly handed at the booking office. Cancellation charges will be

charged. Waitlisted tickets that do not get confirmed are fully refunded.

2. a). Implement Data Definition Language commands -Create, Alter, Drop, Truncate, and Rename.

   b).ImplementDataManipulationLanguagecommands-Insert,Select,Update,and Delete.

3. Implement various types of integrity constraints - NOT NULL constraint, DEFAULT constraint, UNIQUE constraint, PRIMARY key, FOREIGN key, CHECK constraint.

4. Implement group functions with different operators such as aggregate operators, group by, having and order by.

5. a).Creation of views ,synonyms ,sequence, indexes and save point.

   b).Implement various types of joins-outer join and inner join.

6. Construct PL/SQL block for the following.

   a) To determine whether a number is palindrome
   b) To determine whether a number is an Arm strong number

7. Write a program in PL/SQL to update the salary of a specific employee by8% if the salary exceeds the mid-range of the salary against this job and update up to mid-range if the salary is less than the mid-range of the salary, and display a suitable message.

8. Develop a PL/SQL program that displays the name and address of a student whose ID is given. If there is no student with the given student ID in the database, the program should raise a run-time exception NO_DATA_FOUND, which should be captured in the EXCEPTION block

9. a) Write a procedure that accepts two numbers and displays their sum.
   b)Write procedures to demonstrate IN, INOUT and OUT parameters

10. Develop a suitable student database application by considering appropriate attributes. Couple of attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled and internal assessment Using TRIGGERS for the following

    a) Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the concerned head of the department.
    b) Whenever, the marks in an internal assessment test are entered, check if the marks are less than 40%; if so, and notify the concerned head of the department

RESOURCES

TEXT BOOKS:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems,Mc Graw Hill, 3rdEdition, 2014.

2. Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, Database System Concepts, McGrawHill, 7th edition, 2019.

REFERENCE BOOKS:

1. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB publications, 4 thEdition, 2017.

2. RamezElmasri,ShamkantB.Navathe,FundamentalsofDatabaseSystems,7th Edition,Pearson, 2015.

VIDEO LECTURES:

1. https://swayam.gov.in/nd1_noc19_cs46/preview

2. https://www.classcentral.com/course/swayam-introduction-to-database-systems17660

WEB RESOURCES:

1. https://nptel.ac.in/courses/106105175

2. https://onlinecourses.nptel.ac.in/noc21_cs04/preview

3. https://www.coursera.org/learn/database-management

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM201003	**COMPUTER NETWORKS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The course introduces an overview of the concepts and fundamentals of computer networks, data communication concepts and techniques in a layered network architecture and their protocols, switching and routing, types of communication, varioustypes of networks (LAN, MAN, WAN and Wireless networks); bridges, routers and gateways; ,network congestion, network topologies, network configuration and management, network model components, error detection and recovery; and local and remote procedures.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the types of network topologies, layers and protocols.

CO2. Evaluate sub netting and routing algorithms for finding optimal paths in networks.

CO3. Solve problems related to flow control, error control and congestion control in data transmission.

CO4. Assess the impact of wired and wireless networks in the context of network protocols Like DNS, SMTP, HTTP, and FTP.

CO5. Assess the impact of wired and wireless networks in the context of network protocols such as Ethernet, Bluetooth, DNS, WWW, E-Mail, and Streaming.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-		-	3
CO2	3	2	-	3	-	-	-	-	-		-	3
CO3	3	2	-	2	-	-	-	-	-		-	3
CO4	3	2	2	2	2	2	-	-	-	-	-	-
CO5	3	-	2	-	2	2	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**2**	**3**	**2**	**2**	**-**	**-**	-		-	**3**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION AND PHYSICAL LAYER (08 Periods)

Introduction: Uses of computer networks, Types, Network technology from local to global, Examples of networks, Network protocols, Reference models.

Physical Layer: Guided transmission media, Wireless transmission, Using the spectrum for transmission, Communication satellites, and Comparing different access networks.

Module 2: DATA LINK LAYER AND MEDIUM ACCESS CONTROL SUBLAYER (10 Periods)

Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols.

Medium Access Control Sub layer: ALOHA, Carrier sense multiple access protocols, Collision free protocols. Ethernet, Wireless LANs, Bluetooth, Data link layer switching.

Module 3: NETWORK LAYER *(07 Periods)*

Network layer design issues, Routing algorithms - Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing, Any cast routing; Traffic management at the network layer, Software Defined Networking (SDN), Network layer in the internet-The IP version-4 protocol, IP addresses, IP version-6, Internet control protocols, OSPF, BGP.

Module 4: TRANSPORT LAYER *(10 Periods)*

Transport Layer: Process-to-Process Delivery, UDP, TCP, Data traffic, Congestion and Control, Quality of service (QOS) and techniques to improve QOS, Integrated services, QOS in Switched networks. Security: Introduction. Symmetric-key cryptography, public key cryptography, Message security, Digital signature, User authentication, Key management, Kerberos. Communication Security, Authentications Protocols, E-mail Security, Web security, Social Issues.

Module 5: APPLICATION LAYER *(10 Periods)*

Domain Name System - The DNS Lookup Process, The DNS Name Space and Hierarchy, DNS Queries and Responses, Name Resolution. Electronic mail-Architecture and services, User agent, Message formats, Message transfer, Final delivery; The World Wide Web- Architectural overview, HTTP, HTTPS; Streaming audio and video- Digital Audio, Video, Streaming Stored Media, Real-Time Streaming.

Total Periods: 45

EXPERIENTIAL LEARNING:

1 Describe the study of LAN environment
2 Describe briefly about Networking commands in Linux
3 Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4 Implement Dijkstra's algorithm to compute the shortest path through a network.
5 Implement distance vector routing algorithm for obtaining routing tables at each node.
6 Create a simple LAN with hubs and switches and monitor the data flow using Packet Tracer Simulator.
7 Construct a LAN with single/multiple router and share data to local and remote network using Packet Tracer Simulator.

RESOURCES

TEXT BOOKS:

1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, Pearson, 6th Edition, 2022.
2. William Stallings, Data and Computer Communications, 10th Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill, 5th Edition, 2017.
2. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 7th Edition, 2022.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106091
2. https://www.digimat.in/nptel/courses/video/106105183/L01.html
3. https://www.youtube.com/watch?v=6_PINy02_g0
4. http://ns2simulator.com/ns2-tcp-congestion-control/

WEB RESOURCES:

1. Virtual Labs (Computer Networks Lab – http://vlabs.iitb.ac.in/vlabs-dev/labs_local/ computer-networks/ labs/explist.php)
2. Virtual Labs (Advanced Network Technologies Virtual Lab - http: //vlabs.iitkgp.ernet.in /ant)
3. https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/networking-basics.html
4. https://www.ibm.com/in-en/cloud/learn/networking-a-complete-guide
5. https://ipcisco.com/cisco-packet-tracer-configuration-examples/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM202004	**SOFTWARE ENGINEERING**	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Concepts of Software Engineering; Software Process Models; Conventional and Agile Process Models; Software Requirements Engineering Process; System Analysis; Architectural Design; User Interface Design and Re- engineering; Software Testing; Risk and Quality Management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Fundamental concepts of software engineering and analyze process models required to develop a software system.

CO2. Analyze software requirements and model requirements for the given scenario.

CO3. Apply design concepts and metrics for software development.

CO4. Apply testing strategies and techniques for quality software.

CO5. Analyze risks in software development life cycle and apply risk strategies to mitigate risks.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	3	-	3
CO2	2	3	-	-	-	3	3	2	-	2	-	3
CO3	2	3	3	2	-	2	2	-	-	3	-	3
CO4	2	-	-	-	2	3	-	-	-	2	-	2
CO5	2	-	-	-	2	3	-	-	-	2		3
Course Correlation Mapping	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	-	**2**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: SOFTWARE ENGINEERING AND SOFTWARE PROCESS ***(11 Periods)***

A Generic view of process: The Nature of Software, Software Engineering- Software Engineering Layers; The Software Process, Software Engineering Practice, Software myths.

Process models: A Generic Process Model, Prescriptive Process Models-The Waterfall Model, Incremental Process Models, Specialized Process Models; The Unified Process, Agile Development-Agility, Agile Process, Extreme Programming (XP), Scrum, Dynamic System Development Method, Agile Modeling (AM), Agile Unified Process (AUP).

Module 2: REQUIREMENTS ANALYSIS AND SPECIFICATION ***(07 Periods)***

Requirements Engineering: Functional and non-functional requirements, The software requirements document, Requirements specifications, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Requirements Modeling: Requirements Analysis, Data Modeling Concepts, Flow-Oriented Modeling,Scenario based Modeling, UML Models that supplement the Use Case, Case study on Requirements modeling for Web and Mobile Apps.

Module 3: DESIGN ENGINEERING AND METRICS ***(09 Periods)***

Design using UML: Class Diagram - Terms and concepts, Use case Diagram - Terms and concepts, Activity Diagrams - Terms and concepts, Interaction diagrams - Terms and concepts, State machine Diagram- Terms and concepts, Component Diagram- Terms and concepts, Deployment Diagram- Terms and concepts.

Process and Project Metrics: Metrics in the process and project domains, Software Measurement, Metrics for software quality.

Module 4: TESTING AND MAINTENANCE ***(09 Periods)***

Software testing fundamentals,Internal and external views of Testing-white box testing - basis path testing,control structure testing,black box testing- Regression Testing , Unit Testing , Integration Testing , Validation Testing , System Testing And Debugging.

Software Implementation Techniques: Coding practices,Refactoring,Maintenance and Reengineering-BPR model-Reengineering process model,Reverse and Forward Engineering.

Module 5 PROJECT MANAGEMENT ***(09 Periods)***

Software Project Management: Estimation , LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model , Project Scheduling , Scheduling, Earned Value Analysis Planning , Project Plan, Planning Process, RFP Risk Management – Identification, Projection , Risk Management-Risk Identification-RMMM Plan- CASE TOOLS

Total Periods: 45

LIST OF EXERCISES :

1. Study and usage of software project management tools such cost estimates and scheduling.
2. Documentation generators –Study and practice of Documentation generators.

3. Data Modeling using automated tools.

4. Structure charts, Data Flow Diagrams, Decision tables and ER diagrams for
   a. Banking System
   b. Railway Reservation System
   c. Hotel management system
   d. Inventory Control System
   e. Library management system
5. Process and Project metric- Implementation of COCOMO model to estimate the project parameters for a given problem.
6. Software Requirement Specification Developing the SRS for the given project.
7. UML diagram-Building the Class and Object diagrams for the given project.
8. UML diagram-Building the Deployment and Timing diagrams for the given project.
9. UML diagrams-Activity diagram for the given project.
10. UML diagram- Building the Sequence and Use case diagrams
11. UML diagram-State chart diagram
12. Software Testing-Implementation of various testing approaches of white box testing
13. Case study for risk management.

RESOURCES

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering - A Practitioner's Approach, McGraw-Hill,Eight Edition, 2015.
2. Ian Sommerville, Software Engineering**,** Pearson Education, Ninth Edition, 2011.

REFERENCE BOOKS:

1. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age InternationalPublishers, Third Edition, 2007.
2. Shely Cashman Rosenblatt, Systems Analysis and Design, Thomson Publications, SixthEdition, 2006.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105087/
2. https://nptel.ac.in/courses/106105182/

WEB RESOURCES:

1. https://www.coursera.org/courses?query=software%20engineering
2. https://www.javatpoint.com/software-engineering-tutorial
3. https://www.geeksforgeeks.org/software-engineering/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM202005	PYTHON PROGRAMMING	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Basics of Python programming, Control structures, Lists, Tuples, Strings, Sets, Dictionaries, Regular expressions, Functions, File handling, Objectoriented programming, Exception handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Python constructs, sequences, sets and dictionaries to solve basic computational problems.

CO2. Apply the concepts of regular expressions for searching patterns in strings.

CO3. Develop and use Python modules to provide solutions to problems.

CO4. Apply the knowledge of file operations in Python for file processing.

CO5. Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.

CO6 Work independently and communicate effectively oral and written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	3	-	3	-	-
CO2	3	2	-	-	3	-	-	3	-	3	-	-
CO3	3	3	3	3	3	-	-	3	-	3	-	-
CO4	3	3	3	2	3	-	-	3	-	-	-	-
CO5	3	3	3	3	3	-	-	3	-	-	-	-
C06	-	-	-	-	-	3	-	3	-	-		
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	-	-	**3**	-	**3**	-	-

Correlation Levels: 3: High; 2: Medium;1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO PYTHON PROGRAMMING: ***(07 Periods)***

Introduction: Introduction to Python, Tokens, Variables, Literals, Identifiers, Keywords, Special symbols, Operators, Fundamental datatypes, Expressions, Type conversions, Handling Input andoutput in Python.

Module 2: CONTROL STRUCTURES ***(08 Periods)***

Selection Statements: if statement, if-else statement, if-elif-else statement, nested-if statement.
Iterative Statements: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

Module 3: SEQUENCES, SETS, DICTIONARIES AND REGULAR EXPRESSIONS ***(11 Periods)***

Sequences: Lists and operations , Creating, Inserting elements, Updating elements, Deleting elements, Searching and sorting, List comprehensions, Nested lists;
Tuples , Creating, Searching and sorting, Nested tuples;
Strings: Initializing a string and string operations, String handling methods, String formatting.
Sets: Set creation, Set operations.
Dictionaries: Operations on dictionaries, Dictionary methods, Sorting elements using lambdas.

Module 4: FUNCTIONS AND FILE HANDLING ***(09 Periods)***

Regular Expressions: Regular expressions, Sequence characters in regular expressions, Quantifiers in regular expressions, Special characters in regular expressions.
Functions: Need for functions, Function definition, Function call, Variable scope and lifetime, Return statement, Positional arguments, Keyword arguments, Default arguments and variable length arguments, Recursive functions, Lambda functions, Generators.
File Handling: Types of files, Opening and closing files, Reading and writing data

Module 5: OBJECT ORIENTED PROGRAMMING AND EXCEPTION HANDLING ***(10 Periods)***

Object Oriented Programming: Introduction to object-oriented programming, Classes and objects, Inheritance and polymorphism, Abstract Classes and interfaces.
Exception Handling: Errors in a python program, Exceptions, Exception handling, Types of exceptions, Except block, Assert statement, User defined exceptions.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Write a program to demonstrate different number datatypes in python
2. Write a program to perform different arithmetic operations on numbers in python.
3. Write a python script to convert a given decimal number into octal, hexadecimal and binary.
4. Write a python script to read four integer values separated with commas and display the sum of those four numbers.

5. Write a program to create, concatenate and print a string and accessing substring from a given string.
6. Write a python script to display Fibonacci sequence of numbers using while loop, for loop and do-while loop constructs.
7. Write a python script to perform the following operations on Lists:
   (i) Matrix Addition.
   (ii) Matrix Multiplication.
8. Write a program to demonstrate working with dictionaries in python.
9. Write a python program to find largest of three numbers
10. Write a python program to construct the following pattern using nested for loop
11. Write a python script to read details of N students – name, roll number, branch and age. Sort the student details based on their names and display.
12. Design a function that can perform sum of two or three or four numbers.
13. Write a python script to implement Towers of Hanoi problem.
14. Write a python script to copy the content of one file into another file.
15. Write a python script to read all the strings from the text file and display them

RESOURCES

TEXT BOOKS:

1. R. Nageswara Rao, Core Python Programming, 2nd Edition, Dreamtech Press, 2018.

REFERENCE BOOKS:

1. Reema Thareja, Python Programming using Problem Solving Approach, 1st Edition, Oxford University Press, 2017.
2. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India, 2016.

SOFTWARE/TOOLS:

1. Python 3.10.5

VIDEO LECTURES:

1. http://nptel.ac.in/courses/106102064
2. http://nptel.ac.in/courses/106106127/
3. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview
2. https://www.coursera.org/specializations/python
3. https://www.coursera.org/learn/python-for-applied-data-science-ai
4. https://beginnersbook.com/2018/03/python-tutorial-learn-programming/
5. https://www.javatpoint.com/python-tutorial

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM201002	**CLOUD COMPUTING**	3	-	-	-	3

Pre-Requisite

Anti-Requisite **-**

Co-Requisite **-**

COURSE DESCRIPTION: This Course provides a detailed discussion on Virtualization, Cloud Computing Fundamentals along with Deployment Models. Able to understand Cloud Computing Architecture to work with Cloud adopting Cloud Computing Mechanisms and implementing Cloud Security Mechanisms in Cloud Service Models.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of Cloud Computing, Cloud-Enabling Technology, Cloud Architectures

CO2. Apply virtualization and develop virtual environments for the deployment of cloud applications.

CO3. Design applications using cloud service models salesforce.com (SaaS), Google App Engine (PaaS), Amazon (IaaS) and deploy in cloud.

CO4. Identify and analyze the Cloud-Enabling Technologies and architectures for developing the applications to solve e-commerce problems.

CO5. Adhere to ethics and adapt cloud security mechanisms and Cloud-Based Security Groups for providing security to societal applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	3	3
CO2	3	3	3	-	3	-	-	-	-	-	3	3
CO3	3	3	-	-	3	-	-	-	-	-	3	3
CO4	2	3	3	-	3	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: FUNDAMENTAL CLOUD COMPUTING (08 Periods)

Understanding Cloud Computing: Origins and Influences, Concepts and Terminology, Goals and Benefits, Risks and Challenges.

Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

Module 2: CLOUD COMPUTING MECHANISMS AND ARCHITECTURE (08 Periods)

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

Fundamental Cloud Architectures: Workload Distribution, Resource Pooling, Dynamic Scalability, Elastic Resource Capacity, Service Load Balancing, Cloud Bursting, Elastic Disk Provisioning, Redundant Storage.

Module 3 CLOUD COMPUTING ADVANCED ARCHITECTURES (10 Periods)

Advanced Cloud Architectures: Hypervisor Clustering, Load Balanced Virtual Server Instances, Non Disruptive Service Relocation, Zero Downtime, Cloud Balancing, Resource Reservation, Dynamic Failure Detection and Recovery, Bare-Metal Provisioning, Rapid Provisioning, Storage Workload Management.

Specialized Cloud Architectures: Direct I/O Access, Direct LUN Access, Dynamic Data Normalization, Elastic Network Capacity, Cross-Storage Device Vertical Tiering, Intra Storage Device Vertical Data Tiering, Load Balanced Virtual Switches, Multipath Resource Access, Persistent Virtual Network Configuration, Redundant Physical Connection for Virtual Servers, Storage Maintenance Window.

Module 4 CLOUD SECURITY (10 Periods)

Fundamental Cloud Security: Threat Agents, Cloud Security Threats, Additional Considerations, Case Study Example.

Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-On, Cloud-Based Security Groups, Hardened Virtual Server Images.

Module 5 CLOUD SERVICE MODELS (08 Periods)

Cloud Service Models: Software as a Service (SaaS) - Characteristics, Examples and Applications. Platform as a Service (PaaS) - Characteristics, Examples and Applications. Infrastructure as a Service (IaaS) - Characteristics, Examples and Applications.

Case Study: SaaS: Salesforce.com, Facebook.com; PaaS: Google App Engine, MS-Azure and IBM Bluemix; IaaS: Amazon EC2, Amazon S3 and Netflix.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Create a word document of your class time table and store locally and on the cloud with doc, and pdf format.
2. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula DA=10% OF BASIC HRA=30% OF BASIC PF=10% OF BASIC IF BASIC<=3000 12% OF BASIC IF BASIC>3000 TAX=10% OF BASIC IF BASIC<=1500 =11% OF BASIC IF BASIC>1500 AND BASIC<=2500 =12% OF BASIC IF BASIC>2500 NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX.
3. Prepare a ppt on cloud computing – Introduction, models, services, and Architectures. PPTs should contain explanations, images and at least 20 slides
4. iCreate your resume in a neat format using google cloud Programs on PaaS.
5. Create an EC2 instance and invoke Ubuntu operating system with a given set of configuration on amazon web services under IaaS.
6. Create S3 bucket and store a file in it using AWS.
7. Configure web server on Amazon Linux instance with ElasticIP.
8. Develop a web application which contains employee salary information and calculate gross and total sal using the formula DA=10% OF BASIC HRA=30% OF BASIC PF=10% OF BASIC IF BASIC<=3000 12% OF BASIC IF BASIC>3000 TAX=10% OF BASIC IF BASIC<=1500 =11% OF BASIC IF BASIC>1500 AND BASIC<=2500 =12% OF BASIC IF BASIC>2500 NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX.
9. Generating reports in Salesforce admin.
10. Process of User Management in Salesforce admin.
11. Procedure of Data Management in Salesforce admin.
12. Procedure of providing data security using control access to data using point and click tools in Salesforce admin.

RESOURCES:

TEXT BOOKS:

1. 1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini "Cloud Computing- Concepts, Technology & Architecture," Pearson Publication, 2014.
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley India Pvt. Ltd, 2011.
3. George Reese "Cloud Application Architectures," O'Reilly Publications, 2009.

REFERENCE BOOKS:

1. 1. 2. 3. 4. Thomas Erl and Ricardo Puttini "Cloud Computing- Concepts, Technology & Architecture," Pearson, 2013.
2. John W. Rittinghouse, James F. Ransome, "Cloud Computing implementation, Management and Security," CRC Press, ISBN: 9788120341609, Taylor & Francis group, 2010.
3. Barrie Sosinsky, "Cloud Computing Bible," Wiley India Pvt Ltd, 2011.
4. Rajkumar Buyya, James Broberg and Andrzej Goscinski, "Cloud computing principles and paradigms", John Wiley and Sons, 2011

SOFTWARE/TOOLS: 1. 2. WEKA R Studio

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=a4M3GdI5UFY
2. https://www.youtube.com/watch?v=ykZ_UGcYWg&list=PLLspfyoOYoQcI6Nno3gPkq0h5YSe81hsc
3. https://www.youtube.com/watch?v=hEQkqpmtxY&list=PLLspfyoOYoQcI6Nno3gPkq0h5YSe81hsc&index=6

SOFTWARE/TOOLS:

1. Google App Engine
2. Amazon Web Services
3. Sales Force

WEB RESOURCES:

1. www.salesforce tutorial.com
2. https:// trailhead.salesforce.com/en/home
3. https://MKyong.com/tutorials/google-App- engine-tutorial/
4. https://aws.amazon.com

VIDEO LECTURES:

1. https://youtu.be/uroryFU78gM
2. https://youtu.be/Pg5nj90xh68
3. https://youtu.be/2Dd2ducs-ic
4. https://youtu.be/Ijkvx1u0w6o
5. https://youtu.be/sMlOsYBMRag

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM202006	DATA STRUCTURES	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

This course provides a detailed discussion and hands-on experience on Analyze step by step and develop algorithms to solve real world problems. Implementing various data structures like Stacks, Queues, Linked Lists, Trees and Graphs, various searching & sorting techniques

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand compare functions using asymptotic analysis and describe the relative merits of worst-, average-, and best-case analysis.

CO2. Analyzing various linear data structures and Stacks.

CO3. Implementing data structures like Queues, Linked Lists.

CO4. Apply data structures like Trees and Graphs.

CO5. Understanding various searching & sorting techniques

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	1	-	3
CO2	3	2	3	3	-	-	-	-	-	3	2	3
CO3	3	2	2	3	3	-	-	-	-	2	2	3
CO4	3	2	2	3	-	-	-	-	-	3	-	3
CO5	2	-	-	-	-	2	-	-	-	2	2	3
Course Correlation Mapping	3	2	2	3	3	2	-	-	3	-	-	3

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO DATA STRUCTURE (09 Periods)

Basics: Algorithm Specifications: Performance Analysis and Measurement (Time and space analysis of algorithms- Average, best and worst case analysis).
Introduction To Data Structure: Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear & Non Linear Data Structures

Module 2: LINEAR DATA STRUCTURE ARRAY & STACKS (10 Periods)

Linear Data Structure Array: Representation of arrays, Applications of arrays, sparse matrix and its representation.

Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi.

Module 3: QUEUES & LINKED LIST (09 Periods)

Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue.

Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.

Module 4: TREES AND GRAPHS (08 Periods)

Trees: Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees- Some balanced tree mechanism, AVL trees, 2-3 trees, Height Balanced, Weight Balance.

Graph: Graph-Matrix Representation Of Graphs, Elementary Graph operations, Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree.

Module 5: SORTING AND SEARCHING (08 Periods)

SORTING AND SEARCHING : Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Sorting On Several Keys, Linear Search, Binary Search

Total Periods: 45

LIST OF EXERCISES:

1. Demostrate structures & pointers in C.
2. Write a Program to find the Factorial of a Given Number using Recursive Function
3. Write a Program for Implementation of Stacks Using Arrays.
4. Write a Program for Implementation of Stacks Using Linked Lists.
5. Write a Program for Implementation of Queues Using Arrays.
6. Write a Program for Implementation Linked Lists.
7. Write a Program to Implement Binary-Tree Algorithm for Operations with INSERT, DELETE, and DISPLAY.
8. Write a Program to implement circular queues using arrays.
9. Write a Program to sort the given number using bubble sort, Merge sort, Quick sort.
10. Write a Program to implement the following searching techniques Sequential and binary search.

RESOURCES

TEXT BOOKS:

1. D. Samanta, **Classic Data Structures**, 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012
2. Ellis Horowitz and Sartaj Sahni, **Fundamentals of Data Structures in C**, 2nd Edition, Universities Press, 2008.

REFERENCE BOOKS:

1. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub. 2001 ed.
2. Fundamentals of Data Structures in C++-By Sartaj Sahani.
3. Data Structures: A Pseudo-code approach with C -By Gilberg & Forouzan Publisher-Thomson Learning.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://swayam.gov.in/nd2_cec19_cs04/preview
3. https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O
4. https://www.youtube.com/playlist?list=PLrqxgoIHbaCQPHa2LnGX0f-dCIH2MWlFS
5. https://www.youtube.com/playlist?list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR

WEB RESOURCES:

1. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.html
2. https://www.hackerrank.com/domains/data-structures
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. https://discuss.codechef.com/t/data-structures-and-algorithms/6599
5. https://books.goalkicker.com/AlgorithmsBook/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201004	**COMPUTER ORGANIZATION AND ARCHITECTURE**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:This course provides a basic understanding of how computers work. Starting from basic number representation to perform computation. This is followed by higher-level systems designs including memory and input/output. It concludes with a brief discussion of advanced topics in computer systems design such as machine language and assembly programming, machine representation of data and instructions, computer arithmetic, the CPU and instruction interpretation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on computer organization, architecture and interconnection structures of a digital computer.

CO2. Analyze Arithmetic Operations, Addressing Modes, Instruction Formats, Processor and Register organization.

CO3. Design digital circuits for the given functional description of microoperations and memory elements.

CO4. Investigate the performance of Input/Output Systems, Memory systems, parallel processors, Multicore architectures to evaluate the cost-performance trade-offs.

CO5. Demonstrate on Parallel Processing and Multicore Computers.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	3	-	3
CO2	3	2	-	3	-	-	-	-	-	3	-	3
CO3	3	2	1	2	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	2	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**2**	**3**	**-**	**2**	**-**	**3**	-	**3**	-	**3**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: STRUCTURE OF COMPUTERS ***(9 Periods)***

STRUCTURE OF COMPUTERS: Computer types, Functional units, Basic operational concepts, Von-Neumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multi computer, Data representation, Fixed and Floating point, Error detection and correction codes.
COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division Algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.

Module 2: CENTRAL PROCESSING UNIT **(09 Periods)**

Arithmetic logic unit, Integer multiplication- Booth's algorithm; Floating point representation principles, Machine instruction characteristics, Addressing modes, Instruction formats – Instruction length, Allocation of bits; Processor organization, Register organization – User visible registers, Control and status registers; Instruction cycle.

Module 3: CONTROL UNIT AND INPUT/OUTPUT ***(10 Periods)***

Control Unit: Micro operations, Control of the processor – Functional requirements, Control signals, Internal processor organization; Hardwired implementation, Microinstructions, Microprogrammed control unit, Micro instruction sequencing – Design considerations, sequencing techniques, Address generation; Micro instruction execution- A taxonomy of microinstructions, Microinstruction encoding.

Input/Output: External devices, I/O modules, Direct memory access function, I/O Channels and Processors, PCI Physical and Logical Architecture.

Module 4: MEMORY SYSTEM ***(08 Periods)***

Semiconductor Memories: Computer Memory System overview, Semiconductor Main Memory-Organization, DRAM and SRAM, Types of ROM, Chip logic, Chip packaging, Module organization, Interleaved memory; DDR DRAM, Flash Memory, Newer Nonvolatile Solid-State Memory Technologies.
Cache Memory: Cache Memory Principles, Elements of Cache Design-Cache Addresses, Mapping Functions.
External Memory: Solid State Drives.

Module 5 PARALLEL ORGANIZATION ***(09 Periods)***

Parallel Processing: Multiple Processor Organizations,Instruction Pipelining, Symmetric Multiprocessors, Nonuniform Memory Access, Multicore Organization.
Multicore Computers: Hardware performance issues, Software performance issues, Multicore organization, Intel Core i7-990X.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Write a report on Product Specifications such as CPU, Memory, Processor Graphics and advanced technologies of Intel Core i9-12900K -New performance hybrid architecture. The World's Best Gaming Processor: Available with up to 16 cores and 24 threads, the new 12th Gen Intel Core processor family includes the world's best gaming processor, the Core i9-12900K, unleashing gaming experiences across top titles.Case Study on Addressing Modes - Instruction Formats
2. Write a report on OpenCL (Open Computing Language) framework used for writing programs that execute across heterogeneous platforms consisting of

central processing units, graphics processing units, digital signal processors, field-programmable gate arrays and other processors or hardware accelerators.To find the largest and smallest number in an array of data using 8085 instruction set. Using 8085 Microprocessor Simulator

3. Write an simple Interrupt service routine to understand interrupt using 8085 Microprocessor Simulator

RESOURCES

TEXT BOOKS:

1. William Stallings, Computer Organization and Architecture: Design for performance, Pearson, 11th Edition, 2020.

2. M. Moris Mano(2006), Computer System Architecture, 3rd edition, Pearson/PHI, India

REFERENCE BOOKS:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, McGraw Hill Education, 2013.

2. David A. Patterson and John L. Hennessy, Computer Organization and Design - A Hardware software interface, 5th Edition, Morgan Kaufmann, 2014.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs37
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs47/preview
4. https://freevideolectures.com/course/2277/computer-organization
5. https://www.youtube.com/watch?v=4TzMyXmzL8M

WEB RESOURCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/last-minute-notes-computer-organization/
3. https://gateoverflow.in/blog/9728/some-good-resources-for-computer-organisation-architecture
4. https://tutorialspoint.dev/computer-science/computer-organization-and-architecture/
5. https://www.javatpoint.com/computer-organization-and-architecture-tutorial

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM202007	**MOBILE APPLICATION DEVELOPMENT**	3	-	2	-	4

Pre-Requisite Object Oriented Programming through JAVA

Anti-Requisite XXXX-

Co-Requisite XXXX-

COURSE DESCRIPTION: Mobile platforms; Mobile User Interface and tools; Introduction to Android; Activities; Views; Menus; Layouts; widgets; Fragments; Building a Location Tracker Communication between a Service and an Activity.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Analyze architecture of android and current trends in mobile operating systems.

CO2. Apply suitable software tools and APIs for the development User Interface of a particular mobile application.

CO3. Apply intents and broadcast receivers in android application.

CO4. Develop and design apps for mobile devices using SQLiteDatabase

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2	1
CO2	3	2	3	2	-	-	-	-	-	-	-	-	2	2	1
CO3	3	2	2	2	3	2	2	1	-	-	-	-	3	1	2
CO4	3	2	3	2	3	2	2	1	-	-	-	-	2	1	-
CO5	3	2	3	2	-	-	-	-	-	-	-	-	3	1	-
Course Correlation Mapping	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Introduction to Android Operating System (09 Periods)

Introduction to Android Operating System: Android OS and Features – Android development framework.

Installing and running applications on Android Studio, Creating AVDs, Types of Android application; Creating Activities, Activity Life Cycle, Activity states, monitoring state changes;

Module 2 Android application & Building User Interfaces (10 Periods)

Android application components – Android Manifest file, Externalizing recourses like Simple Values, Drawables, Layouts, Menus, etc,

Building User Interfaces: Fundamental Android UI design, Layouts – Linear, Relative, Grid and Table Layouts. User Interface (UI) Components

Module 3 Fragments (09 Periods)

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities.

Module 4 Intents and Broadcasts (09 Periods)

Intents and Broadcasts: Using intents to launch Activities, Types of Intents, Passing data to Intents, Getting results from Activities, Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters.

Module 5 Database (08 Periods)

Database: Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data.

Total Periods: 45

EXPERIENTIAL LEARNING:

1 Create "Hello World" Application.

2 Create an application using the Activity class.

3 Create an application using EditText control.

4 Creating an application that allows choosing options using CheckBox control.

5 Creating an application that allows choosing options using RadioButton control.

6 Creating an application that allows choosing options using two sets of RadioButton controls.

7 Create an application using Linear Layout

8 Create an application using Relative Layout

9 Create an application to play Audio and Video clips

10 Create an application using Menus.

11 Create an application using ActionBar.

12 Create an application to display a Drop-Down List Action Bar.

RESOURCES

TEXT BOOKS

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012

2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCE BOOKS:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
2. Android Application Development (with Kitkat Support), Black Book, Pradeep Kothari, 2014, Dreamtech Press publisher, Kogent Learning Inc.,2014
3. Android Programming: Pushing the Limits, Erik Hellman, 1st Edition,Wiley Publications, 2014

VIDEO LECTURES:

1. https://developer.android.com/guide

2. https://nptel.ac.in/courses/106/106/106106147/

WEB RESOURCES:

1. https://source.android.com/devices
2. https://android-app-development-documentation.readthedocs.io/en/latest/
3. https://www.udemy.com/course/the-complete-android-oreo-developer-course/
4. https://www.youtube.com/playlist?list=PLknSwrodgQ72X4sKpzf5vT8kY80HKcUSe

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201008	**DATA WAREHOUSING AND DATA MINING**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Data Mining Fundamentals; Data Preprocessing; Operational Database Systems and Data Warehouses; Mining Frequent Patterns; Classification and Prediction; Clustering; Data warehousing and Mining tools, New Trends and Research Frontiers.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Data Warehousing architecture, Multidimensional models and OLAP operations.

CO2. Apply data preprocessing techniques to produce refined data.

CO3. Apply Association rules and classification techniques for data categorization.

CO4. Use clustering techniques for grouping similar data items and identify outliers.

CO5. Understand Data Mining trends and applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	3	-	-	-	3
CO2	1	2	-	-	-	-	-	3	-	2	-	3
CO3	3	2	-	-	-	-	-	3	-	1	-	3
CO4	1	2	3	2	-	-	-	3	-	3	-	2
CO5	3	3	-	-	-	-	-	3	-	2		3
Course Correlation Mapping	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**3**	-	**2**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT:

Module 1: INTRODUCTION TO DATA MINING AND PREPROCESSING ***(09 Periods)***

INTRODUCTION TO DATA MINING: Motivation, Importance, Definition of Data Mining, Kind of Data,Data Mining Functionalities, Kinds of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of A Data Mining System With A Database or Data Warehouse System, Major Issues In Data Mining, Types of Data Sets and Attribute Values, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity.

PREPROCESSING: Data Quality, Major Tasks in Data Preprocessing, Data Reduction, DataTransformation and Data Discretization, Data Cleaning and Data Integration.

Module 2: DATA WAREHOUSING AND ON-LINE ANALYTICAL PROCESSING AND DATA CUBE TECHNOLOGY ***(08 Periods)***

DATA WAREHOUSING AND ON-LINE ANALYTICAL PROCESSING: Data Warehouse basicconcepts, Data Warehouse Modeling - Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

DATA CUBE TECHNOLOGY: Efficient Methods for Data Cube Computation, Exploration andDiscovery in Multidimensional Databases.

Module 3 MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS AND FREQUENT PATTERN AND ASSOCIATION MINING ***(09 Periods)***

MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic Concepts,Efficient and Scalable Frequent Item set Mining Methods, Are All the Pattern Interesting, Pattern Evaluation Methods, Applications of frequent pattern and associations.

FREQUENT PATTERN AND ASSOCIATION MINING: A Road Map, Mining Various Kinds ofAssociation Rules, Constraint-Based Frequent Pattern Mining, Extended Applications of Frequent Patterns.

Module 4 CLASSIFICATION ***(10 Periods)***

CLASSIFICATION: Basic Concepts, Decision Tree Induction, Bayesian Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Ensemble Methods, Handling Different Kinds of Cases in Classification, Bayesian Belief Networks, Classification by Neural Networks, Support Vector Machines, Pattern-Based Classification, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

Module 5 CLUSTER ANALYSIS AND OUTLIER ANALYSIS ***(09 Periods)***

CLUSTER ANALYSIS: Basic Concepts of Cluster Analysis, Clustering structures, Major ClusteringApproaches, Partitioning Methods, Hierarchical Methods, Density-Based Methods, ModelBased Clustering - The Expectation-Maximization Method, Other Clustering Techniques, Clustering High-Dimensional Data, Constraint-Based and User-Guided Cluster Analysis, Link-Based Cluster Analysis, Semi-Supervised Clustering and Classification, Bi-Clustering, Collaborative Clustering.

OUTLIER ANALYSIS: Why outlier analysis, Identifying and handling of outliers, DistributionBasedOutlier Detection: A Statistics-Based Approach, Classification-Based Outlier Detection, Clustering-Based Outlier Detection, Deviation-Based Outlier Detection, Isolation-Based Method: From Isolation Tree to Isolation Forest.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
2. Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
3. Understand the data sets and data preprocessing.
4. Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
5. Exercise the data mining techniques with varied input values for different parameters.
6. To study the file formats for the data mining.

RESOURCES

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei, *Data Mining: Concepts and Techniques,* Elsevier, Third Edition, 2013.

REFERENCE BOOKS:

1. K.P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data mining Theory and Practice*, Easter Economy Edition, Prentice Hall of India, 2006.

2. G. K. Gupta, *Introduction to Data Mining with Case Studies*, Easter Economy Edition, Prentice Hall of India, 2006.

3. Tan P.N, Steinbach M. and Kumar V., *Introduction to Data Mining*, Addison-Wesley, 2006.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=grFpC2tBKrY
2. https://www.coursera.org/learn/dwdesign
3. https://onlinecourses.nptel.ac.in/noc21_cs06/preview

WEB RESOURCES:

1. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf
2. https://www.edx.org/learn/data-warehouse
3. https://alison.com/tag/data-mining

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201009	SOFTWARE PROJECT MANAGEMENT	3	-	-	-	3

Pre-Requisite Software Engineering

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

Software project management and its importance, Plans, methods and methodologies, Software processes and process models, Stepwise project planning, Software effort estimation, Cost estimation, Activity planning, Plan models, Critical path and critical activities, Risk management, Resource allocation, Monitoring and control, Managing people, Software quality.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply knowledge of software project management, project plans, process models for efficient implementation and completion of projects

CO2. Estimate effort for the project to assign and schedule available resources in the most effective and economical way possible.

CO3. Develop network models for sequences of activities in a project for effective project management.

CO4. Identify the risk factors, monitor the progress and quality of projects to take mitigating actions.

CO5. Recognize the need for organizational behavior, teamwork and communication to improve the performance on projects.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	-	-	-	-	3	3	3
CO2	3	2	3	3	3	-	-	-	-	3	3	-
CO3	3	3	2	3	-	-	-	-	-	3	3	3
CO4	3	3	3	1	3	1	-	1	-	3	3	3
CO5	3	3	3	3	3	3	-	3	-	3	3	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**2**	**-**	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTIONTO SOFTWARE PROJECT MANAGEMENT (09 Periods)

Importance of software project management, Defining project, Software projects versus other types of project, Contract management and technical project management, Activities covered by software project management, Plans, methods and methodologies, Categorizing software projects, Project charter, Stakeholders, Setting objectives, The business case, Project success and failure, Management and management control, Project management life cycle, Traditional versus modern project management practices.

Module 2: PROJECT PLANNING (09 Periods)

Step wise project planning, Select project, Identify project scope and objectives, Identify project infrastructure, Analyze project characteristics, Identify project products and activities, Estimate effort for each activity, Identify activity risks, Allocate resources, Review/publicize plan, Execute plan/lower levels of planning.

Module 3: PROJECT APPROACH AND EFFORT ESTIMATION (09 Periods)

Build or buy, Choosing methodologies and technologies, Software processes and process models, Choice of process models, Spiral model, Software prototyping, Incremental delivery, Agile methods, Software effort estimation techniques, Bottom-up estimating, The top-down approach and parametric models, Albrecht function point analysis, COCOMO II.

Module 4: RESOURCE ALLOCATION, MONITORING AND CONTROL (09 Periods)

Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (In order, Identifying resource requirements, Scheduling resources, Creating critical paths, Publishing resource schedule, Cost schedules, Scheduling sequence. Creating framework, Review, Visualizing progress, Cost monitoring, Earned value analysis, Prioritizing monitoring.

Module 5: RISK MANAGEMENT (09 Periods)

Risk, Categories of risk, Risk management approaches, A framework for dealing with risk, Risk identification, Risk assessment, Risk planning, Risk management.

Total Periods: 45

LIST OF EXERCISES:

1. Imagine you are initiating a new software project to develop an application that addresses a current market gap in educational technology. Create a comprehensive project charter that includes a definition of the project, identification of stakeholders, and setting clear objectives. Additionally, draft a business case that justifies the investment in this project based on market research and potential ROI. Reflect on how different project management methodologies (traditional vs. modern) could affect the execution of this project.
2. For a software project aimed at developing a mobile health tracking application, perform a step-by-step project planning exercise. Start by defining the project scope and objectives, then identify the necessary infrastructure and project characteristics. Proceed to estimate the effort for each activity, identify risks, and allocate resources. Conclude by drafting a plan review and publication strategy. Reflect on how executing the plan and adapting lower levels of planning could respond to unforeseen project challenges.
3. Choose an existing open-source software project and pretend you are part of the project management team at its initiation. Re-plan the project using the information available about its scope, objectives, and infrastructure. Make effort estimates for key activities, identify risks, and propose a resource allocation plan. Compare your plan with the project's actual development path and results. Discuss the differences and what could have been improved in the planning phase.

RESOURCES

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management, 6th Edition, McGraw Hill, 2018.

REFERENCE BOOKS:

1. Michele Sliger and Stacia Broderick, The Software Project Manager’s Bridge to Agility, Addison-Wesley, 2008.
2. S.A. Kelkar, Software Project Management: A Concise Study, PHI, 2012.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=hCmf20BUWUg
2. https://freevideolectures.com/course/4071/nptel-software-project-management
3. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

WEB RESOURCES:

1. https://www.tutorialspoint.com/software_engineering/software_project_management.html
2. https://www.javatpoint.com/software-project-management

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM202008	**BIG DATA ANALYTICS**	3	-	2	-	4

Pre-Requisite **-**

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The aim of this course is to provide depth knowledge about Big data Technologies and tools used for Big data. The students will learn to implement and work on tools to handle large volume of data in parallel and distributed environments. Retrieval and analysis of unstructured data are done using NOSQL databases.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand fundamental concepts of Big Data and its technologies

CO2. Apply concepts of MapReduce framework for optimization

CO3. Analyze appropriate NoSQL database techniques for storing and processing large volumes of structure and unstructured data.

CO4. Apply data analytics solutions using Hadoop ecosystems.

CO5. Explore modern reporting tools for Machine learning.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	3	-	3
CO2	2	3	-	-	-	3	3	2	-	2	-	3
CO3	2	3	3	2	-	2	2	-	-	3	-	3
CO4	2	-	-	-	2	3	-	-	-	2	-	2
CO5	2	-	-	-	2	3	-	-	-	2		3
Course Correlation Mapping	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	-	**2**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Big Data ***(09 Periods)***

Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data,Typical data warehouse and Hadoop environment.

Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data, Analytics, Technologies used in Big data Environments, Few Top Analytical Tools, NoSQL, Hadoop.

Module 2: Introduction to Hadoop ***(09 Periods)***

Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System),Processing data with Hadoop, Managing resources and applications with Hadoop YARN(Yet Another Resource Negotiator).

Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

Module 3 Introduction to MongoDB ***(09 Periods)***

Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

Module 4 Introduction to Hive and Pig ***(09 Periods)***

Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF).

Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig.

Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.

Module 5 Introduction to Data Analysis with Spark ***(09 Periods)***

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark.

Text, Web Content and Link Analytics: Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.

Total Periods: 45

LIST OF EXERCISES:

1. Install Hadoop and Implement the following file management tasks in Hadoop:
   1. Adding files and directories
   2. Retrieving files
   3. Deleting files and directories.

   Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
2. Develop a MapReduce program to implement Matrix Multiplication.
3. Develop a Map Reduce program that mines weather data and displays appropriate

messages indicating
the weather conditions of the day.

4. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.
5. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB
6. Write Pig Latin scripts to sort, group, join, project, and filter the data.
7. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
8. Implement a word count program in Hadoop and Spark.
9. Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets

RESOURCES

TEXT BOOKS:

1. Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.

REFERENCE BOOKS:

1. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
2. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
3. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

VIDEO LECTURES:

1. https://www.udemy.com/topic/big-data/
2. https://archive.nptel.ac.in/courses/106/104/106104189/
3. https://cognitiveclass.ai/courses/what-is-big-data

WEB RESOURCES:

1. https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
2. https://www.mygreatlearning.com/academy/learn-for-free/courses/mastering-big-data-analytics
3. https://www.coursera.org/courses?query=data%20analytics
4. https://onlinecourses.nptel.ac.in/noc20_cs92/preview

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201010	INFORMATION RETRIEVAL TECHNIQUES	3	-	-	-	3

Pre-Requisite -- Data Warehousing and Data Mining

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Functional overview; Information Retrieval System capabilities; automatic Indexing; stemming algorithms; automatic term clustering; user search techniques; Information visualization technologies; software text search algorithms; Information system evaluation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate IRS functionality, search and browse capabilities, cataloging and Indexingprocess, data structures, Document and Term Clustering.

CO2. Select and apply stemming algorithms, Automatic Term Clustering and Information visualization technologies, Text search algorithms in the Internet or Web search engine to interpret meaningful and relevant patterns.

CO3. Analyze the information retrieval system capabilities, Automatic indexing, user search techniques, Information system evaluation measures to present the relevant search results to the user.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	3	2	3	3	-	-	-	-	-	2	-
CO2	2	3	3	2	2	-	-	-	-	-	2	-
CO3	2	2	3	2	3	-	-	-	-	-	2	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	-	**-**	**2**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION AND INFORMATION RETRIEVAL SYSTEM CAPABILITIES ***(11 Periods)***

Introduction to IRS: Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.
Information Retrieval System Capabilities: Search Capabilities, Boolean logic, Proximity, contiguous word phrases, fuzzy searches, Term masking, Browse Capabilities,Ranking, Zoning, Highlighting, Miscellaneous Capabilities- vocabulary Browse, canned query.

Module 2: CATALOGING AND INDEXING AND DATA STRUCTURE ***(08 Periods)***

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction.
Data Structure: Introduction to data structure, Stemming Algorithms: Introduction to stemming process, Porter stemming algorithm, Successor stemmers, Inverted file Structure, N-Gram Data Structures PAT Data Structure.

Module 3: AUTOMATIC INDEXING ***(08 Periods)***

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing-probabilistic weighting, Vector weighting, Natural Language, Concept Indexing, Hypertext Linkages.
Document and Term Clustering: Introduction to clustering, Thesaurus Generation, Automatic term clustering- complete term relation method, clustering using existing clusters, one pass assignments.

Module 4: USER SEARCH TECHNIQUES AND INFORMATION VISUALIZATION ***(09 Periods)***

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the Internet and Hypertext.
Information Visualization: Introduction, Cognition and Perception, Information Visualization Technologies.

Module 5: TEXT SEARCH ALGORITHMS AND INFORMATION SYSTEM EVALUATION ***(09 Periods)***

Text Search Algorithms: Introduction to text search techniques, Software Text Search Algorithms, Hardware Text Search Systems
Information System Evaluation: Introduction to information system evaluation, Measures Used in System Evaluations, Measurement Example, TREC Results

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Text Analysis - preprocessing text so that it can be indexed in our search engine.
2. Indexing - programming an index data structure and calculating term statistics.
3. Basic Retrieval - the basic TF/IDF retrieval model.
4. Advanced Retrieval - the Dirichlet Language Model for retrieval
5. Evaluation - evaluating a search engines' performance.
6. Applications - how to scrape web data and index it in a high-performance search framework

RESOURCES

TEXT BOOKS:

1. Gerald J. Kowalski and Mark T. Maybury, "Information Storage and Retrieval Systems," Springer International Edition, 2nd Edition, 2009.

REFERENCE BOOKS:

1. Ricardo Baeza – Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval," Pearson Education, 2004.
2. Robert R. Korfhage, "Information Storage and Retrieval," John Wiley and Sons, 1997.

VIDEO LECTURES:

1. https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets/
2. https://sites.pitt.edu/~peterb/2140-061/materials.html
3. https://dl.acm.org/doi/book/10.5555/567292
4. https://www.youtube.com/watch?v=fFxpSmyICwI
5. https://www.youtube.com/watch?v=FkRxmlNiC0c
6. https://www.coursera.org/lecture/text-retrieval/lesson-3-1-evaluation-of-tr-systems-YSvkh

WEB RESOURCES:

1. https://www.coursera.org/courses?query=information%20retrieval
2. https://www.coursera.org/learn/text-retrieval
3. https://www.sciencedirect.com/topics/computer-science/information-retrieval-systems
4. https://www.librarianshipstudies.com/2020/02/information-retrieval.html

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201011	OBJECT ORIENTED MODELLING AND DESIGN	3	-	-	-	3

Pre-Requisite Software Engineering

Anti-Requisite XXXX-

Co-Requisite XXXX-

COURSE DESCRIPTION: The course introduces an overview of the concepts and Principles of Object Oriented Programming, Introduction to UML and Behavioral Modeling, Basic Structural Modeling, Collaboration Diagrams and Sequence Diagrams, Advanced Behaviorial and Architectural

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts and principles of object oriented programming concepts.

CO2. Analyze major components and key mechanisms of Classand ObjectDiagram.

CO3. Use the modeling techniques of interaction diagrams for the dynamic behavior of objects.

CO4. Use the modeling techniques of State-chart Diagram to represent the state of an objects.

CO5. Applying the techniques for modeling Component and Deployment Diagrams.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	-	-	-	-	-	3	3
CO2	2	3	3	-	-	-	-	-	-	-	-	3
CO3	2	3	2	3	3	-	-	-	-	-	2	2
CO4	2	2	2	2	3	-	-	-	-	-	2	2
CO5	2	3	3	2	2	-	-	-	-	-	3	2
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	-	**-**	**-**	-	**-**	**2**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: OBJECT ORIENTED DESIGN AND MODELLING ***(08 Periods)***

Object Oriented Design and Modelling Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modelling, principles of modelling, object oriented modelling.

Module 2: INTRODUCTION TO UML AND BEHAVIORAL MODELING ***(10 Periods)***

Introduction to UML and Behavioral Modeling: Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, UML Diagrams , software development life cycle. Behavioral modeling: Interactions use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams, Modeling Concepts - Diagram Organization - Diagram Extension.

Module 3 BASIC STRUCTURAL MODELING ***(07 Periods)***

Basic Structural Modeling: Classes, relationships, common mechanisms, class and object diagrams. Advanced structural Modeling: Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams.

Class Diagrams – Terms, concepts, modeling techniques for Class Diagram, Modeling Simple collaboration, Logical database Schema, Forward and Reverse Engineering.

Object Diagrams – Modeling object structures, Forward and Reverse engineering.

Module 4 COLLABORATION DIAGRAMS AND SEQUENCEDIAGRAMS ***(10 Periods)***

Collaboration Diagrams and Sequence Diagrams Terms, concepts and depicting a message in collaboration diagrams. Terms and concepts in sequence diagrams. Difference between collaboration and sequence. Diagram. Depicting synchronous messages with/without priority call back mechanism.

Module 5 ADVANCED BEHAVIORIAL AND ARCHITECTURAL ***(10 Periods)***

Advanced Behavioral: Events and signals, state machines, process and threads, time and space, state chart diagrams. Activity Diagrams **–** Terms and Concepts, Modeling a workflow, Modeling an operation, forward and reverse Engineering.

Architectural Modelling: Terms, Concepts, examples, Modelling techniques for component diagrams and deployment diagrams.Component Diagrams – Terms and Concepts, Modeling Source Code, Modeling Physical Database, Forward and Reverse Engineering;

Deployment Diagrams – Terms and Concepts, Modeling Embedded System, Modeling Distributed System, Forward and Reverse Engineering.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Annotated Requirement Specification and Linguistic Analysis of Leave Management System.
2. Implementation of class and object diagrams using Visual Paradigm for Leave Management System.
3. Implementation of Usecase and Interaction diagrams using Visual Paradigm for Leave Management System.
4. Implementation of Activity and State Chart diagrams using Visual Paradigm for Leave Management System.
5. Implementation of Component and Deployment diagrams using Visual Paradigm for Leave Management

Resources:

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering - A Practitioner's Approach, McGraw-Hill,EightEdition, 2015.
2. Ian Sommerville, Software Engineering**,** Pearson Education, Ninth Edition, 2011.

REFERENCE BOOKS:

1. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age InternationalPublishers,Third Edition, 2007.
2. Shely Cashman Rosenblatt, Systems Analysis and Design, Thomson Publications,SixthEdition, 2006.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105087/
2. https://nptel.ac.in/courses/106105182/

WEB RESOURCES:

1. https://www.coursera.org/courses?query=software%20engineering
2. https://www.javatpoint.com/software-engineering-tutorial
3. https://www.geeksforgeeks.org/software-engineering/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201012	INTERNET OF THINGS	3	-		-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Internet of Things Components; Domain Applications; Communication models; Sensors; Connectivity; Prototyping; Hardware; Design Methodology; Development platforms; Data Analytics for IoT; IoT Security..

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand IoT Architectures , communication technologies and various applications of IoT

CO2 Learn IoT-related protocols and Smart Objects

CO3 Understand hardware platforms and cloud services related to IoT

CO4 Build IoT applications using Arduino and Raspberry Pi

CO5 Understand data analytics concepts and security issues in the context of IoT

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	3	2	-
CO2	3	2	-	-	-	-	-	-	-	3	2	-
CO3	-	2	3	-	-	-	-	-	-	-	2	3
CO4	-	-		2	3	-	-	-	-	-	-	2
CO5	-	-	2	3	-	-	-	-	-	-	2	-
Course Correlation Mapping	**3**	**2**	**3**	**3**	**3**	-	-	-	-	**2**	**2**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: **INTRODUCTION & DOMAIN APPLICATIONS** ***(09 Periods)***

Introduction to Internet of Things:

Definition, Conceptual Framework, Architectural View, Technology behind IoT, Communication Technologies, Data Enrichment, Data consolidation and Device management at Gateway.

IoT and M2M: M2M, Difference between IoT and M2M, SDN and NFV for IoT.

Domain Specific IoTs: Home automation, Cities, Environment, Health and Life Style.

Module 2: **SENSORS & CONNECTIVITY** ***(09 Periods)***

Sensor Technology, Actuators, RFID Technology, Internet Connectivity, Internet-Based Communications, IP Addressing in the IoT, Medium Access Control, Application Layer Protocols.

Module 3: **PROTOTYPING & HARDWARE** ***(08 Periods)***

Embedded Computing Basics, Embedded platforms for prototyping, Things always connected to the Internet/Cloud, Amazon Web Services for IoT.

Module 4: **DESIGN METHODOLOGY & CASE STUDIES** ***(10 Periods)***

Design Methodology: Purpose and Requirements specifications, Process Specifications, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specifications, Functional View Specification, Operational View Specification, Device and Component integration, Application development.

Case Studies Illustrating IoT Design: Home Automation, Cities.

Module 5: **DATA ANALYTICS FOR IOT& IoT Security** ***(09 Periods)***

Data Analytics for IoT: Apache Hadoop, Using HadoopMapReduce for Batch Data Analysis.

IoT Security: Vulnerabilities, Security Requirements and Threat analysis, Security Tomography and Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication, Security Models, Profiles and Protocols for IoT

Total Periods: 45

EXPERIENTIAL LEARNING

1. (a) Design and Simulate LED 7-Segment Display interfacing with Arduino.
   (b) Design and Simulate Servo motor interfacing with Arduino.
2. (a) Design and Simulate ultrasonic sensor and LCD interfacing with Arduino.
   (b) Design and Simulate Flame Sensor interfacing with Arduino.
3. Design and Implement to capture Gas Sensor and send sensor data to cloud from your Node MCU device using Arduino IDE.
4. Design and Implementation of Humidity and Temperature Monitoring Using Arduino and upload data to cloud using MQTT.
5. Design and Implementation of an IoT ECG (Electrocardiogram) System to record hearts electrical activity.

RESOURCES

TEXTBOOKS:

1. ArshdeepBahga, Vijay Madisetti, Internet of Things – A hands-on approach, University Press, 2015.
2. Raj Kamal, Internet of Things- Architecture and Design Principles, McGraw Hill, 2017.

REFERENCE BOOKS:

1. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley Publishing, 2013.
2. CharlesBell, Beginning Sensor Networks with Arduino and Raspberry Pi, Apress, 2013.

VIDEO LECTURES:

1. https://www.digikey.com/en/maker/projects/how-to-interface-a-seven-segment-display-with-an-arduino/9c05f147618c4fe3b8bb79acce5c60e3
2. https://www.engineersgarage.com/interfacing-servo-motor-with-arduino-mega-2560/

WEB RESOURCES:

1. What Is the Internet of Things (IoT)? | Oracle India
2. Introduction to Cybersecurity | Codecademy

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM202009	WEB APPLICATIONS DEVELOPMENT USING PHP	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Topics covered include- distributed system models, different cloud service models, service oriented architectures, cloud programming and software environments, resource management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1	Understand fundamentals and various paradigms of computing
CO2.	Demonstrate cloud characteristics and models.
CO3.	Identify the ways in which the cloud can be programmed and deployed.
CO4.	Recognize the services and platform of cloud
CO5.	Design different cloud services from different vendors.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	2	-	3
CO2	3	-	3	3	3	-	-	-	-	2	-	3
CO3	3	3	3	3	3	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	2	-	3
CO5	-	3	3	-	3	-	-	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: HTML ***(09 Periods)***

Introduction: Fundamentals of HTML, Working with Text, Organizing Text in HTML, Working with Links and URLs, Creating Tables, Working with Images, Canvas, Forms, Frames and Multimedia.

HTML5: Introduction, HTML5 Document Structure, Creating Editable Content, Checking Spelling Mistakes, Exploring Custom Data Attributes, Client-Side Storage, Drag and Drop Feature, Offline Web Applications, Web Communications, Cross-Document Messaging and Desktop Notifications.

Module 2: CSS AND JAVASCRIPT ***(09 Periods)***

CSS: Introduction, CSS Selectors, Inserting CSS in an HTML document, Backgrounds, Fonts, and Text Styles, Creating Boxes, Displaying, Positioning and Floating Elements, Features of CSS3, Media Queries.

Javascript: Overview of JavaScript, JavaScript Functions, Events, Image Maps and Animations, JavaScript Objects, Working with Browser and Document Objects, JQuery - Introduction, JQuery Selectors, Events.

Module 3: INTRODUCTION TO PHP ***(09 Periods)***

Lexical structure, data types, variables, expressions and operators, flow control statements, embedding PHP in web pages.

Module 4: FUNCTIONS AND STRINGS ***(09 Periods)***

FUNCTIONS: Calling a function, defining a function, variable scope, function parameters, return values.

STRINGS: quoting string constants, printing strings, cleaning strings, comparing strings, regular expressions.

Module 5: ARRAYS ***(09 Periods)***

Indexed versus associative arrays, identifying elements in array, storing data in arrays, multi- dimensional arrays, extracting multiple values, converting between arrays and variables, traversing arrays.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Install and configure PHP, web server, MYSQL
   (a) Write a program to print "welcome to PHP".
   (b) Write a simple PHP program using expressions and operators
2. Write a PHP program to demonstrate the use of decision making control structures using
   (a) IF statement
   (b) IF-else statement
   (c) Switch statement
3. Write a PHP program to demonstrate the use of looping structures using:
   (a) While statement
   (b) Do-while statement
   (c) For statement
   (d) For each statement

4. Write a PHP program for creating and manipulating
   (a)Indexed array
   (b)Associative array
   (c)Multidimensional array
5. Write a PHP program to-
   (a) Calculate length of string
   (b) Count the number of words in string
   (c) Write a simple PHP program to demonstrate use of various built-in string functions.
6. Design a web page using form controls: Text box, Radio button, Check box, Buttons
7. Design a web page using form controls: List box, Combo box, Hidden field box
8. Develop web page with data validation

RESOURCES

TEXT BOOKS:

1. Kevin tatroe & Peter Macintyre "Programming PHP", O'REILLY,4th Edition.
2. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, Dreamtech Press, First Edition, 2011.Press, 2018

REFERENCE BOOKS:

1. Snig Bahumik, Bootstrap Essentials, PACKT Publishing, First Edition, 2015. (e-book)
2. Thomas A. Powell, The Complete Reference: HTML and CSS, Tata McGraw Hill, Fifth Edition, 2010
3. Andrea Tarr, PHP and MySQL, Willy India, First Edition, 2012.
4. Chris Hay, Brian Prince, "Azure in Action" Manning Publications [ISBN: 9781935182481],2010.
5. Henry Li, "Introducing Windows Azure" Apress; 1 edition [ISBN: 978-14302-2469-3],2009.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=PGvrnas2_Pk
2. https://www.youtube.com/watch?v=hx38tnlYGlA

WEB RESOURCES:

1. https://www.javatpoint.com/php-tutorial
2. https://www.guru99.com/php-practical-example.html
3. https://www.geeksforgeeks.org/build-a-grocery-store-web-app-using-php-with-mysql/
4. https://www.cleart.com/php-web-application-development-php-web-development.html

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201013	**CRYPTOGRAPHY AND NETWORK SECURITY**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Concepts of cryptographic algorithms, Substitution techniques, Symmetric ciphers, Block cipher operations, Cryptographic data integrity algorithms, Key management and distribution, User authentication, Transport level security, Electronic mail security, IP security..

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the knowledge of concepts of network security, symmetric and public key cryptosystems to identify the potential threats in networks.

CO2. Analyze hash functions, message authentication codes, digital signatures for providing data integrity in information security applications.

CO3. Use key management and distribution techniques, user authentication techniques for assuring mutual trust among users.

CO4. Demonstrate knowledge on network and Internet security techniques for addressing the security threats.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	-	**-**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION ***(09 Periods)***

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Symmetric cipher model, Substitution techniques , Monoalphabetic ciphers and Polyalphabetic ciphers.

Module 2: SYMMETRIC CRYPTOGRAPHY ***(09 Periods)***

Stream ciphers and block ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES) , Structure, Transformation Functions; Block Cipher Operation , Multiple encryption and triple DES, Cipher block chaining mode, Cipher feedback mode, Output feedbackmode, Counter model.

Module 3 PUBLIC KEY CRYPTOGRAPHY AND CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS ***(09 Periods)***

Public Key Cryptography: -Elliptic curve cryptography, Diffie-Hellman key exchange, Elgamal cryptographic system.

Message Authentication and Integrity Algorithms: Hash Functions , Simple hash functions, SecureHash Algorithm SHA-512; Message Authentication Codes , Requirements, Functions, Security of MACs, HMAC; Digital signatures.

Module 4 MESSAGE AUTHENTICATION AND INTEGRITY ***(09 Periods)***

Key Management and Distribution: Entity Authentication: Biometrics, Passwords, Distribution of public keys, X.509 certificates, Public key infrastructure.

User Authentication: Remote user authentication principles, Kerberos, Personal identity verification

Module 5 SECURITY PRACTICE AND SYSTEM SECURITY ***(09 Periods)***

SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

Electronic Mail Security: S/MIME, Pretty Good Privacy, DNSSEC.

IP Security: IP security – Web Security, HTTPS.

Total Periods: 45

Experiential learning:

1. Demonstrate how encryption and decryption using the following algorithms:
    - Ceaser Cipher
    - Substitution Cipher
    - Hill Cipher
2. Design and develop program to implement the BlowFish algorithm logic.
3. Design and develop program to implement the Rijndael algorithm logic.
4. Design and develop program program to implement RSA algorithm.

RESOURCES

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, 8th Edition,Pearson, 2020.
2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory",Pearson.

REFERENCE BOOKS:

1. William Stallings, Network Security Essentials: Applications and Standards, 6th Edition,Pearson, 2018.
2. Douglas R. Stinson, Maura B. Paterson, Cryptography: Theory and Practice, 4th Edition,CRC Press, 2018.
3. Atul Kahate, Cryptography and Network Security, 3rd Edition, McGraw Hill, 2017.

VIDEO LECTURES:

1. http://nptel.ac.in/courses/106105031/lecture by Dr. Debdeep MukhopadhyayIIT Kharagpur
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/ lecture by Prof. Robert Morrisand Prof. Samuel Madden MIT.

WEB RESOURCES:

1. https://www.udemy.com/introduction-to-cryptography-online-course-rahsoft-cryptocertificate/
2. https://www.coursera.org/learn/asymmetric-cryptography
3. https://www.khanacademy.org/computing/computer-science/cryptography

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201014	**COMPUTER GRAPHICS**	3	-	-	-	3

Pre-Requisite

Anti-Requisite **-**

Co-Requisite **-**

COURSE DESCRIPTION: Computer Graphics are created using 2D, 3D designs and Animation designs. In Computer Graphics course, students are usually taught subjects like 2D design, 3D design, web design, animation design, image processing etc. The concept of Physics, Optics, and Geometry are largely used in Computer Graphics

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Design and implement algorithms for 2D graphics primitives and attributes.

CO2 Illustrate Geometric transformations on both 2D and 3D objects.

CO3 Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.

CO4 Decide suitable hardware and software for developing graphics packages using OpenGL.

CO5 Explore projections and visible surface detection techniques for display of 3D scene on 2D screen

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**3**	-	**-**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Overview ***(09 Periods)***

Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham"s), circle generation algorithms (Bresenham"s).

Module 2: Fill area Primitives, 2D Geometric Transformations and 2D viewing ***(09 Periods)***

Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions

Module 3: Clipping, 3D Geometric Transformations, Color and Illumination Models ***(09 Periods)***

Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.

Module 4: 3D Viewing and Visible Surface Detection ***(09 Periods)***

3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, depth buffer method only and OpenGL visibility detection functions.

Module 5: Input & interaction, Curves and Computer Animation ***(09 Periods)***

Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modeling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Describe how a color CRT works.
2. Describe the tristimulus theory of color perception and its relevance to computer displays.
3. What is the CIE Chromaticity diagram?

RESOURCES

TEXTBOOKS:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011

2 Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008

REFERENCE BOOKS:

1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education

2. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning

3 Xiang, Plastock : Computer Graphics , sham"s outline series, 2nd edition, TMG.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=qFwOg9M9s2U
2. https://www.youtube.com/watch?v=zi57OkPwzbk
3. https://www.youtube.com/watch?v=2tiLGgoAMcU
4. https://www.geeksforgeeks.org/videos/painters-algorithm-in-computer-graphics/
5. https://www.youtube.com/watch?v=U9NrXOBXA1I

WEB RESOURCES:

1. https://www.edx.org/learn/computer-graphics/
2. https://www.coursera.org/courses?query=computer%20graphics
3. https://onlinecourses.nptel.ac.in/noc20_cs90/preview

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201015	**INTRODUCTION TO MACHINE LEARNING**	3	-	-	-	3

Pre-Requisite Python Programming

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Introduction to machine learning, Bayesian concept learning, Supervised learning, Unsupervised learning, Artificial neural networks, Ensemble learning.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the process of machine learning modeling and evaluation to automatically infer a general description for a given learning problem.

CO2. Analyze the underlying mathematical models within machine learning algorithms and learning tasks.

CO3. Design and implement machine learning solutions for classification, regression, and clustering problems.

CO4. Design and implement efficient neural architectures to model patterns for a given learning problem.

CO5. Develop intelligent solutions to solve societal problems related to computer vision, information security, healthcare and other areas.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3
CO2	2	3	-	-	-	-	-	-	-	-	-	3
CO3	2	3	3	3	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3
CO5	1	3	3	3	-	3	-	-	-	-	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	-	**3**

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO MACHINE LEARNING *(08 Periods)*

Machine Learning: Human learning, Types of human learning, Machine learning, Types of machine learning, Applications of machine learning, Issues in machine learning.

Module 2: MODELING AND EVALUATION, BAYESIAN CONCEPT LEARNING *(10 Periods)*

Modeling and Evaluation: Selecting a model, Training a model, Model representation and interpretability, Evaluating performance of a model, Improving performance of a model.

Feature Engineering: Feature transformation, Feature subset Selection.

Bayesian Concept Learning: Introduction, Importance, Bayes' theorem, Bayes' theorem and concept learning, Bayesian belief network.

Module 3: SUPERVISED LEARNING *(09 Periods)*

Classification: Classification model, Classification learning steps, K-Nearest Neighbor, Support vector machines, Decision Tree - Decision tree representation,

Regression: Introduction, Simple linear regression, Multiple linear regression, Polynomial regression model, Logistic regression.

Module 4: UNSUPERVISED LEARNING *(09 Periods)*

Introduction, Unsupervised vs supervised learning, Applications of unsupervised learning, Clustering as a machine learning task, Types of clustering techniques, Partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN.

Module 5: ARTIFICIAL NEURAL NETWORKS, ENSEMBLE LEARNING *(09 Periods)*

Artificial Neural Networks: Neural network representations, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm, Convergence and local minima, Representational power of feedforward networks, Hypothesis space search and inductive bias, Hidden layer representations, Generalization, Overfitting, Stopping criterion.

Ensemble Learning: Bagging, Boosting, Gradient boosting.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Perform Exploratory Data Analysis on the given dataset. Implement CART algorithm for decision tree learning. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
2. Train an SVM Classifier with Linear Kernel. Use an appropriate data set for building the SVM Classifier and apply this knowledge to classify a new sample.
3. Build linear regression and multiple regression models to predict the price of the house (Boston House Prices Dataset).
4. Build a neural network that will read the image of a digit and correctly identify the number.
5. Solve classification problem by constructing a feedforward neural network using Backpropagation algorithm. (Wheat Seed Data)

RESOURCES

TEXT BOOKS:

1. Tom M. Mitchell, Machine Learning, McGraw Hill, 1997.
2. Saikat Dutt, Subramanian Chandramouli, Amit kumar das, Machine Learning, Pearson, 2019.

REFERENCE BOOKS:

1. Manaranjan Pradhan, U Dinesh Kumar, Machine Learning Using Python, Packt Publishing, 2019.
2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition, O'Reilly, 2019.
3. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 4th Edition, 2020.
4. Shai Shalev Shwartz, Shai Ben David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.

SOFTWARE/TOOLS:

1. Python
2. Scikit-learn/Keras/TensorFlow

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106202/
2. https://www.coursera.org/learn/machine-learning
3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
4. https://onlinecourses.nptel.ac.in/noc23_cs87/preview
5. https://onlinecourses.nptel.ac.in/noc23_ee87/preview
6. https://www.coursera.org/learn/ntumlone-algorithmicfoundations
7. https://www.coursera.org/specializations/machine-learning-introduction
8. http://ndl.iitkgp.ac.in/document/YkxlRXFvZXJrTDBkVzVVZi9ESjl6eXpRZkxRc2lhOWhlVXBhUVVWaXZlNDNyZUVldU9LdlYvd20wbkQ4MC92UQ
9. https://www.coursera.org/learn/unsupervised-learning-recommenders-reinforcement-learning

WEB RESOURCES:

1. https://www.ibm.com/topics/machine-learning
2. https://www.simplilearn.com/tutorials/machine-learning-tutorial/what-is-machine-learning
3. https://www.w3schools.com/python/python_ml_getting_started.asp
4. https://developers.google.com/machine-learning/crash-course
5. https://www.greenteapress.com/thinkstats/
6. https://info.deeplearning.ai/machine-learning-yearning-book
7. https://www.kaggle.com/code/kanncaa1/machine-learning-tutorial-for-beginners

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM202010	CLOUD ARCHEITECTURE AND DESIGN	3	-	2	-	4

Pre-Requisite Cloud computing

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:
Topics covered include- distributed system models, different cloud service models, service oriented architectures, cloud programming and software environments, resource management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand fundamentals and various paradigms of computing

CO2. Demonstrate cloud characteristics and models.

CO3. Identify the ways in which the cloud can be programmed and deployed.

CO4. Recognize the services and platform of cloud

CO5. Design different cloud services from different vendors.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	2	-	3
CO2	3	-	3	3	3	-	-	-	-	2	-	3
CO3	3	3	3	3	3	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	2	-	3
CO5	-	-	-	-	3	-	-	-	3	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**-**	**3**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: COMPUTING PARADIGMS (09 Periods)

High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing , Cloud Infrastructure Components – Compute, Storage, and Networking

Module 2: CLOUD COMPUTING FUNDAMENTALS (09 Periods)

Introduction to Cloud Computing, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity. Virtualization Concepts – Virtual Machines, Hypervisors, Containers, Docker, Kubernetes

Module 3: CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT (09 Periods)

Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud. Design for Failure – Redundancy and Disaster Recovery, AWS Well-Architected Framework and Best Practices

Module 4: CLOUD SERVICES AND PLATFORMS (09 Periods)

Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers – FIFO, Capacity, and Fair Scheduler.

Module 5: CLOUD SERVICE PROVIDERS (09 Periods)

Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint.
IBM: Introduction to IBM Cloud architecture and services, IBM Cloud Compute and Object Storage, IBM Cloud Foundry – platform for deploying enterprise applications, Watson AI and Machine Learning services on IBM Cloud Integration with hybrid and multi-cloud environments

Total Periods: 45

EXPERIENTIAL LEARNING

1. Implement a parallel algorithm using MPI. Measure and compare its performance on a single core versus multiple cores.
2. Configure a distributed file system on a cluster and simulate a node failure. How does the system respond?
3. Create a small application that utilizes both cloud and grid computing. Analyze and document the differences in setup, cost, and performance.
4. Deploy a VM on a cloud platform, install a web server, and dynamically adjust its resources based on simulated load.
5. Use a cloud storage service to host and manage a static website. Explore the service's interface for asset management and access control.
6. Setup a VPC and demonstrate the configuration of its network connectivity using subnets, gateways, and route tables.
7. Migrate a local web application to the cloud. Document the migration process, focusing on changes in the application architecture and deployment.
8. Deploy a Hadoop cluster using a cloud service and run a MapReduce job. Discuss the impact of different Hadoop schedulers on the job execution.
9. Use a cloud-based analytics service to analyze a dataset. Highlight key findings and how cloud analytics can influence business decisions.
10. Compare the execution of a serverless function (e.g., AWS Lambda vs. Google Cloud Functions) in terms of performance, cost, and ease of use.

Resources:

TEXT BOOKS:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
2. Arshadeep Bhaga, Vijay Madisetti, "Cloud Computing A Handson Approach", Universities Press, 2018 .

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.
4. Chris Hay, Brian Prince, "Azure in Action" Manning Publications [ISBN: 9781935182481],2010.
5. Henry Li, "Introducing Windows Azure" Apress; 1 edition [ISBN: 978-14302-2469- 3],2009.

VIDEO LECTURES:

1. https://www.youtube.com/results?search_query=nptel+cloud+computing
2. https://www.youtube.com/watch?v=2LaAJq1lB1Q&pp=ygUYY2xvdWQgY29tcHV0aW5nIHBsYXlsaXN0

WEB RESOURCES:

1. https://www.javatpoint.com/cloud-computing
2. https://www.geeksforgeeks.org/architecture-of-cloud-computing/
3. https://www.guru99.com/architecture-of-cloud-computing.html
4. https://www.w3schools.in/cloud-computing/cloud-computing-architecture

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201016	ARTIFICIAL INTELLIGENCE	3	-	-	-	3

Pre-Requisite -

Anti-Requisite XXXX-

Co-Requisite XXXX-

COURSE DESCRIPTION: Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Architect intelligent agents using artificial intelligence techniques and principles.

CO2. Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.

CO3. Select and apply appropriate knowledge representation to build Bayesian network models to reason under uncertainty.

CO4. Investigate robot hardware and frameworks for intelligent robotic perception.

CO5. Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	1	-	-	-	-	-	3
CO5	-	-	-	-	-	1	-	2	-	-	-	3
Course Correlation Mapping	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (09 Periods)

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

Module 2: PROBLEM SOLVING BY SEARCHING (09 Periods)

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

Module 3: SEARCH IN COMPLEX ENVIRONMENTS (09 Periods)

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

Module 4: PROBABILISTIC REASONING (09 Periods)

Representing Knowledge in an uncertain domain, Semantics of Bayesian networks, Probabilistic reasoning over time – Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman Filter.

Module 5: ROBOTICS, ETHICS AND SAFETY IN AI (09Periods)

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. **Speech Recognition:** Read an audio file with Python and use the Google speech recognition API to perform conversion of Speech to Text.
2. Detect the language of the text using Language detection library (langdetect) ported from Google's language-detection.
3. **Language Translation:** Perform translation of given input text phrases or document using Google Translate API.
4. **Object Detection:** Detect multiple objects present in an image using Detectron-Facebook's free API.
5. **Human Body Estimation:** Extract a 3D mesh model of a human body from 2D RGB images using Facebook's DensePose tool.
6. Real time Smile Detection in Human Face using OpenCV.
7. Face Recognition using Microsoft Face API.
8. Test and evaluate the performance of the Google Tesseract OCR tool in recognizing printed Text characters.
9. **Chatbot:** Build a Chatbot capable of communicating and interacting with the users based on the given text input.
10. **Video Recognition –** Test and evaluate the videos using Google’s tools

RESOURCES

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 4th Edition, 2020.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education, 2017.
3. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011

REFERENCE BOOKS:

1. Stephen Lucci , Danny Kopec, Artificial Intelligence in the 21st Century, Mercury Learning and Information, 3rd Edition,2018.
2. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009.

VIDEO LECTURES:

1. https://www.coursera.org/courses?query=artificial%20intelligence

WEB RESOURCES:

1. https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence
2. http://aima.cs.berkeley.edu/
3. https://ai.google/education/
4. https://www.edureka.co/blog/artificial-intelligence-with-python/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM201017	DEEP LEARNING	3	-	-	-	3

Pre-Requisite Introduction to Machine Learning

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Overview of machine learning; Fundamentals of deep learning; Modern approaches in deep learning; Feedforward neural network architectures; Deep learning Models and Applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze a neural network by applying the basics of mathematics and machine learning

CO2. Analyzethedatausingmultilayerperceptronandbackpropagationalgorithms.

CO3. Apply regularization and optimization techniques to improve the performance of Deep neural networks

CO4. Identify appropriate deep learning model for text, multimedia, and biological data analysis.

CO5. Comparedeepneuralnetworksanddeeplearningmodelstoinferthesuitable learning algorithm on large scale data

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	2	2	-	-	3
CO2	3	2	-	-	-	-	-	2	2	-	-	3
CO3	2	3	-	-	-	-	-	2	2	-	-	3
CO4	2	3	-	2	-	-	-	2	2	-	-	3
CO5	2	2	-	3	-	-	-	2	2	-	-	3
Course Correlation Mapping	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION ***(09 Periods)***

Historical Trends in Deep Learning – Machine Learning basics - Learning algorithms: Supervised and Unsupervised Training - Linear Algebra for Machine Learning - Testing - Cross Validation - Dimensionality Reduction - Over fitting /Under Fitting - Hyper parameters and validation sets - Estimators – Bias – Variance - Loss Function- Regularization

Module 2: FEED FORWARD NEURAL NETWORKS ***(09 Periods)***

Basic concept and terminology, Representing networks, Perceptron rule, Delta rule, From logistic regression to Back propagation, Back propagation, Complete Feed forward NNs

Module 3 MODERN PRACTICES IN DEEP NETWORKS ***(09 Periods)***

Introductions to Simple DNN - Platform for Deep Learning - Deep Learning Software Libraries- Deep Feed forward networks – Gradient-Based Learning – Architecture Design– Various Activation Functions, ReLU, Sigmoid – Error Functions - Regularization methods forDeepLearning-EarlyStopping-DropOut-OptimizationmethodsforNeuralNetworks- Adagrad, Adam

Module 4 CONVOLUTION & RECURRENT NEURAL NETWORKS ***(09 Periods)***

Convolutional Neural Networks (CNNs): CNN Fundamentals – Architectures – Pooling – Visualization – Sequence Modeling: Recurrent Neural Networks (RNN) - Long-Short Term Memory (LSTM) – Bidirectional LSTMs-Bidirectional RNNs –Deep.

Module 5 AUTO ENCODERS ***(09 Periods)***

Learning Representations, Different Auto encoder Architectures, Stacking Auto encoders.

Total Periods: 45

EXPERIENTIAL LEARNING

1. ImplementationofdifferentactivationfunctionstotrainNeuralNetwork.
2. Implementation of different Learning Rules
3. Implementation of A deadline network for system identification.
4. Pattern matching using different rules.
5. Implementation of Made line network

RESOURCES

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, 4th Edition, MIT Press, 2016.

REFERENCE BOOKS:

1. Michael A. Nielsen, *Neural Networks and Deep Learning, Determination* Press,2015.

2. KevinP.Murphy,"*MachineLearning:AProbabilisticPerspective*",MITPress,2012

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=lhufOy2W3Ps
2. https://www.youtube.com/watch?v=DooxDIRAkPA&list=PL9ooVrP1hQOEX8BKDplfG86ky8s7Oxbzg
3. https://www.youtube.com/watch?v=YFNKnUhm_-s&list=PLZoTAELRMXVPGU70ZGsckrMdr0FteeRUi
4. https://www.youtube.com/watch?v=lhufOy2W3Ps

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs22/preview
2. https://www.simplilearn.com/introduction-to-deep-learning-free-course-skillup
3. https://www.udemy.com/tutorial/deeplearning/what-is-deep-learning/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25AI201701	**BUSINESS ANALYTICS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course emphasizes on the basic concepts of Business Analytics. It covers the basic excel skills, Excel look up functions for database queries in business analytics. By the end of this course students will acquire basic knowledge to implement statistical methods for performing descriptive, predictive and prescriptive analytics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the basic concepts and models of Business Analytics

CO2. Select Suitable basic excel function to perform analytics on spread sheets.

CO3. Apply different statistical techniques and distributions for modeling the data

CO4. Develop user-friendly Excel applications by using statistical models for effectiveness decision making.

CO5. Analyze the performance of different optimization models used in prescriptive analytics on Binary and Categorical data.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	2	1	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-
CO4	1	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: FOUNDATIONS OF BUSINESS ANALYTICS ***(09 Periods)***

Introduction, What is Business Analytics, Evolution of Business Analytics, Scope of Business Analytics, Data for Business Analytics, Applications of Business Analytics, Models in Business Analytics, Problem Solving with Analytics.

Module 2: ANALYTICS ON SPREADSHEETS ***(09 Periods)***

Basic Excel Skills, Excel Functions, Using Excel Lookup Functions for Database Queries, Spreadsheet Add-Ins for Business Analytics.
Visualizing and Exploring Data: Data Visualization, Creating Charts In Microsoft Excel, Other Excel Data Visualization, Statistical Methods For Summarizing Data, Exploring Data Using Pivot tables.

Module 3: DATA MODELING ***(09 Periods)***

Basic concepts of Probability, Random Variables and Probability Distributions, Continuous Probability Distributions.
Statistical Sampling, Estimation population parameters, Sampling Error, Sampling Distributions, Hypothesis Testing, ANOVA, Chi Square Test.

Module 4: Predictive analytics ***(09 Periods)***

Trend lines And Regression Analysis, Modeling Relationships And Trends In Data, Simple Linear Regression, Multiple Linear Regression, Building Good Regression Models,
Strategies for predictive decision modeling, implementing models on spreadsheets, spreadsheet applications in business analytics, developing user-friendly excel applications, analysing uncertainty and model assumptions, model analysis using analytic solver platform

Module 5: Prescriptive analytics ***(09 Periods)***

Linear Models: Building Linear Models, Implementing Linear Optimization Models On Spreadsheets, Graphical Interpretation Of Linear Optimization, Linear Optimization Models for prediction and Insight.
Integer Models: Solving models with Integer Variables, Integer Optimization Models with Binary Numbers
Decision Analysis: Formulating Decision Problems, Decision Strategies Without Outcome Probabilities, Decision Trees With Outcome Probabilities, Decision Trees.

Total Periods: 45

EXPERIENTIAL LEARNING

1. **Diabetic Prediction:**
   The National Institute of Diabetes and Digestive and Kidney Diseases has a created a dataset. The objective of the dataset is to diagnostically predict whether or not a patient has diabetes, based on certain diagnostic measurements included in the dataset. Several constraints were placed on the selection of these instances from a larger database. In particular, all patients here are females at least 21 years old of Pima Indian heritage. The datasets consists of several medical predictor variables and one target variable, Outcome. Predictor variables includes the number of pregnancies the patient has had, their BMI, insulin level, age, and so on. Build a machine learning model to accurately predict whether or not the patients in the dataset have diabetes or not?
2. Solve the house price prediction problem using **Linear regression analysis** method. Optimize the parameters of the regression function using gradient descent method.
3. Visualize the decision tree built for solving Heart disease prediction problem and measure the impurity of nodes created via **Decision Tree Analysis**.
   Dataset:https://www.kaggle.com/arviinndn/heart-disease-prediction-uci dataset/data

4. The data set baby boom (Using R) contains data on the births of 44 children in a one-day period at a Brisbane, Australia, hospital. Compute the skew of the wt variable, which records birth weight. Is this variable reasonably symmetric or skewed?
5. Visualize the **Distribution of data** with different feature scaling methods on online news popularity dataset for article word count.
   Dataset:https://www.kaggle.com/datasets/deepakshende/onlinenewspopularity
6. **Human Activity Recognition System:**
   The human activity recognition system is a classifier model that can identify human fitness activities. To develop this system, you have to use a smart phone dataset, which contains the fitness activity of 30 people which is captured through smart phones. This system will help you to understand the solving procedure of the **Multi-classification problem**.

RESOURCES

TEXT BOOKS:

1. James Evans, *Business Analytics*, Pearson Education, 2nd Edition, 2017.

REFERENCE BOOKS:

1. Marc J. Schniederjans, *Business Analytics*, Pearson Education,2015
2. Camm, Cochran, *Essentials of Business Analytics*, Cenage learning, 2015

VIDEO LECTURES:

1. https://nptel.ac.in/courses/110105089
2. https://archive.nptel.ac.in/courses/110/107/110107092/
3. https://nptel.ac.in/courses/110106050

WEB RESOURCES:

1. https://www.proschoolonline.com/certification-business-analytics-course/what-is-ba
2. https://michael.hahsler.net/SMU/EMIS3309/slides/Evans_Analytics2e_ppt_01.pdf
3. https://www.guru99.com/business-analyst-tutorial-course.html

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25AI201702	**ETHICS FOR AI**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

Recognize the fundamental ideas and standards of AI ethics. Recognizing fairness and prejudice in artificial intelligence. Obstacles to obtaining explain ability and openness. Frameworks based on ethics and the law that designate accountability. Privacy and security concerns related to AI ethics. Ethics in AI in the future.

COURSE OUTCOMES: At the end of the course, student will be able to:

CO1. Understand the basic concepts of AI Ethics and ethical principles.

CO2. Understanding the concept of bias and fairness in AI.

CO3. Challenges in achieving the transparency and explainability.

CO4. Legal and ethical frameworks for assigning responsibility.

CO5. Security and privacy issues of AI Ethics. Future of AI ethics.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	2	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-
CO4	2	3	3	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	-	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

MODULE 1: INTRODUCTION TO AI ETHICS ***(09 Periods)***

Overview of ethical issues in AI. Historical context and key concepts. Importance of ethical considerations in AI development and deployment.

Ethical Principles and Frameworks:

Utilitarianism, deontology, virtue ethics, and other ethical theories. Ethical principles for AI, such as fairness, transparency, accountability, and privacy.

MODULE 2: BIAS AND FAIRNESS IN AI ***(09 Periods)***

Understanding bias in AI systems. Types of bias (e.g., algorithmic bias, dataset bias). Approaches to detecting and mitigating bias. Fairness metrics and fairness-aware machine learning algorithms.

MODULE 3: TRANSPARENCY AND EXPLAINABILITY ***(09 Periods)***

Importance of transparency and explainability in AI. Techniques for explaining AI decisions. Challenges and trade-offs in achieving transparency and explainability. Regulatory requirements and guidelines for transparent AI systems.

MODULE 4: ACCOUNTABILITY AND RESPONISIBILITY ***(09 Periods)***

Holding AI developers, users, and organizations accountable for AI systems' actions. Legal and ethical frameworks for assigning responsibility. Challenges in attributing responsibility in complex AI systems

MODULE 5: PRIVACY AND DATA PROTECTION ***(09 Periods)***

Privacy issues in AI, including data collection, storage, and sharing. Privacy-preserving AI techniques. Regulatory frameworks (e.g., GDPR) and ethical guidelines for data protection in AI. Ethical considerations in emerging AI technologies.

Total Periods: 45

EXPERENTIAL LEARNING

Case -1: Emergence of Bias and Fairness Interventions

For the problem of Loan Approval and Hiring by AI, specify the steps and practices to the entry of bias and fairness improvement interventions.

Case-2: AI governance with critical thinking, negotiation skills, and a multi-stakeholder perspective
Undertake the study from ethical perspective for the problem of Public response system, Policy making and Contract negotiation.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Müller, Vincent C., Ethics of Artificial Intelligence and Robotics. The Stanford Encyclopedia of Philosophy, 2021.
2. Meredith Broussard, Artificial Unintelligence: How Computers Misunderstand the World, Cambridge, MA: MIT Press, 2018.

REFERENCE BOOKS:

1. Brett Frischmann and Evan Selinger, Re-Engineering Humanity, Cambridge University Press, Cambridge, 2018.
2. Cathy O'Neil, Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy, Crown Publishers, 2016.
3. Shoshana Zuboff, The Age of Surveillance Capitalism, Financial Times, 2020.

VIDEO LECTURES:

1. https://rainermuehlhoff.de/en/EoAI2025/
2. https://www.youtube.com/watch?v=qpp1G0iEL_c
3. https://rainermuehlhoff.de/en/EoAI2025/

WEB RESOURCES:

1. https://www.ibm.com/topics/ai-ethics
2. https://www.coursera.org/articles/ai-ethics
3. https://ai.google/responsibility/principles/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CM201701	**COST MANAGEMENT OF ENGINEERING PROJECTS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course will provide an understanding of the cost tools and techniques that can be used throughout a project's design and development. The students will be exposed to the methods, processes, and tools needed to conduct economic analysis, estimation of Project.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the costing concepts and their role in decision-making.
CO2. Understand the project management concepts and their various aspects in selection.
CO3. Interpret costing concepts with project execution.
CO4. Knowledge of costing techniques in the service sector and various budgetary control techniques.
CO5. Become familiar with quantitative techniques in cost management.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	-	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	2	-	-	-
Course Correlation Mapping	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO COSTING CONCEPTS ***(05 Periods)***

Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost, and Opportunity cost; Creation of a Database for operational control.

Module 2: INTRODUCTION TO PROJECT MANAGEMENT ***(10 Periods)***

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre-project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts

Module 3: PROJECT EXECUTION AND COSTING CONCEPTS ***(10 Periods)***

Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing

Module 4: COSTING OF SERVICE SECTOR AND BUDGETARY CONTROL ***(10 Periods)***

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets

Module 5: QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT ***(10 Periods)***

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a mini-project report regarding cost control techniques in manufacturing units.
2. Prepare a report on real-life engineering project case studies, especially those that faced cost overruns or successfully managed costs
3. Conduct hands-on budgeting exercises where participants are given a project scope, and they have to create detailed budgets.

RESOURCES

TEXT BOOKS:

1. John M. Nicholas, Herman Steyn Project Management for Engineering, Business and Technology, Taylor & Francis, 2 August 2020, ISBN: 9781000092561
2. Albert Lester ,Project Management, Planning and Control, Elsevier/Butterworth-Heinemann, 2007, ISBN: 9780750669566, 075066956X.

REFERENCE BOOKS:

1. Charles T. Horngren et al Cost Accounting a Managerial Emphasis, Prentice Hall of India, New Delhi, 2011.
2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher, 1991.
3. Vohra N.D., Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd, 2007
4. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, 2003

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=rck3MnC7OXA
2. https://www.youtube.com/watch?v=QWD1LMzStI4

WEB RESOURCES:

1. https://www.superfastcpa.com/what-are-cost-concepts-in-decision-making
2. https://www.indeed.com/career-advice/career-development/project-cost-controls
3. https://www.geeksforgeeks.org/difference-between-pert-and-cpm/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CE201701	DISASTER MANAGEMENT	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on disaster prone areas in India, repercussions of disasters and hazards, disaster preparedness and management, risk assessment and disaster management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the vulnerability of an area to natural and man-made disasters/hazards as per the guidelines to solve complex problems using appropriate techniques ensuring safety, environment and sustainability.

CO2. Analyze the causes and impacts of disasters using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO3. Suggest the preparedness measures using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.

CO4. Analyze the Risk Assessment using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.

CO5. Design disaster management strategies to solve pre, during and post disaster problems using appropriate tools and techniques following the relevant guidelines and latest developments ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	-	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	2	-	-	-
Course Correlation Mapping	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: DISASTER PRONE AREAS IN INDIA ***(09 Periods)***

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types And Magnitude. Disaster Prone Areas: Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Module 2: REPERCUSSIONS OF DISASTERS AND HAZARDS ***(09 Periods)***

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Module 3: DISASTER PREPAREDNESS AND MANAGEMENT ***(11 Periods)***

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Module 4: RISK ASSESSMENT ***(08 Periods)***

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Module 5: DISASTER MANAGEMENT ***(08 Periods)***

Disaster management organization and methodology, Disaster management cycle, Disaster management in India – Typical cases and Cost–benefit analysis, Disaster management programs implemented by NGOs and Government of India, Usage of GIS and Remote sensing techniques in disaster management, Leadership and Coordination in Disaster management, Emerging trends in disaster management.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Perform hazard assessment and vulnerability analysis for any nearby town/city and prepare a detailed report of possible impacts of various disasters on environment, infrastructure and development.
2. Prepare a detailed report on the causes and effects of Tsunami that was occurred in the year 2004. Also discuss various advancements in Tsunami warning systems.
3. Identify the major causes of urban floods in cities like Chennai, Hyderabad & Mumbai. Also list various mitigation strategies to reduce the impact of floods.
4. Prepare a detailed report on how various man-made activities are directly/indirectly related to the occurrence of landslides that occurred in recent days in India.
5. Visit AP State Disaster Response and Fire Services Department and record about various methods used by them in mitigating disasters and their management.

RESOURCES

TEXT BOOKS:

1. Sharma V. K., *Disaster Management, Medtech Publishing, 2nd Edition, 2013*.
2. Anand S. Arya, Anup Karanth, and Ankush Agarwal, *Hazards, Disasters and Your Community: A Primer for Parliamentarians*, GOI–UNDP Disaster Risk Management Programme, Government of India, National Disaster Management Division, Ministry of Home Affairs, New Delhi, Version 1.0, 2005

REFERENCE BOOKS:

1. Donald Hyndman and David Hyndman, *Natural Hazards and Disasters*, Cengage Learning, USA, 5th Edition, 2015.
2. *Disaster Management in India,* A Status Report, Ministry of Home Affairs, Govt. of India, May 2011.
3. Rajendra Kumar Bhandari, *Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers*, Springer India, 2014.
4. Singh R. B., *Natural Hazards and Disaster Management*, Rawat Publications, 2009.
5. R. Nishith, Singh AK, *Disaster Management in India: Perspectives, issues and strategies,* New Royal book Company.
6. Sahni, PardeepEt.Al. (Eds.), *Disaster Mitigation Experiences And Reflections*, Prentice Hall of India, New Delhi.
7. Goel S. L. , *Disaster Administration And Management Text And Case Studies*, Deep &Deep Publication Pvt. Ltd., New Delhi

VIDEO LECTURES:

1. https://nptel.ac.in/courses/105104183
2. https://www.digimat.in/nptel/courses/video/124107010/L01.html

WEB RESOURCES:

1. https://egyankosh.ac.in/handle/123456789/25093
2. https://www.egyankosh.ac.in/handle/123456789/25912
3. https://www.nios.ac.in/media/documents/333courseE/12.pdf
4. https://ndmindia.mha.gov.in/images/public-awareness/Primer%20for%20Parliamentarians.pdf

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25SS201701	**VALUE EDUCATION**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with understanding the value of education and self-development, Imbibe good values in students, and making them know about the importance of character.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the knowledge of values and self-development

CO2. Analyze the importance of the cultivation of values.

CO3. Learn suitable aspects of personality and behavioral development

CO4. Function as a member and leader in multi-disciplinary teams by avoiding faulty thinking.

CO5. Develop character and competence for effective studies.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	-	-	-	-	-	-	3	2
CO2	2	3	-	-	2	-	-	3	2
CO3	2	-	-	-	2	-	-	3	2
CO4	2	-	-	-	-	-	-	3	2
CO5	2	2	-	-	-	-	-	3	2
Course Correlation Mapping	**2**	**3**	**-**	**-**	**2**	**-**	**-**	**3**	**2**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: VALUES AND SELF-DEVELOPMENT ***(09 Periods)***

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements- Case studies

Module 2: IMPORTANCE OF CULTIVATION OF VALUES. ***(09 Periods)***

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline- Case studies

Module 3: PERSONALITY AND BEHAVIOR DEVELOPMENT ***(09 Periods)***

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness - Case studies

Module 4: AVOID FAULTY THINKING. ***(09 Periods)***

Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature - Case studies

Module 5: CHARACTER AND COMPETENCE ***(09 Periods)***

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and the same message. Mind your Mind, Self-control. Honesty, Studying effectively- Case studies

Total Periods: 45

EXPERIENTIAL LEARNING

1. Demonstrate orally using your experiences of what values are naturally acceptable in a relationship to nurture or exploit others.
2. Prepare a report by identifying and analyzing the importance of cultivation of values.
3. Present a poster on different attitudes and behaviours.
4. Students give a PowerPoint presentation on doing best for nature.
5. Students are encouraged to bring a daily newspaper to class or to access any news related to the need for human values and note down the points.
6. Prepare a case study on how to maintain harmony with different religious people through character and competence.

(It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in the Course Handout)

RESOURCES

TEXTBOOKS:

1. R. Subramanaian, *Professional Ethics*, Oxford Higher Education, 2013.
2. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd Edition, 2007.
3. Chakravarthy, S.K.: Values and ethics for Organizations: Theory and Practice, Oxford University Press, NewDelhi, 1999.

REFERENCE BOOKS:

1. M.G. Chitakra: Education and Human Values, A.P.H. Publishing Corporation, New Delhi, 2003
2. Awakening Indians to India, Chinmayananda Mission, 2003
3. Satchidananda, M.K.: Ethics, Education, Indian Unity and Culture, Ajantha Publications, Delhi, 1991

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=90VQPZURN5c
2. https://www.youtube.com/watch?v=6ofPcK0uDaA
3. https://www.youtube.com/watch?v=5_f-7zCi79A
4. https://www.youtube.com/watch?v=2ve49BWAJRE
5. https://www.youtube.com/watch?v=kCOIfnxxQ5U

WEB RESOURCES:

1. https://www.livingvalues.net/
2. https://livingvalues.net/materials-for-schools/
3. https://www.edb.gov.hk/en/curriculum-development/4-key-tasks/moral-civic/index.html

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25SS201702	**PEDAGOGY STUDIES**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with understanding pedagogical practices that are being used by teachers in formal and informal classrooms, the effectiveness of pedagogical practices, teacher education (curriculum and practicum), and the school curriculum and guidance materials that can best support effective pedagogy.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of pedagogical methodology

CO2. Analyze the functional knowledge in Pedagogical practices, Curriculum, and Teacher Education

CO3. Learn effective pedagogical practices and apply strategies.

CO4. Function effectively as an individual and as a member of the Professional development.

CO5. Understand research Gaps and provide future Directions.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	2	1	-	-	-	-	-	-	-
CO2	2	3	-	-	3	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-
CO4	1	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	2	2	-	-	3	-	-	-	3

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION AND METHODOLOGY ***(09 Periods)***

Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of Methodology and Searching- Case studies

Module 2: THEMATIC OVERVIEW ***(09 Periods)***

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher Education- Case studies

Module 3: EFFECTIVENESS OF PEDAGOGICAL PRACTICES ***(09 Periods)***

Evidence on the effectiveness of pedagogical practices, Methodology for the in-depth stage: quality Assessment of included studies, teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy, Theory of change, Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' Attitudes and beliefs and Pedagogic strategies- Case studies

Module 4: PROFESSIONAL DEVELOPMENT ***(09 Periods)***

Alignment with classroom practices and follow-up support, Peer support, and Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes- Case studies

Module 5: RESEARCH GAPS AND FUTURE DIRECTIONS ***(09 Periods)***

Research design, Contexts, Pedagogy, Teacher Education, Curriculum and Assessment, Dissemination and research impact- Case studies

Total Periods: 45

EXPERIENTIAL LEARNING

1. List out the self-improvement in you after going through pedagogical methodologies.
2. Discuss different practices that you would like to adopt in the curriculum.
3. Describe in your own words how can you bring effectiveness to the curriculum.
4. Imagine you are a head teacher and illustrate different barriers to learning.
5. Assume you are a teacher and Interpret different directions that you would bring for the assessment of the students.

(It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in the Course Handout)

RESOURCES

TEXTBOOK:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.

REFERENCES:

1. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of
2. Curriculum Studies, 36 (3): 361-379.Oxford and Boston: Blackwell.
   Educational Development, 33 (3): 272–282.
   Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of
3. basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
4. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=WL40UeySag4
2. https://www.youtube.com/watch?v=MMXaXDIHFJ8
3. https://www.youtube.com/watch?v=7uJL1R6M4Iw

WEB RESOURCES:

1. https://acrl.ala.org/IS/instruction-tools-resources-2/pedagogy/a-selected-list-of-journals-on-teaching-learning/
2. https://guides.douglascollege.ca/TLonline/resourcesforonlinepedagogy
3. https://www.refseek.com/directory/teacher_resources.html

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25LG201701	**PERSONALITY DEVELOPMENT THROUGH ESSENTIAL LIFE SKILLS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course gives awareness to students about the various dynamics of personality development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge in Self-Management and Planning Career

CO2. Analyze the functional knowledge in attitudes and thinking strategies

CO3. Learn and apply soft skills for professional success.

CO4. Function effectively as an individual and as a member in diverse teams

CO5. Communicate effectively in public speaking in formal and informal situations.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-
CO4	1	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	2	2	3	-	3	-	-	-	3

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: SELF-ESTEEM & SELF-IMPROVEMENT ***(09 Periods)***

Concept of personality, significance of personality-Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself- SWOT Analysis- Exercises- case studies

Module 2: DEVELOPING POSITIVE ATTITUDES ***(09 Periods)***

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes – Exercises- case studies- Positive attitude and its advantages, negative attitude and its disadvantages-case studies

Module 3: SELF-MOTIVATION & SELF-MANAGEMENT ***(09 Periods)***

Concept of motivation, significance, factors leading to de-motivation- Show Initiative – Be Responsible - Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies- Exercises- case studies

Module 4: GETTING ALONG WITH THE SUPERVISOR ***(09 Periods)***

Know your Supervisor – Communicating with your Supervisor – Special Communication with Supervisor – What Should you Expect of Your Supervisor? – What your Supervisor expects of you - Moving Ahead Getting Along with your Supervisor- Exercises- case studies

Module 5: WORKPLACE SUCCESS ***(09 Periods)***

First Day on the Job – Keeping Your Job – Planning Your Career – Moving Ahead- Esse employability skills, professional attributes, and career development strategies -Exercises- C studies.

Total Periods: 45

EXPERIENTIAL LEARNING

1. List out the self-improvements in you on the charts and explain in detail.
2. Discuss different famous personalities and their attitudes.
3. Describe different personalities concerning self-motivation and self-management.
4. Imagine you are a supervisor and illustrate different special communications.
5. Assume and Interpret different experiences on the first day of your job.

RESOURCES

TEXTBOOK:

1 Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th edition Indian Reprint, 2011. (6th Indian Reprint 2015)

2 Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, 2011.

REFERENCE BOOKS:

1 K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition, 2011.

2 Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=6Y5VWBLi1es
2. https://www.youtube.com/watch?v=H9qA3inVMrA

WEB RESOURCES:

1 https://www.universalclass.com/.../the-process-of-perso

2 https://www.ncbi.nlm.nih.gov/pubmed/25545842

3 https://www.youtube.com/watch?v=Tuw8hxrFBH8

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25ME201701	**ENTREPRENEURSHIP AND INNOVATION MANAGEMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course aims to provide students with a deep understanding of entrepreneurship and innovation. It explores entrepreneurial processes, opportunity identification, business planning, innovation management, intellectual property rights, and venture growth strategies. Students will develop entrepreneurial thinking, creativity, and problem-solving abilities to create and manage innovative ventures that contribute to economic and societal development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1: Explain the fundamentals of entrepreneurship and its role in economic development.

CO2: Analyze opportunities and prepare business plans for entrepreneurial ventures.

CO3: Apply creativity and innovation techniques to business problems.

CO4: Demonstrate knowledge of technology management, IPR, and startup ecosystem.

CO5: Evaluate financing options, marketing strategies, and growth models for ventures.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	2	1	1	-	-	3	2	1
CO2	3	3	2	2	2	-	3	3	2
CO3	2	3	3	2	2	1	2	3	3
CO4	2	2	2	2	2	1	2	2	2
CO5	3	3	2	2	3	1	3	3	2
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**2**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION TO ENTREPRENEURSHIP ***(09 Periods)***

Concept, meaning and importance of entrepreneurship – Characteristics and skills of entrepreneurs – Types of entrepreneurs: social, women, corporate, rural, technology-based – Intrapreneurship vs. entrepreneurship – Entrepreneurial ecosystem and its components.

Module 2: ENTREPRENEURIAL PROCESS AND BUSINESS PLANNING ***(09 Periods)***

Stages of entrepreneurial process: Idea, Feasibility, Startup, Growth – Opportunity identification and evaluation – Market research and environmental scanning – Structure and components of a business plan – Case studies of successful entrepreneurs.

Module 3 INNOVATION MANAGEMENT ***(09 Periods)***

Meaning, scope and significance of innovation – Types of innovation: product, process, business model, disruptive, frugal – Creativity techniques: brainstorming, lateral thinking, design thinking, TRIZ – Managing innovation in organizations – Innovation as a competitive advantage.

Module 4 TECHNOLOGY, IPR AND STARTUP ECOSYSTEM (09 Periods)

Technology management and commercialization – Intellectual Property Rights (IPR): patents, copyrights, trademarks, designs, trade secrets – Technology transfer and licensing – Startup India, Atal Innovation Mission, MSME policies – Role of incubators, accelerators and innovation hubs.

Module 5 FINANCING AND GROWTH OF VENTURES ***(09 Periods)***

Sources of finance: bootstrapping, angel investors, venture capital, crowdfunding, government support – Entrepreneurial marketing strategies – Financial planning for startups – Scaling up ventures: challenges and strategies – Exit strategies: mergers, acquisitions, IPO.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a mini-business plan for a startup idea.
2. Visit a nearby incubation/innovation center and prepare a report.
3. Conduct a creativity workshop (brainstorming/design thinking session).
4. Prepare a case study presentation on a successful entrepreneur/startup.

RESOURCES

TEXT BOOKS:

1. Hisrich, R.D., Peters, M.P., & Shepherd, D.A. (2017), *Entrepreneurship*, McGraw-Hill Education.
2. Drucker, P. (2007), *Innovation and Entrepreneurship*, Harper Business.
3. Kuratko, D.F. (2020), *Entrepreneurship: Theory, Process and Practice*, Cengage Learning.

REFERENCE BOOKS:

1. Timmons, J.A., & Spinelli, S. (2019), *New Venture Creation: Entrepreneurship for the 21st Century*, McGraw-Hill Education.
2. Schilling, M.A. (2020), *Strategic Management of Technological Innovation*, McGraw-Hill Education.
3. Scarborough, N.M. (2018), *Essentials of Entrepreneurship and Small Business Management*, Pearson.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=rA4uKIy5gO0&list=PLsh2FvSr3n7fQlIDbfKutmSL26TsWitGQ
2. https://www.youtube.com/watch?v=itRVzjk9mkg

WEB RESOURCES:

1. https://nacosadsu.org.ng/main/docs/300L/ENT%20301.pdf?utm_source=chatgpt.com
2. https://www.measiim.edu.in/myweb/uploads/2022/05/PMFEA-IE-1.pdf?utm_source=chatgpt.com
3. https://ocw.mit.edu/courses/15-351-managing-innovation-and-entrepreneurship-spring-2008/pages/lecture-notes/?utm_source=chatgpt.com