

MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102



SCHOOL OF COMPUTING

M.C.A - Master of Computer Applications

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 COMPUTING

Vision

To lead the advancement of computer science research and education that has real-world impact and to push the frontiers of innovation in the field.

Mission

- ❖ Instil within our students fundamental computing knowledge, a broad set of skills, and an inquisitive attitude to create innovative solutions to serve industry and community.
- ❖ Provide an experience par excellence with our state-of-the-art research, innovation, and incubation ecosystem to realise our learners' fullest potential.
- ❖ Impart continued education and research support to working professionals in the computing domain to enhance their expertise in the cutting-edge technologies.
- ❖ Inculcate among the computing engineers of tomorrow with a spirit to solve societal challenges.

DEPARTMENT OF COMPUTER APPLICATIONS

Vision

To become a center of excellence in the field of computer science and applications.

Mission

- Imparting knowledge and skills through contemporary curriculum to the diverse group of students.
- Creating a talent pool of faculty in diverse domains of computer applications through continuous training.
- Domain and transferable skill development for the holistic personality of students to inculcate values and ethics for effective professional practice and as an entrepreneur.

MASTER OF COMPUTER APPLICATIONS

PROGRAM EDUCATIONAL OBJECTIVES

After few years of completion of the Program, the graduates of MCA will be able to:

- PEO1.** Pursue higher education in the core and allied areas of computer science by applying computing knowledge and domain-specific knowledge, demonstrating their innovative skills, and considering social and environmental concerns.
- PEO2.** Become professionals in industry and academia with ability to investigate, and solve complex computing problems using modern tools in evolving technologies in the core and allied areas of computer science.
- PEO3.** Become successful entrepreneurs to excel in diverse application skills in the core or allied area of computer science of societal importance.
- PEO4.** Exhibit professionalism, and uplifting health, safety, legal, environmental, ethical, and cultural diversity issues for serving the society and communicating with local, and national peers, bound within regulations and leading to lifelong learning.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of M.C.A Program will be able to:

- PO1 (Foundation Knowledge):** Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
- PO2 (Problem Analysis):** Identify, review, formulate and analyse problems for primarily focussing on customer requirements using critical thinking frameworks.
- PO3 (Development of Solutions):** Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
- PO4 (Modern Tool Usage):** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
- PO5 (Individual and Teamwork):** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
- PO6 (Project Management and Finance):** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
- PO7 (Ethics):** Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
- PO8 (Life-long learning):** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

MASTER OF COMPUTER APPLICATIONS

Basket Wise - Credit Distribution

S. No.	Basket	Credits (Min.- Max.)
1	SCHOOL CORE	30-36
2	PROGRAM CORE	21-26
3	PROGRAM ELECTIVE	18-24
4	SPECIALIZATION ELECTIVE	12-18
5	UNIVERSITY ELECTIVE	6-9
TOTAL CREDITS		Min. 90

School Core (30-36 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project Based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25CA201001	Computational Statistics	3	-	-	-	3	-
25MM201404	Mathematical Foundations for Computer Applications	3	-	-	-	3	-
25CA201002	Computer Organization and Architecture	3	-	-	-	3	-
25CA202001	Operating Systems	2	-	2	-	3	-
25CA202002	Python Essentials	3	-	2	-	4	-
25CA211001	Internship	-	-	-	-	2	-
25CA209001	Project Work	-	-	-	-	12	-
25CA201003	Operations Research	3	-	-	-	3	-
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	-
25MG207601	Project Management	2	-	-	-	2	-
25MG207602	Essentials of Business Etiquette	2	-	-	-	2	-
25LG207601	Technical Report Writing	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	
25CA202003	Database Management Systems	3	-	2	-	4	-
25CA202004	Data Mining	3	-	2	-	4	Database Management Systems
25CA202005	Computer Networks	3	-	2	-	4	-
25CA202006	Data Structures and Algorithms	3	-	2	-	4	Python Essentials
25CA204001	Object Oriented Programming through JAVA	3	-	2	4	5	-
25CA204002	Web Technologies	3	-	2	4	5	Object Oriented Programming through JAVA
25CA201004	Software Engineering	3	-	-	-	3	-
25CA201005	Artificial Intelligence	3	-	-	-	3	-
25CA202007	Cloud Computing	3	-	2	-	4	-
25CA201006	Cloud Security	3	-	-	-	3	-
25CA201007	Distributed Databases	3	-	-	-	3	-

Program Elective (18-24 Credits)

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
25CA202008	Information Management	Data Analytics	3	-	2	-	4	Data Mining
25CA201008		Information Retrieval Systems	3	-	-	-	3	Data Mining
25CA201009		Data Science and Statistical Modeling	3	-	-	-	3	Data Mining
25CA201010		Big Data	3	-	-	-	3	-
25CA202009	Intelligent Computing	Machine Learning	3	-	2	-	4	Data Mining, Python Essentials
25CA202010		Data Handling and Visualization	3	-	2	-	4	Data Analytics
25CA201011		Deep Learning	3	-	-	-	3	Machine Learning
25CA201012		Reinforcement Learning	3	-	-	-	3	Machine Learning
25CA201013		Predictive Analytics	3	-	-	-	3	Machine Learning
25CA202011		AI for Health Care	3	-	2	-	4	Artificial Intelligence
25CA201014		Digital Image Processing	3	-	-	-	3	-
25CA201015		Generative AI and Large Language Models	3	-	-	-	3	Artificial Intelligence
25CA201016		Explainable AI (XAI)	3	-	-	-	3	Artificial Intelligence
25CA201017	Networks	Internet of Things	3	-	-	-	3	-
25CA201018		Mobile Computing	3	-	-	-	3	-

25CA202012	Programming Languages	Programming in C# and .Net Framework	3	-	2	-	4	-
25CA202013		R Programming	3	-	2	-	4	Computational Statistics
25CA202014		Programming with AngularJS	3	-	2	-	4	-
25CA202015		LINUX Programming	3	-	2	-	4	Operating Systems
25CA202016		Natural Language Processing	3	-	2	-	4	Python Essentials
25CA202017	Cloud Computing	Cloud Practitioner	3	-	2	-	4	Cloud Computing
25CA202018		Cloud Architecture and Design	3	-	2	-	4	Cloud Computing
25CA202019		Cloud Architect	3	-	2	-	4	Cloud Computing
25CA201019	Information Security	Cryptography and Network Security	3	-	-	-	3	Computer Networks
25CA201020		Cyber Security	3	-	-	-	3	Computer Networks
25CA201021		Ethical Hacking	3	-	-	-	3	Computer Networks
25CA201022	Software Engineering	Software Project Management	3	-	-	-	3	Software Engineering
25CA201023		Software Architecture and Design Patterns	3	-	-	-	3	Software Engineering
25CA202020		Software Testing and Quality Assurance	3	-	2	-	4	Software Engineering
25CA201024		Optimization Techniques	3	-	-	-	3	Computational Statistics
25CA203001		Object-Oriented Modeling and Design	3	-	-	4	4	Software Engineering
25CA202021	Platform Based Development	Mobile Application Development	3	-	2	-	4	Object Oriented Programming through JAVA
25CA201025		User Experience/Interface Design (UX/UI)	3	-	-	-	3	-
25CA201026		Blockchain Technologies	3	-		-	3	Computer Networks
25CA201027		Real time Operating System	3	-	-	-	3	-

Specialization Elective (12 - 16 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25CA201028	Full Stack Web Development	3	-	-	-	3	-
25CA202022	MERN Stack Development	3	-	2	-	4	-
25CA202023	Go Java Full Stack with Spring Boot and React	3	-	2	-	4	-
25CA202024	Full Stack Cloud Developer	3	-	2	-	4	-
25CA202025	DevOps	3	-	2	-	4	Software Engineering
25CA202026	Responsive Website Development and Design	3	-	2	-	4	-
25CA204003	Modern Application Development with Node.js on AWS	2	-	2	4	4	Cloud Computing
25CA202027	Extreme Web Development	3	-	2	-	4	Web Technologies
25CA202028	Enterprise App and API Development with AngularJS and Sails	3	-	2	-	4	-
25CA201029	Social Network Analysis	3	-	-	-	3	-

Note:

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

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 Essential Life Skills	3	-	-	-	3	-
25MG201701	Entrepreneurship and Innovation Management	3	-	-	-	3	-

Note:

1. 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.
2. 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
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 Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
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	1.5	-	-	-

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.

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. Who do you think were the cybercriminals behind it, and what might have been their motive?

a. Requirement gathering

- a. Identify the variables and methods
- b. Draw Histogram for statistical analysis
- c. Write use cases for Patient information & Recovery percentage

b. Analysis

- a. Fit the Linear Regression model for the system
- b. Draw Mathematical relationship to find the Patient information
- c. Identify the Patient current condition and to provide right Medication

c. Design

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

d. Evaluate quality of design

- a. 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.mymooc.com/en/categorie/statistics-and-probability>

RESOURCES

TEXT BOOKS:

1. T. K. V. Iyengar, B. Krishna Gandhi et al., "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>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MM201404	MATHEMATICAL FOUNDATIONS FOR COMPUTER APPLICATIONS	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 Mapping Table:

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

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, Karnaugh Map.

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

Algebraic Structures: Binary Operations and Algebraic Structures Groups, Subgroups, Lagrange's Theorem.

Number Theory: Division Algorithm, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Modular Arithmetic (Fermat'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: GRAPH THEORY AND ITS APPLICATIONS (09 Periods)

Graphs: Representation of Graphs and Graph Isomorphism, Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Properties of Trees, Applications of Trees, Spanning Trees, Counting trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Draw the Shortest Path in a Campus Map using DFS.
2. Draw the Shortest Path in a Campus Map using BFS.
3. Social Network Graph Analysis using Gephi.

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 Johnsonbaugh, "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, 3rd 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
25CA201002	COMPUTER ORGANIZATION AND ARCHITECTURE	3	-	-	-	3
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: This course deals with basic function, structure and components of computer system, Central Processing Unit, Control Unit and I/O Unit. This course also imparts knowledge on different types of Memory Systems, Parallel Processing techniques and Multicore architectures with its issues.

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.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: INTRODUCTION TO COMPUTER SYSTEM (08 Periods)

Basic Functional units of Computers: Functional units, basic Operational concepts, Bus structures. Software, Performance, Multiprocessors, Multicomputer. Data Representation: Signed number representation, fixed and floating point Representations.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms. Error detection and correction codes.

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 SYSTEMS (09 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. (<https://ark.intel.com/content/www/us/en/ark/products/134599/intel-core-i912900k-processor-30m-cache-up-to-5-20-ghz.html>)
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.

(<https://www.khronos.org/api/opencl>)

RESOURCES

TEXT BOOK:

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

REFERENCE BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 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/preview
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/>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA202001	OPERATING SYSTEMS	2	-	2	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides theoretical and practical knowledge on process management, synchronization, handling deadlocks, memory management, storage, File system, I/O System. It also emphasizes the mechanisms for access control and security.

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

- C01.** Analyze performance of CPU scheduling algorithms.
- C02.** Design solutions for process synchronization problems by using semaphores and monitors.
- C03.** Devise solutions for deadlocks using deadlock handling mechanism.
- C04.** Solve memory management problems, file allocation using page replacement and disk scheduling algorithms.
- C05.** Analyze services of I/O subsystems and mechanisms of security & protection

CO-PO Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
C01	3	3	2	2	2	-	-	-
C02	3	2	3	-	2	-	-	-
C03	3	2	3	-	2	-	-	-
C04	3	2	3	-	2	-	-	-
C05	3	3	-	3	2	-	-	-
Course Correlation Mapping	3	2.4	3	3	2	-	-	-

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

COURSE CONTENT

Module 1: INTRODUCTION TO OPERATING SYSTEM AND (6 Periods) PROCESS MANAGEMENT

Introduction: Definition, Operating System Structure and Services, System Calls. **Process Management:** Process Scheduling, Process Control Block, Inter Process Communication, Threads, Multithreading Models, CPU Scheduling Criteria, Scheduling Algorithms, Multiprocessor Scheduling.

Module 2: PROCESS SYNCHRONIZATION AND DEADLOCKS (6 Periods)

Process Synchronization: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Synchronization Problems, Monitors.

Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Prevention, Detection, Avoidance, Recovery from deadlock.

Module 3: MEMORY MANAGEMENT AND SECONDARY STORAGE (6 Periods)

Memory Management: Contiguous Allocation, Paging, Segmentation, Segmentation with Paging

Virtual Memory: Demand Paging, Page Replacement Algorithms, Copy-on-Write, Thrashing.

Secondary Storage Structure: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling.

Module 4: FILE AND I/O SYSTEMS (06 Periods)

File System: File concept, Access Methods, Directory Structure, File System Structure, i- node, File System Implementation, Directory Implementation, Allocation Methods.

I/O System: I/O Hardware, Application I/O Interface, Kernel I/O subsystem.

Module 5: PROTECTION AND SECURITY (06 Periods)

Protection: Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.

Security: Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

Total Periods: 30

EXPERIENTIAL LEARNING

1.
 - Write a program to implement Process System Calls.
 - Write a program to implement I/O System Calls.
2. Write a program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority
3. Write a program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue
4. Write a program to simulate producer-consumer problem using semaphores
5. Design Banker's Algorithm for Deadlock Avoidance. Find the safe sequence. If Maximum request of any one process is changed, detect whether a deadlock has occurred or not. Consider the number of resources are three and Jobs are five.
6. Write a program to simulate the MVT and MFT memory management techniques
7. Write a program to simulate the following contiguous memory allocation techniques Worst-fit b) Best-fit c) First-fit
8. Implement the following Page Replacement Algorithms
a) FIFO b) LFU c) LRU d) Optimal
9. Write a program to simulate disk scheduling algorithms
a) FCFS b) SSTF c) SCAN d) CSCAN
10. Write a program to simulate the following file allocation strategies.
a) Sequential b) Indexed c) Linked

RESOURCES

TEXT BOOK:

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

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.

SOFTWARE/TOOL:

1. Software: Dev C++

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs44/preview
2. <https://www.edx.org/learn/operating-systems>
3. <https://www.cse.iitb.ac.in/~mythili/virtcc/>
4. <https://www.youtube.com/channel/UCCsCO5D7PHqAqVLFM5aKAHA>

WEB RESOURCES:

1. http://www.sncwgs.ac.in/wp-content/uploads/2015/11/operating_system_tutorial.pdf
2. https://www.tutorialspoint.com/operating_system/index.html

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA202002	PYTHON ESSENTIALS	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course introduces Python programming with fundamentals of input/output, data types, operators, control structures, and exception handling. It covers strings, data structures, functions, recursion, and object-oriented programming concepts. Learners explore data analysis and visualization using NumPy, Pandas, and Matplotlib. The course also provides basics of web development with Flask, leading to a mini project.

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

- CO1.** Demonstrate understanding of Python basics including input/output, data types, operators, and expressions.
- CO2.** Apply decision-making constructs, looping techniques, and comprehensions to solve computational problems.
- CO3.** Develop Python applications using strings, data structures, functions, recursion, and functional programming tools to solve problems.
- CO4.** Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism, and exception handling.
- CO5.** Utilize Python libraries such as NumPy, Pandas, Matplotlib for data analysis and visualization, and develop simple web applications using Flask.
- CO6.** Work independently to solve problems with effective communication.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	3	-	-	-
CO2	3	2	-	-	3	-	-	-
CO3	3	3	3	3	3	-	-	-
CO4	3	2	2	2	3	-	-	-
CO5	3	3	3	3	3	-	-	-
CO6	-	-	-	-	-	2	2	2
Course Correlation Mapping	3	3	2	2	2	1	1	1

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

COURSE CONTENT

Module 1: INTRODUCTION TO PYTHON, INPUT/OUTPUT AND OPERATORS (7 Periods)

Features of Python, history, installation, interpreter vs compiler, Python environments: Jupyter, VS Code; Input using input(), output using print(), formatted strings using f-strings and format(), Data types: int, float, str, bool; dynamic typing, type conversions: explicit, implicit; arithmetic, relational, logical, bitwise, assignment, membership, identity operators, expression evaluation, operator precedence and associativity. Single-line and multi-line comments.

Module 2: DECISION MAKING AND LOOPING (8 Periods)

Conditional statements using if, if-else, elif, nested conditions, Loops: for loop, while loop, break, continue, pass; enumerate() and zip() function, else with loops, List and dictionary comprehensions, combining loops with conditionals for iterative logic, basic exception handling using try-except.

Module 3: DATA STRUCTURES, STRINGS, FUNCTIONS & RECURSION (10 Periods)

Strings: creation, indexing, slicing, immutability; common methods: upper, lower, find, replace, split, join; Data structures: lists, tuples, dictionaries, sets, operations and use cases; Functions: definition, parameters, return values, default/keyword arguments; recursion concepts and examples (factorial, Fibonacci), function integration with strings and collections. Lambda functions, map() and filter()

Module 4: OBJECT-ORIENTED PROGRAMMING IN PYTHON (8 Periods)

Classes and objects, defining classes, instance variables and methods, Constructors (__init__), destructors, encapsulation with access conventions: public, protected, private; Inheritance and its types, method overriding, polymorphism, abstraction using abstract classes (abc module).

Module 5: DATA VISUALIZATION & WEB DEVELOPMENT (12 Periods)

Importance and purpose of data visualization, Numpy, Pandas, Matplotlib: line graphs, bar charts, histograms, scatter plots; Flask overview and environment setup, App structure and routing, Template rendering with Jinja2, Form handling: GET/POST methods, Basic CRUD operations, HTML/CSS integration, Mini project implementation

Total Periods: 45

EXPERIENTIAL LEARNING

1) INTRODUCTION TO PYTHON, INPUT/OUTPUT AND OPERATORS

1. FORMATTED INPUT/OUTPUT PROGRAM

Exercise: Create a Receipt Formatter

Write a Python program that takes user input for item names, quantities, and prices, then prints a formatted receipt using string formatting.

Example Input:

Enter item: Apple

Quantity: 3

Price per item: 25

Enter item: Bread

Quantity: 2

Price per item: 40

Example Output:

----- RECEIPT -----

Apple x3 ₹75

Bread x2 ₹80

Total: ₹155

Concepts Reinforced:

- f-strings and .format() for clean alignment
- input() function and basic control flow
- Improves fluency in creating readable CLI outputs
- Introduces beginners to formatted design and user interaction

2. TYPE CONVERSION & ARITHMETIC EXPRESSION EXERCISES

Exercise: Calculate Average Marks

Prompt the user to enter marks of five subjects. Convert the input to integers or floats, calculate the average, and display the result.

Example Input:

Enter marks (comma-separated): 87,92,78,90,85

Example Output:

Average Marks: 86.4

Grade: A

Concepts Reinforced:

- split() and map() for type conversion
- Arithmetic operations: sum and division
- Decision-making for grading logic (optional extension)
- Strengthens understanding of parsing and converting data types

3. OPERATOR-BASED MINI CALCULATOR

Exercise: Interactive Calculator

Build a simple calculator that allows users to perform basic operations (+, -, *, /, %, //, **).

Example Input:

Enter first number: 12

Enter operator: *

Enter second number: 4

Example Output:

Result: 48

Concepts Reinforced:

- Operators and precedence
- Control flow with if-elif statements
- User-friendly interaction via input()
- Solidifies arithmetic logic implementation

2) **DECISION MAKING AND LOOPING**

Exercise: Grade Evaluator

Create a program that takes exam marks as input and outputs a grade based on predefined criteria using conditional statements.

Example Input:

Enter your marks: 76

Example Output:

You scored 76 marks.

Grade: B

Grading Rules (Example):

- A: 90–100
- B: 75–89
- C: 60–74
- D: 40–59
- F: Below 40

Concepts Reinforced:

- if-elif-else statements
- Comparison operators
- Control flow logic and decision-making
- Real-world scenario application

Exercise: Guess the Number

Write a game where the user must guess a randomly generated number between 1 and 100. The program should give hints and allow multiple attempts.

Example Output:

Guess a number between 1 and 100: 50

Too low!

Guess again: 75

Too high!

Guess again: 64

Correct! You guessed it in 3 tries.

Concepts Reinforced:

- while loops
- Random number generation (random.randint)
- Loop control with break conditions
- Interactive CLI experience and feedback

Exercise: Print a Pyramid Pattern

Create a program that prints a pyramid of stars based on user-defined height using nested loops.

Example Input:

Enter the number of rows: 4

Example Output:

```
*
***
*****
*****
```

Concepts Reinforced:

- Nested for loops
- String multiplication and spacing
- Visualization of loop nesting through output

- Creativity with logic-based formatting

Exercise: Display Index and Value

Use `enumerate()` to print items of a list with their index.

```
colors = ["red", "green", "blue"]
for index, color in enumerate(colors):
    print(f"{index}: {color}")
```

Exercise: Match Items from Two Lists

Use `zip()` to pair elements from two lists and print them.

```
names = ["Alice", "Bob", "Charlie"]
scores = [95, 80, 88]
for name, score in zip(names, scores):
    print(f"{name} scored {score}")
```

Concepts Reinforced:

- Advanced iteration techniques
- Pairing data logically
- Cleaner, more Pythonic loops
- Enhanced readability and flexibility

3) **DATA STRUCTURES, STRINGS, FUNCTIONS & RECURSION**

Exercise: Text Analyzer Tool

Write a Python script that accepts a sentence from the user and performs the following operations:

- Counts total words
- Converts all letters to uppercase and lowercase
- Removes punctuation
- Reverses the sentence
- Extracts unique words

Example Input:

Enter a sentence: Hello, world! Welcome to Python.

Example Output:

Original: Hello, world! Welcome to Python.

Uppercase: HELLO, WORLD! WELCOME TO PYTHON.

Lowercase: hello, world! welcome to python.

Word count: 5

Unique words: {'Hello', 'world', 'Welcome', 'to', 'Python'}

Reversed: .nohtyP ot emocleW !dlrow ,olleH

Concepts Reinforced:

- String methods: `.lower()`, `.upper()`, `.split()`, `.replace()`, slicing
- Sets and basic data structures
- Input handling and output formatting
- Sharpening problem-solving through text-based logic

Exercise: Phonebook Manager

Create a simple contact book that allows users to add, search, update, and delete contact information using a dictionary.

Example Interaction:

1. Add Contact
2. Search Contact
3. Update Contact
4. Delete Contact
5. Exit

Choose option: 1

Enter name: Priya
Enter number: 9876543210
Contact added.

Choose option: 2
Enter name to search: Priya
Number: 9876543210

Concepts Reinforced:

- Dictionaries for key-value storage
- Control flow with menus and choices
- Exception handling and validation
- Real-world simulation of data management systems

4) **OBJECT ORIENTED PROGRAMMING IN PYTHON**

Exercise: Create a Student Class

Write a class Student with a constructor (`__init__`) that initializes attributes like name, age, and grade. Include a method to display student details.

Example Output:

Name: Arjun
Age: 17
Grade: A

Concepts Reinforced:

- Class creation and instance variables
- Use of `__init__` constructor
- Object instantiation and method definition
- Encourages understanding of encapsulation and code reuse

Exercise: Company Employee Structure

Design a base class Employee with attributes such as name and salary. Derive two subclasses Manager and Developer that add specific attributes like department and programming language.

Example Output:

Manager: Ravi, Salary: ₹80,000, Department: Sales
Developer: Maya, Salary: ₹70,000, Language: Python

Concepts Reinforced:

- Single and multi-level inheritance
- Use of `super()` to access parent class methods
- Demonstrates code reuse and organization
- Encourages a real-world perspective on class relationships

Exercise: Unified Interface for Animals

Create a base class `Animal` with a method `make_sound()`. Define subclasses `Dog`, `Cat`, and `Cow`, each overriding `make_sound()` with their unique behavior.

Example Output:

Dog says: Woof!

Cat says: Meow!

Cow says: Moo!

Concepts Reinforced:

- Method overriding
- Polymorphism through dynamic method calls
- Promotes writing flexible and extendable code
- Highlights the importance of interfaces and consistency

5) DATA VISUALIZATION

Example 1: Student Performance Analysis

Objective: Analyze and visualize students' exam scores across subjects.

Sample Dataset:

```
data = {'Name': ['Asha', 'Kiran', 'Neha', 'Ravi'],  
       'Math': [88, 76, 90, 65],  
       'Science': [92, 70, 85, 60],  
       'English': [85, 80, 78, 70]}
```

Concepts Reinforced:

- Use of pandas DataFrame for organizing tabular data
- Bar charts for comparative analysis
- Legends, axis labels, and titles for clarity
- Understanding performance trends across categories

Example 2: Population Growth Trends

Objective: Plot population growth of countries over years to identify patterns.

Sample Dataset:

```
data = { 'Year': [2000, 2010, 2020],  
       'India': [1.05, 1.21, 1.38],  
       'China': [1.26, 1.34, 1.41],  
       'USA': [0.28, 0.31, 0.33]}
```

Concepts Reinforced:

- Transposing data for time series plotting
- Line plots to show progression over time
- Grid lines for readability
- Data-driven storytelling using real-world metrics

6) WEB DEVELOPMENT IN PYTHON

Exercise: Create a user registration page that includes fields like email, password, and password confirmation. Ensure all fields are properly validated:

- Email must be in correct format

- Password must meet length or strength requirements
- Confirm password must match the original password

Skills Developed:

- Route handling in Flask
- Form creation using Flask-WTF and WTFForms
- Server-side validation logic
- Delivering real-time feedback to users

Exercise: Build a web-based student record manager where users can perform CRUD (Create, Read, Update, Delete) operations:

- Add student details like name, roll number, and marks
- View a list of students
- Edit or delete entries when needed

Skills Developed:

- Integrating Flask with a database (like SQLite) using SQLAlchemy
- RESTful routing and templates with Jinja2
- Managing data dynamically through web pages
- Creating responsive user interfaces

Exercise: Develop a small personal portfolio showcasing projects, hobbies, or profile info. Include a feedback form where visitors can submit comments or messages.

Skills Developed:

- Designing static and dynamic web pages
- Using Flask blueprints for clean structure
- Building feedback forms and storing responses
- Enhancing layout with CSS and front-end tools

RESOURCES

TEXT BOOKS:

1. Ultimate Python Programming – Deepali Srivastava, BPB publishers, 2024
2. Intro to Python for Computer Science and Data Science - Paul J. Deitel, Pearson, 2022

REFERENCE BOOKS:

1. Learn Python the Hard Way - ZED Shaw's Hard Way Series, 5th Edition Pearson, 2024
2. Hands-on Data Analysis & Visualization with Pandas, BPB publishers, 2020
3. Flask Framework Cookbook - Third Edition, Packt Publishing, 2020

SOFTWARE/TOOLS:

1. Python 3.10
2. Jupyter Notebook/Pycharm/Vscode
3. Any browser

VIDEO LECTURES:

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://www.youtube.com/watch?v=ix9cRaBkVe0&pp=ygUPcHI0aG9uIHR1dG9yaWFs>
5. <https://www.youtube.com/playlist?list=PL-osiE80TeTs4UjLw5MM6OjgkjFeUxCYH>
6. <https://www.youtube.com/watch?v=GPVsHOIRBBI&pp=ygUbZGF0YSB2aXN1YWxpemF0aW9uIHBsYXlsaXN0>

WEB RESOURCES:

1. <https://www.programiz.com/python-programming>
2. <https://www.geeksforgeeks.org/python-programming-language/>
3. <https://electronstudio.github.io/pygame-zero-book/>
4. <https://www.learnpython.org/>
5. <https://riptutorial.com/ebook/flask>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA211001	INTERNSHIP	-	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

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

- CO1.** Analyze latest equipment, materials and technologies that are used in industry to solve complex engineering problems following relevant standards, codes, policies and regulations.
- CO2.** Analyze safety, health, societal, environmental, sustainability, economical and managerial factors considered in industry in solving complex engineering problems.
- CO3.** Perform individually or in a team besides communicating effectively in written, oral and graphical forms on practicing engineering.

CO-PO Mapping Table:

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

Correlation Level: 3-High; 2-Medium; 1-Low

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA209001	CAPSTONE PROJECT	-	-	-	-	12

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

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

- CO1.** Create/Design computer science engineering systems or processes to solve complex computer science engineering and allied problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.
- CO2.** Consider society, health, safety, environment, sustainability, economics and project management in solving complex computer science engineering and allied problems.
- CO3.** Perform individually or in a team besides communicating effectively in written, oral and graphical forms on computer science engineering systems or processes.

CO-PO Mapping Table:

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

Correlation Level: 3-High; 2-Medium; 1-Low

SCHOOL CORE
(Mandatory Course)

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
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: MALICIOUS 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, Volatility 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: Principles, 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
(Mandatory Course)

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 χ^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
CO1	3	2	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-
Course Correlation Mapping	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, μ - 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 χ^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
(Mandatory Course)

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
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	1	1
Course Correlation Mapping	2	2	2	2	1	1	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
(Mandatory Course)

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 face relationships.

CO-PO Mapping Table

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

TEXT BOOKS:

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
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&hspar=sz¶m1=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&hspar=sz¶m1=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
(Mandatory Course)

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
CO1	3	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	2	-
CO3	3	-	-	-	-	-	2	-
CO4	2	-	-	-	3	-	2	-
CO5	2	3	2	-	2	-	2	-
Course Correlation Mapping	2	3	-	-	3	-	2	-

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 2nd Edition, 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/technical-report-writing>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA201003	OPERATIONS RESEARCH	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course introduces students to the fundamentals of Operations Research (OR), a scientific approach to decision-making. The curriculum emphasizes optimization techniques such as Linear Programming, Transportation Models, Network Analysis, Game Theory, and Sequencing. Students will learn to formulate real-world problems into mathematical models and solve them using analytical and graphical methods. The course empowers learners to apply OR techniques in engineering, management, logistics, and various operational systems to improve performance and reduce costs.

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

- CO1.** Understand the scope, significance, and applications of Operations Research and formulate problems as Linear Programming Problems (LPP).
- CO2.** Solve LPPs using graphical and simplex methods, including advanced techniques like Big-M and Two-Phase Methods.
- CO3.** Apply transportation problem techniques for optimizing resource allocation using methods like NW Corner, VAM, and MODI.
- CO4.** Analyze and manage project timelines using Network Techniques such as CPM and PERT; apply crashing and cost optimization strategies.
- CO5.** Solve decision-making problems using Game Theory and Scheduling algorithms to optimize operational tasks across machines and resources.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	3	-	-	1	2
CO2	3	3	-	3	-	-	1	2
CO3	3	3	3	2	-	-	1	-
CO4	2	3	3	-	-	-	-	3
CO5	3	3	3	2	1	-	-	-
Course Correlation Mapping	3	3	3	2.5	1	-	1	2

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

COURSE CONTENT

Module 1: INTRODUCTION

(09 Periods)

Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables)

Module 2: LPP

(09 Periods)

Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

Module 3: TRANSPORTATION PROBLEM

(09 Periods)

Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem

Module 4: NETWORK ANALYSIS

(09 Periods)

Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Module 5: GAME THEORY

(09 Periods)

Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2×2 games by Arithmetic method, Solution of $2 \times n$ and $m \times 2$ games by graphical method. Formulation of games.

Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Factory Production Planning Simulation"

Scenario:

You are managing a factory producing 2 products using limited labor and material. You must maximize profit subject to constraints.

Activity:

1. Problem Formulation:
 - Students write constraints and objective function (profit maximization).
 - Convert to standard/canonical form.
2. Graphical Method (2 variables):
 - Plot constraints.
 - Identify feasible region and optimal solution.
3. Simplex Method & Variants:
 - Solve the same problem using:
 - Simplex
 - Big-M method
 - Two-Phase method
 - Dual Simplex (for advanced learners)
4. Extension:
 - Add real constraints like time-off, machine breakdown, etc.
 - Explore duality: Create dual and interpret.

Tools:

- Spreadsheet
- Graph paper for plotting manually

Learning Outcome:

- Hands-on experience with different LPP methods.
- Learn how changing variables affects outcomes.

2. Transportation Problem

Experiential Learning Activity: "Disaster Relief Logistics Simulation"

Scenario:

Distribute supplies from 3 warehouses to 4 disaster-hit cities. Minimize cost.

Activity:

1. Problem Formulation:
 - Create a transportation table using real/estimated costs.
 - Use NW Corner, VAM for initial solutions.

2. Optimization:
 - Apply MODI method for optimal solution.
 - Handle unbalanced and maximization cases.
3. Degeneracy:
 - Identify and resolve degenerate cases.
4. Discussion:
 - Groups analyze their transport plans and cost impact.

Tools:

- Excel for automatic calculation
- Colored index cards for manual simulation

RESOURCES

TEXT BOOKS:

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company Ltd., Publications, New Delhi – 2007
2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.

REFERENCE BOOKS:

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt. Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8th Ed., McGraw Hill

WEB ROUSORCES:

1. <https://salimian.webersedu.com/courses/OR>

VIDEO LECTURES

1. <https://04.phf-site.com/2016/11/g-srinivasan-fundamentals-of-operations.html>
2. <https://www.slideshare.net/slideshow/game-theory-lecture/37745071>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA202003	DATABASE MANAGEMENT SYSTEMS	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This Course provides theoretical concepts and hands-on experience on 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.** Analyze and 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.** Develop PL/SQL blocks to centralize database applications for maintainability
- CO5.** Analyze transaction processing, concurrency control and storage Methods for database management.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	-	-	-	-	-
CO2	1	3	2	2	3	-	-	-
CO3	1	2	3	2	3	-	-	-
CO4	2	3	3	3	3	2	-	-
CO5	-	2	-	2	1	-	-	-
Course Correlation Mapping	2	3	2	2	2.5	1	-	-

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

COURSE CONTENT

Module 1: INTRODUCTION TO DATABASE SYSTEMS AND DATABASE DESIGN (08 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.

Module 2: RELATIONAL MODEL AND RELATIONAL ALGEBRA (08 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: SQL AND PL/SQL (10 Periods)

SQL: Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complex integrity constraints in SQL, Triggers.

PL/SQL: Generic PL/SQL block, PL/SQL data types, Control structure, Procedures and functions, Cursors, Database triggers.

Module 4: SCHEMA REFINEMENT AND TRANSACTIONS (10 Periods)

Schema Refinement: Problems caused by redundancy, Decompositions, Problems related to decomposition, Functional dependencies, Reasoning about FDs, First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multivalued dependencies, Fourth normal form, Join dependencies, Fifth normal form.

Transactions: Transaction concept, Transaction atomicity and durability, Concurrent Executions – Serializability, Recoverability, Implementation of isolation, Testing for serializability.

Module 5: CONCURRENCY CONTROL, STORAGE AND INDEXING (09 Periods)

Concurrency Control: Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols, Multiple Granularity, Deadlock Handling.

Storage and Indexing: Data on external storage, File organizations and indexing – Clustered indexes, Primary and secondary indexes; Index data structures – Hash based indexing, Tree based indexing; Comparison of file organizations.

Total Periods: 45

EXPERIENTIAL LEARNING

- 1) Design and analyze an ER-Model for the following use case.

Road way Travels is in business since 1977 with several buses connecting different places in India. Its main office is in Hyderabad. The company wants to computerize its operations in the following areas:

- a) Reservations
- b) Ticketing
- c) Cancellation

Reservations:

Reservations are directly handled by booking office. Reservations can be made 60 days in advance in either cash or credit. In case 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 handled at the booking office. Cancellation charges will be charged. Wait listed tickets that do not get confirmed are fully refunded.

- 2) a) Implement Single Row functions-Character, Numeric and Date functions.
b) Implement Data Definition Language commands>Create, Alter, Drop, Truncate, and Rename.
c) Implement Data Manipulation Language commands-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) a) Implement group functions with different operators such as aggregate operators, group by, having and order by.
b) Implement nested and correlated nested queries using set operators and set comparison operators.
- 5) a) Creation of views, synonyms, sequence, indexes and save point
b) Implement various types of joins-outer join and inner join.

Basic PL/SQL:

- 6) Construct PL/SQL block for the following:
- a) To determine whether a number is palindrome
 - b) To determine whether a number is an Armstrong number
 - c) To find greatest of three numbers
 - d) To display Fibonacci series

Control Structures:

- 7) a) Write a programming PL/SQL to update the salary of a specific employee by 8% 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.

- b) Write a PL/SQL program to display the description against a student's grade using CASE statement.

Exception Handling:

- 8) a) 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.
- b) Construct the user-defined exceptions to get the salary of an employee and check it with the job's salary range. If the salary is below the range, raise an exception BELOW_SALARY_RANGE. If his salary is above the range, raise the exception ABOVE_SALARY_RANGE.

Functions

- 9) a) Write a function that accepts two numbers A and B and performs the following operations.
- o Addition
 - o Subtraction
 - o Multiplication
 - o Division
- b) Write a PL/SQL block that updates salary of an employee in Employee table by using incr function which takes employee number as argument and calculates increment and returns increment based on the following criteria.
- o If salary ≤ 3000, increment = 30% of salary
 - o If salary > 3000 and ≤ 6000, increment = 20% of salary
 - o Else increment = 10% of salary

Procedures:

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

Cursors:

- 11) a) Write a block in PL/SQL to create a Cursor that displays the employee name and number of jobs he/she has done in the past.
- b) Write a program in PL/SQL to create a cursor to display the name and salary of each employee in the EMPLOYEES table whose salary is less than that specified by a passed-in parameter value.

Triggers:

- 12) 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:

RESOURCES

TEXT BOOKS:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw Hill, 3rd Edition, 2014.
2. Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, Database System Concepts, McGraw Hill, 7th edition, 2019.

REFERENCE BOOKS:

1. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB publications, 4th Edition, 2017.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, 2015.
3. Thomas Connolly, Carolyn Begg, Database Systems, Pearson, 6th edition, 2019.
4. S.K.Singh, Database System Concepts, Design and Applications, 1st Edition, Pearson Education, 2006.
5. SatishAnsani, Oracle Database 11g: Hands-on SQL and PL/SQL, PHI, 2010.
6. Dr. Rajiv Chopra, Database Management Systems, Sultan Chand, 2016.
7. Pranab Kumar Das Gupta, P. Radha Krishna, Database Management System Oracle SQL and PL/SQL, PHI, 2nd Edition, 2009.

VIDEO LECTURES:

1. https://swayam.gov.in/nd1_noc19_cs46/preview
2. <https://nptel.ac.in/courses/106105175>
3. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
4. <https://www.youtube.com/watch?v=MDQxqYVXiVU>
5. <https://www.youtube.com/watch?v=c5HAWKX-suM>

WEB RESOURCES:

1. <https://www.classcentral.com/course/swayam-introduction-to-database-systems-17660>
2. <https://www.scaler.com/topics/dbms/>
3. https://www.academia.edu/27988617/Database_Management_System_DBMS_Tutorial
4. <https://nptel.ac.in/courses/106104135>
5. <https://downloads.mysql.com/docs/mysql-tutorial-excerpt-5.7-en.pdf>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA202004	DATA MINING	3	-	2	-	4

Pre-Requisite - DATABASE MANAGEMENT SYSTEMS

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The course covers the basic concepts of data mining and select and apply appropriate data pre-processing techniques, Data Cube Computation Methods and data mining algorithms. Association Rule Mining, Classification, and Clustering methods implemented to infer the valid conclusions in addition to forecasting time series, data mining trends and research frontiers.

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

- CO1.** Analyse pre-processing techniques, Data Cube Technology, data mining algorithms and identify frequent itemsets.
- CO2.** Apply data mining techniques and tools to discover knowledge from text, and multimedia data.
- CO3.** Select and apply Classification and Clustering algorithms on pre-processed datasets to infer predictions effectively.
- CO4.** Apply data mining methods to forecasting time series and provide analytical solutions for societal issues.
- CO5.** Work independently or in team to solve problems with effective communications.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: DATA MINING AND DATA PREPROCESSING (09 Periods)

Data Mining: Motivated Data Mining, Kinds of Data to mined, kinds of patterns mined, Technologies Used, Kinds of applications targeted, Major issues in Data Mining.

Data Preprocessing: Need for Pre-processing the Data, Major Tasks in Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization

Module 2: DATA CUBE TECHNOLOGY AND MINING FREQUENT PATTERNS, ASSOCIATIONS, AND CORRELATIONS (10 Periods)

Data Cube Technology: Data Cube Computation, Data Cube Computation Methods, Multidimensional Data Analysis in Cube Space.

Association Rule Mining: Basic Concepts, Frequent Itemset Mining Methods: The Apriori algorithm for finding frequent itemsets using candidate generation, generating association rules from frequent itemsets, Mining frequent itemsets without candidate generation, Pattern Evaluation Methods

Module 3: CLASSIFICATION (09 Periods)

Classification: Basic Concepts of Classification, Classification by Decision Tree Induction, Bayesian Classification, Rule-based classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Bayesian Belief Networks, Classification by Backpropagation, Support Vector Machines.

Module 4: CLUSTER ANALYSIS (08 Periods)

Clustering: Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning methods - k-means and k-medoids methods, CLARANS, Hierarchical Methods-Agglomerative and divisive hierarchical clustering, **Density-Based Methods:** DBSCAN, **Grid-Based Methods:** STING, Evaluation of Clustering, Outliers and Outlier Analysis.

Module 5: FORECASTING TIME SERIES AND DATA MINING TRENDS AND RESEARCH FRONTIERS (09 Periods)

Forecasting Time Series: Concepts of time series, Evaluating time series models, Analysis of the components of time series, Exponential smoothing models.

Data Mining Trends and Research Frontiers: Mining Complex Data Types, Data Mining Applications, Data Mining and Society.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Create data sets in ARFF and CSV formats and load into the Weka Explorer.
2. Perform data preprocessing steps on weather nominal and student information data sets as follows:
 - a) Handle missing values for categorical and nominal values.
 - b) Select relevant attributes.
 - c) Apply normalization techniques
3. Generate strong Association rules by applying Apriori algorithm on preprocessed dataset with Min_Sup=60% and Min_Conf=80%.
4.
 - i) Implement the Classification using Decision Tree algorithm on 'Weather' dataset. Draw the confusion matrix and report the model with accuracy.
 - (ii) Implement Bayesian Classification and analyze the results on 'iris' dataset.
5. Implement simple k-Means clustering algorithm on 'iris' dataset.
6. Use Experimenter WEKA component to rank the performance of j48, oneR, ID3, algorithms on 'weather nominal' dataset.
7. Verify ID3 classifier performance using Gain ratio and Ranker method using a Knowledge flow WEKA component.
8. Implement SVM / Decision tree classification techniques in R tool.
9. Implement clustering techniques in R tool.
10. Visualize data using any plotting framework in R tool.

RESOURCES

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques," Elsevier, 3rd Edition, 2013.
2. G. K. Gupta, "Introduction to Data Mining with Case Studies," Eastern Economy Edition, Prentice Hall of India, 2006.

REFERENCE BOOKS:

1. Ian H. Witten, Eibe Frank, and Mark, "A Data Mining: Practical Machine Learning Tools and Techniques," Hall Morgan Kaufmann, 3rd Edition, 2011.
2. Mining of Massive Datasets by Anand Rajaraman and Jeff Ullman.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies," PHI, New Delhi, 3rd Edition, 2009.
4. Arun K Pujari, "Data Mining Techniques," Universities Press (India) Pvt. Ltd, 2nd Edition, 2001.

SOFTWARE/TOOLS:

1. WEKA
2. R Studio

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=a4M3GdI5UFY>
2. https://www.youtube.com/watch?v=ykZ-_UGcYWg&list=PLLspfyOYoQcI6Nno3gPkq0h5YSe81hsc
3. https://www.youtube.com/watch?v=ykZ-_UGcYWg&list=PLLspfyOYoQcI6Nno3gPkq0h5YSe81hsc
4. https://www.youtube.com/watch?v=N_whCVtfl9M&list=PLLspfyOYoQcI6Nno3gPkq0h5YSe81hsc&index=4
5. <https://www.youtube.com/watch?v=hEQkqpmtx-Y&list=PLLspfyOYoQcI6Nno3gPkq0h5YSe81hsc&index=5>

WEB RESOURCES:

1. <https://www.cs.waikato.ac.nz/ml/weka/book.html>
2. <http://infolab.stanford.edu/~ullman/mmds/book.pdf>
3. Open source tools for data mining: <http://eprints.fri.uni-lj.si/893/1/2008-OpenSourceDataMining.pdf>
4. <https://www.kaggle.com/datasets>
5. <https://nptel.ac.in/courses/106/105/106105174/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA202005	COMPUTER NETWORKS	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Network topology, Protocols, Physical layer, Error detection and Correction, Medium access, Ethernet, Routing protocols, IP addressing, TCP, UDP, Congestion control, DNS, Email, HTTPS.

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

- CO1.** Interpret different types of network topologies, layers and protocols.
- CO2.** Solve problems related to flow control, error control and congestion control in data transmission.
- CO3.** Evaluate sub netting and routing algorithms for finding optimal paths in networks.
- CO4.** Analyze various congestion control mechanisms and identify appropriate transport layer protocols.
- 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 Mapping Table:

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

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

COURSE CONTENT

Module 1: INTRODUCTION AND PHYSICAL LAYER (09 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, 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 (10 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.

Module 4: TRANSPORT LAYER (08 Periods)

UDP – Introduction to UDP, Remote procedure call, Real-time transport protocols; TCP – service model, Protocol, Segment header, Connection establishment, Connection release, Sliding window, Timer management, Congestion control.

Module 5: APPLICATION LAYER (08 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.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Implement the following data link layer framing methods.
 - i) Character count
 - ii) Character stuffing
 - iii) Bit Stuffing
2. Design and develop a program to compute checksum for the given frame 1101011011 using CRC-12, CRC-16, and CRC-CCIP. Display the actual bit string transmitted. Suppose any bit is inverted during transmission. Show that this error is detected at the receiver's end.
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.

Packet Tracer Simulator:

1.
 - a) Create a simple LAN with hubs and switches and monitor the data flow.
 - b) Construct a LAN with single/multiple router and share data to local and remote network.
2. Create and implement a standard access list that blocks the student's section from accessing the server section.
3. Simulate OSPF routing protocol using packet tracer.

NS2 Simulator:

1. Simulate star/mesh network topology used in LAN using TCP/UDP connection.
2. Simulate distance vector/link state routing algorithm.

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, 8th Edition, 2022.

SOFTWARE/TOOLS:

1. Software: J2SDK, Eclipse/Netbeans
2. NS-2, Packet Tracer

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/106105081>
2. <http://nptel.ac.in/courses/106106091>
3. <https://archive.nptel.ac.in/courses/106/105/106105183/>
4. <https://www.youtube.com/watch?v=frUQMHXhnvs>
5. https://www.youtube.com/watch?v=k_lfL93zDNQ

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/>
6. <https://www.isi.edu/nsnam/ns/>
7. https://www.cisco.com/c/dam/global/fi-fi/assets/docs/SMB_University_120307_Networking_Fundamentals.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA202006	DATA STRUCTURES AND ALGORITHMS	3	-	2	-	4
Pre-Requisite	-Python Programming					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Analyze step by step and develops 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 Mapping Table:

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

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.

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.

Module 4: TRANSPORT LAYER (08 Periods)

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-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

EXPERIENTIAL LEARNING

1. Introduction to 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.

SOFTWARE/TOOLS:

1. Software: J2SDK, Eclipse/Netbeans
2. C++ Turbo Editor

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=PLDN4rrl48XKpZkf03iYFI-O29szjTrs_O
4. <https://www.youtube.com/playlist?list=PLrqxgoIHbaCQPHa2LnGX0f-dCIH2MWIFS>
5. <https://www.youtube.com/playlist?list=PLrjkTqI3jnm8ikiQIeIHrMYCaBfkBkfYR>

WEB RESOURCES:

1. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
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 CORE

Course Code	Course Title	L	T	P	S	C
25CA204001	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	3	-	2	4	5

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course is emphasize on the fundamentals structure design with classes including development, testing, implementation and documentation. This course also focuses on understanding and practical mastery of object oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism.

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

- CO1.** Apply object oriented programming constructs to solve computational problems.
- CO2.** Use Exception handling and multithreading mechanisms to create efficient software applications.
- CO3.** Create Web based applications using collections frameworks to solve real world problems.
- CO4.** Design and develop GUI using applets and swings for internet and system based applications.
- CO5.** Work independently or in team to solve problems with effective communication.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: OOPS FUNDAMENTALS

(09Periods)

Introduction: History of Java, Byte code, JVM, Java buzzwords, OOP principles, Data types, Variables, Scope and life time of variables, Operators, Control statements, Type conversion and casting, Arrays.

Concepts Of Classes And Objects: Introducing methods, Method overloading, Constructors, Constructor overloading, Usage of static with data and method, Access control, this key word, Garbage collection, String class, StringTokenizer.

Module 2: INHERITANCE, INTERFACE AND PACKAGES

(09Periods)

Inheritance basics, Types of inheritance, Member access rules, Usage of super key word, Method overriding, Usage of final, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces; Packages - defining, creating and accessing a package, importing packages, access control in packages.

Module 3 EXCEPTION HANDLING AND MULTITHREADING

(10 Periods)

Exception Handling: Concepts of exception handling, Types of exceptions, Usage of try, catch, throw, throws and finally keywords, Built-in exceptions, Creating user defined exception;

Multithreading: Concepts of multithreading, Differences between process and thread, Thread life cycle, Creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication.

Module 4 COLLECTION FRAMEWORK

(08 Periods)

Collection Framework: Collections Overview, Collection Interfaces - List, Set, Map, List ArrayList, Linked List, Vector, Set - HashSet, TreeSet, Map - Hashtable, HashMap, Accessing a collection via an Iterator.

Module 5 GUI PROGRAMMING

(09 Periods)

GUI Programming With Applets: Applets - Applet Class, Applet skeleton, Simple Applet; 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.

Total Periods: 45

EXPERIENTIAL LEARNING

OOPS Fundamentals

1. a) Develop a Java application for generating Electricity bill.
Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
 - First 100 units - Rs. 1 per unit
 - 101-200 units - Rs. 2.50 per unit
 - 201 -500 units - Rs. 4 per unit
 - >501 units - Rs. 6 per unitIf the type of the EB connection is commercial, calculate the amount to be paid as follows:
 - First 100 units - Rs. 2 per unit
 - 101-200 units - Rs. 4.50 per unit
 - 201 -500 units - Rs. 6 per unit
 - > 501 units - Rs. 7 per unit
 - b) Design a class to represent a Student details include the Student ID, Name of the Student, Branch, year, location and college. Assign initial values using Constructor. Calculate average of marks of 6 subjects and calculate attendance percentage.
2. a) Create a class Student which has data members as name, branch, roll no, age, sex, marks in five subjects. Display the name of the student and his percentage who has more than 70%.Use array of objects.
 - b) Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imaginary parts to equal values and third which takes two argument is used to initialized real and imaginary to two different values.

Inheritance

- 3 a) Create a base class basic_info with data members name, roll no, sex and two member functions getdata and display. Derive a class physical_fit from basic_info which has data members height and weight and member functions getdata and display. Display all the information using object of derived class.
- b) Create class first with data members book no, book name and member function getdata and putdata. Create a class second with data members author name, publisher and members getdata and showdata. Derive a class third from first and second with data member no of pages and year of publication. Display all these information using array of objects of third class.

- 4 A High School application has two classes: The Person superclass (Name, age, Gender) and the Student subclass (RegNo, Dept, CGPA). Using inheritance, create two new classes, Teacher and College Student. Teacher will be like Person but will have additional properties such as salary (the amount the teacher earns) and subject (e.g., "Computer Science", "Chemistry", "English", "Other"). The College Student class will extend the Student class by adding a year (current level in college) and major (e.g., "Electrical Engineering", "Communications", "Undeclared"). Create objects and test the functionality of all the methods.
- 5 Develop a java application for generating pay slip on different category of employees using the concept of inheritance.

Exception Handling and Multithreading

- 6 Consider two integers x and y as input and compute the value of x/y. Implement a class which raise an exception if x and y are not signed integers or if y is zero.
- 7 a) Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number
- b) Write a program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.

Collection Framework

- 8 Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

GUI Programming

- 9 a) Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with "STOP" or "READY" or "GO" should appear above the buttons in selected color. Initially, there is no message shown.
- b) Write an Applet that computes the payment of a loan on the amount of the loan, the interest rate and the number of months. It takes one parameter from the browser. Monthly; if true, the interest rate is per month, otherwise the interest rate is annual.
- c) Write a java programs to find factorial of a number. User is allowed to enter a number into the text field whose factorial is to be determined. On pressing the button the value of the text field is firstly converted into integer and then processed to find its factorial. The result will get displayed in another text field. (Hint: use swings).

PROJECT BASED LEARNING:

FACULTY SHALL PROVIDE PROJECTS RELEVANT TO THE CONTENTS OF THE COURSE. SAMPLE PROJECTS:

1. CALENDER APPLICATION

Develop a calendar application that uses many windows properties to make it colorful, for example, to indicate the vacation, it uses the red foreground color. The calendar can be used for two purposes. First to see the date and month as usual calendars and second to find out the day corresponding to given date.

Some of the salient features of the project are

1. It uses various windows properties to make the program colorful although it has lack of graphics.
2. It entirely uses java code which is written in simple manner with lots of comments and important notes can be added.
3. The date with such notes appears different than others with red background color
4. The months can be navigated using arrow keys.

2. TICKET RESERVATION SYSTEM

Develop Ticket reservation system to manage details of seats, passenger, trains, Bookings and stations. The features required to be implemented are as follows

- a. Provides searching facility based on factors such as seats, trains, booking and stations
- b. Manage the information of passengers
- c. Shows the information of the seats and trains
- d. Provide filter on train, booking, time and station
- e. Information Management of booking
- f. Export excel report for trains, passengers and station
- g. Export pdf for booking details

RESOURCES

TEXT BOOKS:

1. Herbert Schildt, "Java the complete reference", 11th edition, McGraw Hill, Education, 2018.
2. C. Thomas Wu, "An Introduction to Object-Oriented Programming with Java 5th edition", McGraw-Hill Higher Education 2010.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch, "An Introduction to programming and OOPS design using Java", 3rd edition, John Wiley & sons, 2008.
2. P. Radha Krishna, "Object Oriented Programming through Java", 1st edition, Universities Press, 2007.

SOFTWARE/TOOLS:

1. Software: Eclipse / Net beans / JDK 1.7
2. Java compatible web browser

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106105191>
2. <https://www.udemy.com/course/java-tutorial/>

WEB RESOURCE:

1. https://www.tutorialspoint.com/java/java_tutorial.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA204002	WEB TECHNOLOGIES	3	-	2	4	5
Pre-Requisite	- Object Oriented Programming through JAVA					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides Concepts of HTML, Java Script, and Developing Web Applications using Servlets, JSP, Adopting Tomcat Server and XAMP Server for deploying Web Applications.

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

- CO1.** Demonstrate knowledge on HTML, CSS and Client-side Scripting
- CO2.** Design and develop web Applications using HTML, JavaScript, Servlets, JSP.
- CO3.** Apply Servlets, and JSP to implement Societal E-Commerce applications to infer potential insights
- CO4.** Analyze 2-tier, 3-tier and MVC architectures, Servlets Life cycle and JSP Life cycle, Directory structure of servlets and JSP to design web application
- CO5.** Analyze and Solve real time problems using Server-side technologies, Tomcat Server and XAMPP Server for deployment of web applications.
- CO6.** Work independently or in team to solve problems with effective communications.

CO-PO Mapping Table

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	-	-	-	-	-	-
CO2	3	2	3	3	-	-	-	-
CO3	3	2	2	3	3	-	-	-
CO4	3	2	2	3	-	-	-	-
CO5	2	-	-	-	-	2	-	-
CO6	-	-	-	-	-	3	-	3
Course Correlation Mapping	3	2	2	2	1	1	-	1

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

COURSE CONTENT

Module 1: INTERNET AND THE WORLD WIDE WEB AND HTML (09 Periods)

World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), browsers – internet explorer, Netscape navigator, opera, Firefox, chrome, Mozilla. search engine, web saver – apache, IIS, proxy server, HTTP protocol.

Introduction to HTML: Elements of HTML Document, HTML Elements and HTML Attributes, Headings, Paragraph, Division, Formatting: b, i, small, sup, sub, Spacing: Pre, Br.

Phrases: span, strong, tt, Image element, Anchors, Lists: Ordered and Unordered and Definition, Tables, Frames, Forms: Form Elements, ID attributes, Class Attributes of HTML Elements, Meta Tag, Audio, Video, Canvas, Main, Section, Article, Header, Footer, Aside, Nav, Figure Tags, HTML Events: Window Events, Form Element Events, Keyboard Events, Mouse Events.

Module 2: CASCADING STYLE SHEETS (CSS) AND CLIENT-SIDE SCRIPTING (10 Periods)

Cascading Style Sheets (CSS), CSS Syntax, Inserting CSS: Inline, Internal, External, ID and Class Selectors, Colors, Backgrounds, Borders, Text, Font, List, Table, CSS Box Model, Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin, Positioning: Relative, Float, Absolute, CSS3 Borders, Box Shadows, Text Effects and shadow, Basics of Responsive Web Designs, Media Queries.

Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, functions. event handlers (onclick, onsubmit etc.), Document Object Model, Form validation.

Module 3: XML (09 Periods)

XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

Module 4: SERVLETS (09 Periods)

Introduction to Servlets: Common Gateway Interface (CGI), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

Module 5: JSP (08 Periods)

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Design the following static web pages required for an online book store web site.

1) HOME PAGE:

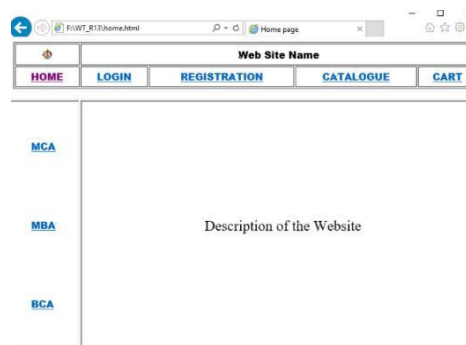
The static home page must contain three frames.

Top frame: Logo and the college name and links to Home page, Login page, Registration page, Catalogue page and Cart page (the description of these pages will be given below).

Left frame: At least four links for navigation, which will display the catalogue of respective links.

For e.g.: When you click the link "MCA" the catalogue for MCA Books should be displayed in the Right frame.

Right frame: The pages to the links in the left frame must be loaded here. Initially this page contains description of the web site.



2. **LOGIN PAGE:** Login page must contain Login field, Password field, Submit and reset buttons.
3. **CATALOGUE PAGE:** The catalogue page should contain the details of all the books available in the web site in a table. The details should contain the following: 1. Snap shot of Cover Page. 2. Author Name. 3. Publisher. 4. Price. 5. Add to cart button.
4. **REGISTRATION PAGE:**
Create a "registration form" with the following fields
 - 1) Name (Text field)
 - 2) Password (password field)
 - 3) E-mail id (text field)
 - 4) Phone number (text field)
 - 5) Sex (radio button)
 - 6) Date of birth (3 select boxes)
 - 7) Languages known (check boxes – English, Telugu, Hindi, Tamil)
 - 8) Address (text area)

5. Design a web page using CSS (Cascading Style Sheets) which includes the following:
 - A. Use different font, styles: In the style definition you define how each selector should work (font, color etc.). Then, in the body of your pages, you refer to these selectors to activate the styles.
 - B. Set a background image for both the page and single elements on the page.
 - C. Control the repetition of the image with the background-repeat property.
6. Write an XML file which will display the Book information which includes the following:
 - 1) Title of the book
 - 2) Author Name
 - 3) ISBN number
 - 4) Publisher name
 - 5) Edition
 - 6) Price

Write a Document Type Definition (DTD) to validate the above XML file.
7. Implement a JAVA Servlet Program to implement a dynamic HTML using Servlet (user name and password should be accepted using HTML and displayed using a Servlet).
8. Design a JAVA Servlet Program to Download a file and display it on the screen (A link has to be provided in HTML, when the link is clicked corresponding file has to be displayed on Screen).
9. Design a JAVA Servlet Program to implement RequestDispatcher object using include() and forward() methods.
10. Implement a JAVA Servlet Program to implement sessions using HTTP Session Interface.
11. Design a JAVA JSP Program to implement verification of a particular user login and display a welcome page

PROJECT BASED LEARNING

Project - 1: Design a web application for selling products online with the following features.

Mobile website option - The online store should be built on a responsive design template and its features need to be available to all users, at any time, from anywhere and in any device.

Image options - The photos should also be taken from different points of view to give you a clearer idea of the product. Image options should include viewing angles, zoom, multiple images, and more. Detailed product description - The description should often include the important details, such as the expiration date, size dimensions, weight, manufacturers date, and practical uses must be included in a good product description.

Order Tracking - The customers should be able to track their ordered products by logging into an account created upon registration.

Payment Options - An online website should allow credit card/debit card/net banking for payment.

Project - 2: Design a social website with the following features.

Build Profile - Members allow to build their profiles.

Upload content - The Social Networking Sites allow members to upload text messages, photographs, audio and video files. All posts are arranged in descending order with the last post coming first.

Build conversations - Content posted by members can be browsed and commented upon by all members who form part of the community. Content can also be tagged from third party sites on subjects that interest the group.

RESOURCES

TEXT BOOKS:

1. Uttam K Roy, "Web Technologies", 2nd Edition, Oxford University Press, 2010.
2. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, Dreamtech Press, First Edition, 2011.

REFERENCE BOOKS:

1. Harvey M. Deitel and Paul J. Deitel, "Internet and World Wide Web How to Program", 4th Edition, Pearson publications, 2006.
2. Snig Bahumik, Bootstrap Essentials, PACKT Publishing, First Edition, 2015. (e-book).
3. Thomas A. Powell, The Complete Reference: HTML and CSS, Tata McGraw Hill, Fifth Edition, 2010.
4. Andrea Tarr, PHP and MySQL, Wiley India, First Edition, 2012.

WEB RESOURCES

1. ICT4LT – "Introduction to the Internet / WWW" (ict4lt.org)
 2. HTML Tutorial – Scaler Topics (Scaler)
 3. "HTML Tutorial: Create Full Basic Website" – Moo ICT (mooict.com)
 4. MarkSheet.io – Web / Internet / HTTP / HTML introduction (MarkSheet)
 5. The Pocket HTML Tutorial (goer.org)
- SOFTWARE/TOOLS:**
1. Editor: Notepad++
 2. Technologies: HTML, CSS, Servlets, JSP

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=Q33KBiDriJY>
2. [https://www.coursera.org/learn/html-css-javascript-for-web-developers?=&](https://www.coursera.org/learn/html-css-javascript-for-web-developers?)

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA201004	SOFTWARE ENGINEERING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on 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.** Understand 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 Mapping Table:

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

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 ENGINEERING AND MODELING (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.

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: SOFTWARE TESTING STRATEGIES AND APPLICATIONS (08 Periods)

Testing strategies: A strategic approach to software testing, Strategic issues, Test strategies for conventional software, Test strategies for object oriented software, Validation testing, System testing.

Testing Conventional Applications: Software testing fundamentals, White box testing- Basis path testing, Control structure testing; Black box testing, Object oriented testing methods.

Module 5: RISK, QUALITY MANAGEMENT AND REENGINEERING (10 Periods)

Risk and Quality Management: Reactive and Proactive risk strategies, Software risks, Risk Mitigation Monitoring and Management (RMMM), RMMM plan, Formal Technical Reviews (FTR), Software Quality Assurance (SQA)-Tasks, Goals and Metrics; Software reliability.

Reengineering: Introduction, Business Process Reengineering (BPR), Software Reengineering, Restructuring, Reverse engineering, Forward engineering.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Identify Functional and Non-Functional Requirements for:
 - a. Online Ticket Reservation for Railways
 - b. Recruitment Procedure for Software Industry

2. **Online Ticket Reservation for Railways**

Problem Statement: Computer plays an integral part of the day in today's life. It makes the entire job easier and faster, every job is computerized so as the ticket reservation we can book over the online ticket reservation system. During the booking of the ticket reservation passenger has to select origin, date of journey, destination, class of train etc. The reservation counter keeps track of passenger's information. Thus the system will have all the details about the trains and facilities provided by them. There are various trains with the different level of convenience for the passengers. The whole database will be maintained by database administrator. There are varieties of trains where the passengers can select the train according to the convenience for their destination journey. The journey could be within the state or across the India. Each train has the three types of classes i.e. Sleeper class, First class and the AC compartment. Design the application for the above problem description. Model using Visual modelling tools in different views i.e. component view, Deployment view.

3. **Recruitment Procedure for Software Industry**

Problem Statement: In the software industry the recruitment procedure is the basic thing that goes in the hand with the requirement as specified by the technical management team. HR first gives an advertisement in leading Newspapers, Journals, Weeklies and Websites. The job seekers can apply for it through by Post or by e-mail to the company. The technical skill and the experience of the candidates are reviewed and the short listed candidates are called for the interview. There may be different rounds for interview like the written test, technical interview, and HR interview. After the successful completion of all rounds of interview, the selected candidates' names are displayed. Meanwhile HR gives all the details about the salary, working hours, terms and conditions and the retirement benefit to the candidate. Model using Visual modelling tools in different views i.e. Use case view, logical view

RESOURCES

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Grady Booch, James Rumbaugh and Ivar Jacobson, "The Unified Modeling Language User Guide," Second Edition, Pearson Education, 2009.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers, Third Edition, 2007.
3. Shelly Cashman Rosenblatt, Systems Analysis and Design, Thomson Publications, Sixth Edition, 2006.

VIDEO LECTURES:

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

WEB RESOURCES:

1. AgileModeling: <https://www.techtarget.com/searchsoftwarequality/definition/agile-software-development>
2. Functional and Non Functional Requirements: <https://www.linkedin.com/learning/software-design-developing-effective-requirements/functional-vs-non-functional>
3. Software Metrics and Measures: https://www.youtube.com/watch?v=bnydxXPN_rI
4. Risk Management: <https://www.youtube.com/watch?v=8DstdqQBjps>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA201005	ARTIFICIAL INTELLIGENCE	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

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 Mapping Table:

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

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (10 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.

Module 2: PROBLEM SOLVING BY SEARCHING (9 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 (9 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 (9 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.

Module 5: ROBOTICS, ETHICS AND SAFETY IN AI (8 Periods)

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks. Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Solve the travelling sales man problem using Hill Climbing search algorithm.
2. Design and implement solution for 8-puzzle problem using Greedy Best First Search.

RESOURCES

TEXT BOOK:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 4th Edition, 2020.

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.
3. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education, 2017.
4. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.

WEB RESOURCES:

1. <https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence>
2. <http://aima.cs.berkeley.edu/>
3. <https://ai.google/education/>

VIDEO LECTURES

1. <https://www.coursera.org/courses?query=artificial%20intelligence>
2. <https://www.edureka.co/blog/artificial-intelligence-with-python/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA202007	CLOUD COMPUTING	3	-	2	-	4

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 Mapping Table:

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

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 (10 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.

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.

Module 4: CLOUD SECURITY (09 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.

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. Create 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. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini "CloudComputing-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. 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. Google App Engine
2. Amazon Web Services
3. Sales Force

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/sMIOsYBM Rag>

WEB RESOURCES:

1. www.salesforce tutorial.com
2. [Htpps:// trailhead.salesforce.com/en/home](https://trailhead.salesforce.com/en/home)
3. <https://MKyong.com/tutorials/google-App- engine-tutorial/>
4. <https://aws.amazon.com>

<u>PROGRAM CORE</u>		L	T	P	S	C
Course Code	Course Title					
25CA201006	CLOUD SECURITY	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course explores the foundational and advanced concepts of cloud security, focusing on virtualization, infrastructure management, secure data handling, identity access, and application-level protections in cloud environments. Students will gain insights into IaaS architecture, cloud service models, key management, and security audits across major platforms like AWS and Azure. The course also covers current industry practices like DevSecOps and Secure SDLC, preparing students to secure cloud-based applications and infrastructures effectively.

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

- CO1.** Understand system modeling, virtualization, distributed computing models, and the enterprise cloud paradigm.
- CO2.** Analyze IaaS components including virtual machine provisioning, cluster-based environments, and secure storage systems in cloud platforms.
- CO3.** Implement and evaluate cloud data protection strategies, including data lifecycle, audits, and key management in AWS and Azure environments.
- CO4.** Demonstrate knowledge of Identity and Access Management (IAM) and apply audit best practices using real-time cloud platforms.
- CO5.** Identify cloud application security challenges, apply OWASP guidelines, and implement secure development practices such as DevSecOps and monitoring using tools like CloudTrail and Lambda.

CO-PO Mapping Table:

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

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

COURSE CONTENT

MODULE : 1 FUNDAMENTALS

(9 Periods)

System Modeling, Clustering and Virtualization: distributed system models and enabling technologies, computer clusters for scalable parallel computing, virtual machines and virtualization of clusters and data centers. introduction to cloud computing, migrating into cloud, enriching the integration of service paradigm for cloud era, the enterprise cloud computing paradigm

MODULE : 2 INFRA STRUCTURE AS SERVICE (IAAS)

(9 Periods)

Virtual machine provisioning and migration services, on the management of virtual machines for cloud infrastructure, enhancing cloud computing environments using a cluster as service, secure distributed data storage in cloud computing Aneka, comet cloud, T-systems, work flow engine for clouds understanding scientific applications for cloud environments.

MODULE : 3 CLOUD DATA SECURITY

(9 Periods)

Data Protection (rest, at transit, in use), Data Information lifecycle, Cloud Data Audit (Intro, Audit, Best Practice): Aws - EBS, S3, Azure - SAS, Demo-Aws cli & powershell & Amazon, Azure portal, Key management, Cloud Key management Audit (Intro, Audit, Best Practice): Aws -KMS, Azure - Azure Key Vault

MODULE : 4 IDENTITY AND ACCESS MANAGEMENT

(9 Periods)

Introduction to Identity and Access Management, Introduction to Federated Identity Management, Case Study, Cloud IAM Audit (Intro, Audit, Best Practice): Aws -IAM, Demo -Aws Cli & Amazon portal .

MODULE : 5 CLOUD APPLICATION SECURITY

(9 Periods)

Cloud Application Challenges, OWSAP Top 10, Secure SDLC, DevSecOps, Cloud Trail, Cloud watch, Lambda.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Use AWS S3 bucket with encryption (SSE-S3 / SSE-KMS).
2. Enable CloudTrail on AWS and view IAM activity logs.
3. Use AWS Lambda with IAM Role.

RESOURCES

TEXT BOOKS:

1. Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, 30 July 2010.
2. Securing the Cloud: Cloud Computer Security Techniques and Tactics - Illustrated, 1 June 2011.

REFERENCE BOOKS:

1. Charlie Kaufman, Network Security: Private Communication in a Public World, 2nd edition, Prentice Hall. Atul Kahate 2008.
2. Cryptography and Network Security, 2nd edition, Tata Mc Grawhill, India., Robert Bragg, Mark Rhodes 2004.

VIDEO LECTURES:

1. Cloud Computing Tutorial for Beginners | Cloud-Compu (Edureka)
Covers architecture, virtualization, service & deployment models, migration challenges. [EDUREV.IN](https://www.edureka.co/cloud-computing)
2. Cloud Computing full course (2025) – Intellipaat / YouTube
This longer video covers multiple modules including IaaS, EC2, clustering, migration. [ytclass.co](https://www.youtube.com/watch?v=...)
3. Key Areas of Cloud Security – Encryption, IAM, Data Governance
Concise video on encryption, governance, identity, etc. [Class Central](https://www.classcentral.com/course/...)
4. Full-stack IAM Options on Google Cloud (Google Cloud Tech talk)
Though GCP-centric, many principles apply across cloud providers. [Class Central](https://www.classcentral.com/course/...)
5. Introduction to serverless computing | AZ 900 Azure Fundamentals Good to see security in serverless / Lambda-like environments.

WEB RESOURCES:

1. CS4740 Lecture: Cloud Computing Fundamentals
Lecture slides + readings (e.g. *A Berkeley View of Cloud Computing*) [tddg.github.io](https://github.com/tddg/tddg.github.io)
2. Machine Learning–Centric Resource Management in Cloud Computing (survey paper)
Useful for advanced topics in resource provisioning in IaaS. [arXiv](https://arxiv.org/abs/...)

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA201007	DISTRIBUTED DATABASES	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides an in-depth understanding of distributed database systems, focusing on data distribution strategies, query processing, transaction management, reliability, and security. It explores the design principles and architectures that differentiate distributed databases from centralized systems. Students will also examine distributed concurrency control, failure recovery, and distributed object database systems, equipping them with the knowledge to design and manage scalable, secure, and efficient distributed databases.

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

- CO1.** Gain knowledge on the architecture, design principles, and data fragmentation techniques of distributed databases compared to centralized databases.
- CO2.** Transform and optimize global queries into fragment queries and analyze query execution strategies for performance in distributed systems.
- CO3.** Manage distributed transactions and apply concurrency control mechanisms, including timestamping and optimistic methods.
- CO4.** Assess reliability and consistency techniques such as checkpoints, commitment protocols, catalog management, and security in distributed environments.
- CO5.** Understand the architecture and functioning of distributed object database systems, including object management, query execution, and transaction support.

CO-PO Mapping Table:

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

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

COURSE CONTENT

MODULE : 1 INTRODUCTION

(9 Periods)

Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design.

MODULE : 2 QUERY PROCESSING

(9 Periods)

Translation of Global Queries to Fragment Queries, Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries. Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries

MODULE : 3 TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL

(9 Periods)

The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

MODULE : 4 RELIABILITY AND SECURITY IN THE DISTRIBUTED DATABASES

(9 Periods)

Reliability, Basic Concepts, Non blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection

MODULE : 5 DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS

(9 Periods)

Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Compare Centralized vs Distributed DB — group analysis of performance, fault tolerance, cost.
2. Analyze a deadlock scenario and show resolution using Wait-for Graph.
3. Create a plan for consistent checkpointing and recovery in a given distributed setup.
4. Design a simple Object-Oriented schema (e.g., for library or e-commerce).

RESOURCES:**TEXT BOOKS:**

1. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri & Navathe; Pearson Education; Asia Database System Concepts; Korth & Sudarshan; TMH
3. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall

REFERENCE BOOKS:

1. Data Base Management System; Leon & Leon; Vikas Publications
2. Introduction to Database Systems; Bipin

VIDEO LECTURES:

1. Free Video: Introduction to Distributed Databases - Lecture 21 from CMU Database Group | Class Central
2. Free Video: Distributed Data Warehouse OLAP Databases - Lecture 23 from CMU Database Group | Class Central
3. Free Video: Distributed Analytical Databases - Lecture 24 from CMU Database Group | Class Central

WEB RESOURCES:

1. <https://www.geeksforgeeks.org/concurrency-control-in-dbms/>
2. <https://www.ibm.com/docs/en/informix-servers/12.10?topic=concepts-distributed-database-security>
3. <https://www.studytonight.com/dbms/object-oriented-database>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202008	DATA ANALYTICS	3	-	2	-	4
Pre-Requisite	-Data Mining					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and understanding the need of Big Data, challenges and different analytical architectures, Installation and understanding of Hadoop Architecture and its ecosystems, Processing of Data with Advanced architecture.

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

CO1. Understand and implement the basic fundamentals in R.

CO2. Understand the concepts of matrices, arrays and lists

CO3. Implementing data frames

CO4. Understand different Statistical models

CO5. Understand and implement visualization and learning techniques

CO-PO Mapping Table:

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

(09 Periods)

Constants and Variables; Numbers; R Data Structures – Help functions in R – Vectors: Numeric Vectors - Scalars – Declarations – recycling – Vectorized operation: Using all and any, NA and NULL values, Filtering, Vectorized if-then else, Vector Equality, Vector Element names – Arithmetic and Boolean operations – conditional and loop statement in R – Functions and Recursions in R.

Module 2: MATRICES, ARRAYS AND LISTS

(09 Periods)

Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns: Adding and deleting rows and columns – Higher Dimensional arrays - Vector/Matrix Distinction – Avoiding Dimension Reduction - Characters and Strings - String vector - String operations and functions – List – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists – Different R operations using a List, matrix, Array;

Module 3: DATA FRAMES

(09 Periods)

Overview on Data Frames – Create it in scratch - Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Math and Simulations in R - Reading a datafile directly into a dataframe - EDA using R - Reading different file formats.

Module 4: STATISTICAL MODELS

(09 Periods)

String Manipulation – Statistical analysis: Basic Statistics – Linear Model – Generalized Linear models – Non-linear models - R functions for statistical analysis - Graphics: Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots – interfacing: Interfacing R to other languages – Parallel R – Time Series and Auto-correlation – Clustering

Module 5: VISUALIZATION AND LEARNING TECHNIQUES

(09 Periods)

Introduction to GGPlot2 – Library - Factors – Aesthetics – Plotting with Layers – Overriding Aesthetics – Mapping vs Setting – Histograms – Density Charts – Statistical Transformation – Facets – Coordinates – Themes. Learning Techniques - Supervised Learning: Linear Regression; Logistic Regression; Decision Trees; Random Forests; K-Nearest Neighbours (k-NN); Support Vector Machine. Unsupervised Learning: K-Means Clustering; Hierarchical clustering.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Perform the basic functions in R.
2. Create a matrix with specific dimensions, Add and delete rows/columns
3. Creating and basic operations on Data Frames
4. Linear and Logistic Regression, Fit and interpret a statistical model
5. Explore plotting features in base R

RESOURCES

TEXT BOOK:

1. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.

REFERENCE BOOKS:

1. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.
2. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013.
3. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

SOFTWARE/TOOLS: R studio

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=IP1zCz_tMAQ
2. <https://www.youtube.com/watch?v=fWE93St-RaQ&list=PL9ooVrP1hQOHAPQPcVgnVZjbrbKSckiii>

WEB RESOURCES:

1. <https://www.geeksforgeeks.org/data-analysis-using-r/>
2. [w3schools.com](https://www.w3schools.com)
3. [hackerrank-solutions](#) · [GitHub Topics](#) · [GitHub](#)

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201008	INFORMATION RETRIEVAL SYSTEMS	3	-	-	-	3

Pre-Requisite -Data Mining

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The main objective of this course is to present the scientific support in the field of information search and retrieval. This course explores the fundamental relationship between information retrieval, hypermedia architectures, and semantic models, thus deploying and testing several important retrieval models such as vector space, Boolean and query expansion. It discusses implementation and evaluation issues of new algorithms like clustering, pattern searching, and stemming with advanced data/file structures, indirectly facilitating a platform to implement comprehensive catalogue of information search tools while designing an e-commerce web site.

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

- CO1.** Demonstrate genesis and diversity of information retrieval situations for text and hyper media
- CO2.** Describe hands-on experience store, and retrieve information from www using semantic approaches.
- CO3.** Demonstrate the usage of different data/file structures in building computational search engines.
- CO4.** Analyse the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia.
- CO5.** Analyze ranked retrieval of a very large number of documents with hyperlinks between them and the Internet or Web search engine

CO-PO Mapping Table:

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

(09 Periods)

Introduction: Retrieval strategies: vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language models.

Module 2: RETRIEVAL UTILITIES

(10 Periods)

Retrieval Utilities: Relevance feedback, clustering, N-grams, Regression analysis, Thesauri.

Module 3: RETRIEVAL UTILITIES

(10 Periods)

Retrieval utilities: Semantic networks, parsing Cross –Language: Information Retrieval: Introduction, Crossing the Language barrier.

Module 4: EFFICIENCY

(08 Periods)

Efficiency: Inverted Index, Query processing, Signature files, Duplicate document detection

Module 5: DISTRIBUTED INFORMATION RETRIEVAL

(08 Periods)

Integrating structured data and text. A historical progression, Information retrieval as relational application, Semi Structured search using a relational schema. Distributed Information Retrieval: A theoretical Model of Distributed retrieval, web search.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Presentation on image query processing i.e. about QBIC
2. Presentation on one of the case studies of Information Retrieval System

RESOURCES

TEXT BOOKS:

1. David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition(Distributed by Universal Press), 2004
2. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.

REFERENCE BOOKS:

1. Soumen Chakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
2. Christopher D Manning, Prabhakar Raghavan, Hinrich Schutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=qIXvczunFLg>
2. <https://www.youtube.com/watch?v=MD3Ferad0oM>

WEB RESOURCES:

1. Information Storage and Retrieval Systems: Theory and Implementation By Kowalski (UNIT I to UNIT VI)
2. Modern Information Retrieval by Ricardo Beeza-Yates
3. International Journal of Multimedia Information Retrieval (IJMIR)
4. International Journal of Information Retrieval Research (IJIRR)

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201009	DATA SCIENCE AND STATISTICAL MODELING	3	-	-	-	3

Pre-Requisite -Data Mining

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a introduce the field of data science, the nature and structure of data. The importance and application of statistics in analyzing the data. Develop the skills in using data science techniques for solving data intensive problems. Understand learning concepts that is vital for data science and concepts of supervised and unsupervised learning.

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

- CO1.** Memorize the statistics concepts applicable to data science
- CO2.** Demonstrate data analysis, manipulation and visualization of data using Python libraries such as Pandas, Matplotlib and Plotly etc.
- CO3.** Enumerate machine learning algorithms.
- CO4.** Analyze the various applications of data science.
- CO5.** To demonstrate the clustering algorithms.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: INTRODUCTION TO PROBABILITY

(09 Periods)

Descriptive Statistics: Measures of central tendency – mean, median, mode, harmonic mean and geometric mean.

Measures of dispersion: mean deviation from mean, standard deviation and variance.

Central moments: Covariance and correlation, rank correlation.

Sampling distributions: Hypothesis testing, definition of random variable and probability.

Module 2: INTRODUCTION TO STATISTICS

(09 Periods)

Probability distributions: Bernoulli, Binomial, Poisson.

Continuous probability distributions: Gaussian, exponential, Chi-square. Definition of Bayes probability. What Is data science, How does data science relate to other fields, Eigen values & Eigen vectors, Sparse matrices.

Module 3: PYTHON FOR DATA SCIENCE

(11 Periods)

Python for Data Analysis: Introduction to Numpy, Numpy Arrays and indexing, Introduction to pandas, Series, Data frames, Missing data, Groupby, Merging Joining and Concatenating, read csv and json, Cleaning Data.

Python for Data Visualization: Matplotlib library, Seaborn Distribution, Matrix and Regression Plots, Introduction to SKlearn and Plotly.

Module 4: REGRESSION

(08 Periods)

Data Preprocessing in Python, Regression, Simple Linear regression, Multiple Linear Regression, Polynomial regression, Support Vector Regression(SVR), Decision Tree Regression.

Module 5: SUPERVISED LEARNING -CLASSIFICATION

(08 Periods)

Introduction to Supervised Learning: Logistic Regression, K-Nearest Neighbors(KNN), Support vector Machine(SVM), Naïve Bayes, Decision Tree Classification, Random Forest Classification.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Execute programs using python libraries such as Numpy, Pandas
2. Execute and solve data visualization problems with python libraries like matplotlib, Seaborn and Plotly.
3. Evaluate various classification techniques.

RESOURCES

TEXT BOOKS:

1. A Hands On Introduction to DataScience, Cambridge University Press, ISBN10: 1108472443, 2020.
2. Principles of DataScience-Learn the techniques and math you need to start making sense of your data by SinanOzdemir,

REFERENCE BOOKS:

1. Joel Grus, Data Science from Scratch, Oreilly media,2015.
2. Gareth James Daniela Witten Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, February11, 2013.
3. Mark Gardener, Beginning R The statistical Programming Language, Wiley, 2015.
4. Han, Kamber, and J Pei, Data Mining Concepts and Techniques,3rd edition, Morgan Kaufman,2012.
5. Linear Algebra and Its Applications, 4thEdition, GilbertStrang

VIDEO LECTURES:

1. <https://www.dataquest.io/blog/best-free-tools-data-science/>
2. <https://www.youtube.com/watch?v=NOIfMY0KajE>
3. <https://youtu.be/GGL6U0k8WYA>
4. <https://www.youtube.com/watch?v=2pWv7GOvuf0&list=PLqYmG7hTraZDM-OYHWgPebj2MfCFzFObQ>
5. https://www.youtube.com/watch?v=fn1rKKNLuzk&list=PL15FRvx6P0OWTINBS_93NG2hIn9c ynVT

WEB RESOURCES:

1. <https://intellipaat.com/blog/tutorial/data-science-tutorial/>
2. <https://www.guru99.com/data-science-tutorial.html>
3. <https://www.edureka.co/blog/data-science-tutorial/>
4. <https://www.programmer-books.com/introducing-data-science-pdf/>
5. <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119092919>
6. <https://www.digiteum.com/data-visualization-techniques-tools>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201010	BIG DATA	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides an in-depth understanding of distributed database systems, focusing on data distribution strategies, query processing, transaction management, reliability, and security. It explores the design principles and architectures that differentiate distributed databases from centralized systems. Students will also examine distributed concurrency control, failure recovery, and distributed object database systems, equipping them with the knowledge to design and manage scalable, secure, and efficient distributed databases.

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

- CO1.** Explain the architecture, design principles, and data fragmentation techniques of distributed databases compared to centralized databases.
- CO2.** Transform and optimize global queries into fragment queries and analyze query execution strategies for performance in distributed systems.
- CO3.** Manage distributed transactions and apply concurrency control mechanisms, including timestamping and optimistic methods.
- CO4.** Assess reliability and consistency techniques such as checkpoints, commitment protocols, catalog management, and security in distributed environments.
- CO5.** Understand the architecture and functioning of distributed object database systems, including object management, query execution, and transaction support.

CO-PO Mapping Table:

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

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

COURSE CONTENT

MODULE 1: INTRODUCTION TO BIG DATA AND HADOOP

(9 Periods)

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

MODULE 2: HDFS(Hadoop Distributed File System)

(9 Periods)

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

MODULE 3: MAP REDUCE

(9 Periods)

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

MODULE 4: HADOOP ECO SYSTEM

(9 Periods)

Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.

Big SQL : Introduction.

MODULE 5: DATA ANALYTICS WITH R

(9 Periods)

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Set up a small single-node Hadoop instance (e.g. in a VM) and run a simple "word count" job.
2. Write custom MapReduce programs (Java, Python streaming) for simple tasks (e.g. inverted index, log summarization).
3. Write Pig Latin scripts to load, filter, group, join datasets.
4. Implement a simple collaborative filtering algorithm over sample user-item data.

RESOURCES:

TEXT BOOKS:

1. Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

REFERENCE BOOKS:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
7. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=IiKhXC6NFDg>
2. https://edurev.in/v/133632/Hadoop-Ecosystem-Tutorial--Hadoop-Ecosystem-Compon?utm_source

WEB RESOURCES:

1. <https://www.bigdatainrealworld.com/hadoop-tutorial/>
2. <https://hackr.io/tutorial/bigdata-and-hadoop-tutorial?>
3. <https://www.scholarhat.com/tutorial/hadoop?>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202009	MACHINE LEARNING	3	-	2	-	4

Pre-Requisite - Data mining, Python Essentials

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.
- CO6.** Work Independently to solve problems with effective communication.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	3	3	1	3	3	-	-
CO2	2	-	2	2	-	2	-	-
CO3	-	3	2	-	3	2	-	-
CO4	2	-	2	2	-	2	-	-
CO5	1	2	2	1	2	2	-	-
CO6	-	1	-	2	-	-	-	-
Course Correlation Mapping	3	2	2	3	3	2	-	-

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

COURSE CONTENT

Module 1: INTRODUCTION TO MACHINE LEARNING

(09 Periods)

Machine Learning: Human learning, Types of human learning, Machine learning, Types of machine learning, Applications of machine learning, Issues in machine learning.

Preparing to Model: Machine learning activities, Types of data, Exploring structure of data, Data quality and remediation.

Module 2: MODELING AND EVALUATION, BAYESIAN CONCEPT LEARNING

(09 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

(10 Periods)

Classification: Classification model, Classification learning steps, K-Nearest Neighbor, Support vector machines, Decision Tree - Decision tree representation, Problems for decision tree learning, Decision tree learning algorithm, Hypothesis space search, Inductive bias in decision tree learning, Issues in decision tree learning.

Regression: Introduction, Simple linear regression, Improving accuracy of the linear regression model, Multiple linear regression, Assumptions and problems in regression analysis, Polynomial regression model.

Module 4: UNSUPERVISED LEARNING

(07 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.

Module 5: ARTIFICIAL NEURAL NETWORKS, ENSEMBLE LEARNING

(10 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.

Ensemble Learning: Bagging, Boosting, Gradient boosting.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Introduction to Python machine learning libraries.
2. Use Naïve Bayes classifier to solve the credit card fraud detection problem.
3. Implement K-Nearest Neighbor algorithm to solve classification problem.
4. 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. Explore the problem of overfitting in decision tree and develop solution using pruning technique.
5. 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.
6. 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.
7. Build linear regression and multiple regression models to predict the price of the house (Boston House Prices Dataset).
8. Build a polynomial regression model for predicting the salary of the employees.
9. Build a neural network that will read the image of a digit and correctly identify the number.
10. 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/YkxIRXFvZXJrTDBkVzVVZi9ESjI6eXpRZkxRc2lhOWhlVX BhUVVWaXZINDNyZUVldU9ldlYvd20wbkQ4MC92UQ>
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>
8. <https://machinelearningmastery.com/machine-learning-in-python-step-by-step/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202010	DATA HANDLING AND VISUALIZATION	3	-	2	-	4
Pre-Requisite	-Data Analytics					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Introduction to data Visualization, Methodology, Data Presentation, design objectives, seven stages of data visualization, Data representation methods, Acquiring data, Parsing data, data processing, drawing with data, Port scan visualization, Attacking and defending visualization systems.

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

- CO1.** Understand the fundamentals of representing complex and voluminous data.
- CO2.** Design and use various methodologies in visualization.
- CO3.** Understanding the various process and tools used for visualization.
- CO4.** Using interactive visualization to make inference.
- CO5.** Discuss the process involved and security issues present in visualization.

CO-PO Mapping Table

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

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

COURSE CONTENT:

Module 1 : INTRODUCTION

(9 Periods)

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

Module 2 : VISUALIZING DATA METHODS

(9 Periods)

Mapping - Time series - Connections and correlations – Indicator-Area chart-Pivot table- Scatter charts, Scatter maps - Tree maps, Space filling and non-space filling methods- Hierarchies and Recursion - Networks and Graphs-Displaying Arbitrary Graphs-node link graph-Matrix representation for graphs- Info graphics

Module 3 : VISUALIZING DATA PROCESS

(9 Periods)

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

Module 4 : INTERACTIVE DATA VISUALIZATION

(9 Periods)

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting, Framework – T3, .js, tablo.

Module 5 : SECURITY DATA VISUALIZATION

(9 Periods)

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems – Creating security visualization system.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.

RESOURCES

TEXT BOOKS:

1. Scott Murray, "Interactive data visualization for the web", O'Reilly Media, Inc., 2013.
2. Ben Fry, "Visualizing Data", O'Reilly Media, Inc., 2007.
3. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", NoStarch Press Inc, 200

REFERENCE BOOKS:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015..

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=jLfo9uqgKFk&list=PL7yAVmu-X0Mm5cjTIDBZRvL8i7bFsWsce>
2. <https://www.youtube.com/watch?v=MiiANxRHSv4&t=176s>

WEB RESOURCES:

1. <https://www.geeksforgeeks.org/data-handling/>
2. <https://www.tableau.com/learn/articles/data-visualization>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201011	DEEP LEARNING	3	-	-	-	3

Pre-Requisite Machine Learning

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Basics of Machine Learning, Neural Networks, Classifications, Classifiers, learning models, Back propagation algorithm, Feed Forward algorithm, Convolution and Recurrent Neural Networks, Auto encoder Architectures.

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

- CO1.** Understand the concepts of classifications, neural networks, classifiers and learning models for the development of applications.
- CO2.** Select appropriate algorithms for solving the real time problems.
- CO3.** Analyze the working of Feed Forward Neural Networks and their modifications.
- CO4.** Apply Convolution & Recurrent Neural Networks to solve problems.
- CO5.** Commit to ethics in the use of algorithms in the development of applications.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: BASICS OF MACHINE LEARNING (10 Periods)

Beginnings of ANN, XOR Problem, From Cognitive Science to Deep Learning, NNs and their importance. Elementary classification problem, evaluating classification results, Simple Classifier – Naïve Bayesian Classifier, Simple NN: Logistic Regression, Learning without Labels, Learning alternative representation of data – PCA.

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: MODIFICATIONS & EXTENSIONS OF FF NEURAL NETS (09 Periods)

Regularization, L1 & L2 regularization, Learning Rate, Momentum and Dropout, Stochastic Gradient Descent and Online Learning, Problems with multiple hidden layers, Vanishing and exploding gradients.

Module 4: CONVOLUTION & RECURRENT NEURAL NETWORKS (09 Periods)

Introduction, Feature maps and Pooling, Building a complete convolutional neural network. Recurrent Neural Networks – Sequences of unequal length, Settings for learning with recurrent neural networks, Adding feedback loops and Unfolding neural networks, Elman Networks, LSTM.

Module 5 AUTO ENCODERS (08 Periods)

Learning Representations, Different Auto encoder Architectures, Stacking Auto encoders.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Deep Learning Methods for Object Detection.
2. Understanding YOLO Algorithm.
3. Transfer Learning and its applications.

RESOURCES

TEXT BOOK:

1. Skansi S., "Introduction to Deep Learning - From Logical Calculus to Artificial Intelligence," Springer International Publishing, 1st Edition, 2018.

REFERENCE BOOKS:

1. Buduma N., "Fundamentals of Deep Learning," O Reilly Media, 1st Edition, 2016.
2. Seth Weidman, "Deep Learning from Scratch: Building with Python from First Principles," O'REILLY Media.

VIDEO LECTURES:

1. <https://www.coursera.org/specializations/deep-learning>

WEB RESOURCES:

1. <https://www.mltut.com/best-resources-to-learn-deep-learning/>
2. <https://github.com/ChristosChristofidis/awesome-deep-learning>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201012	REINFORCEMENT LEARNING	3	-	-	-	3

Pre-Requisite Machine learning

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Knowledge on fundamentals of reinforcement learning and the methods used to create agents that can solve a variety of complex tasks.

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

CO1. Understand basics of RL.

CO2. Understand RL Framework and Markov Decision Process.

CO3. Analyzing through the use of Dynamic Programming and Monte Carlo

CO4. Understand TD(0) algorithm, TD(λ) algorithm

CO5. Analyzing geometric view problems

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: BASICS OF PROBABILITY AND LINEAR ALGEBRA (09 Periods)

Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sublinear regret, UCB algorithm, KL-UCB, Thompson Sampling.

Module 2: DECISION PROBLEM AND VALUE FUNCTION (09 Periods)

Markov Decision Problem, policy, and value function, Reward models (infinite discounted, total, finite horizon, and average), Episodic & continuing tasks, Bellman's optimality operator, and Value iteration & policy iteration.

Module 3: REINFORCEMENT LEARNING PROBLEM (09 Periods)

The Reinforcement Learning problem, prediction and control problems, Model-based algorithm, Monte Carlo methods for prediction, and Online implementation of Monte Carlo policy evaluation

Module 4: BOOTSTRAPPING (09 Periods)

Bootstrapping, TD (0) algorithm, Convergence of Monte Carlo and batch TD(0) algorithms, Model-free control: Q-learning, Sarsa, Expected Sarsa.

Module 5: GEOMETRIC VIEW (09 Periods)

N-step returns, TD (λ) algorithm, Need for generalization in practice, Linear function approximation and geometric view, Linear TD (λ). Tile coding, Control with function approximation, Policy search, Policy gradient methods, Experience replay, Fitted Q Iteration, Case studies.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Design and execute a simulation project to compare the performance of the UCB algorithm, KL-UCB, and Thompson Sampling on a set of stochastic multi-armed bandit problems
2. Organize a study group to dive deep into the mathematical underpinnings of the UCB algorithm.

RESOURCES

TEXT BOOKS:

1. "Reinforcement learning: An introduction," First Edition, Sutton, Richard S., and Andrew G. Barto, MIT press 2020.
2. "Statistical reinforcement learning: modern machine learning approaches," First Edition, Sugiyama, Masashi. CRC Press 2015.

REFERENCE BOOKS:

1. "Bandit algorithms," First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020.
2. "Reinforcement Learning Algorithms: Analysis and Applications," Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=ifma8G7LegE>
2. https://lcnwww.epfl.ch/gerstner/VideoLecturesRL-Gerstner.html?utm_source
3. https://www.classcentral.com/course/youtube-a-short-course-on-reinforcement-learning-lecture-1-by-hugo-touchette-377994?utm_source
4. https://cbmm.mit.edu/learning-hub/tutorials/computational-tutorial/reinforcement-learning?utm_source
5. https://simons.berkeley.edu/tutorial-reinforcement-learning?utm_source

WEB RESOURCES:

1. https://getvm.io/tutorials/reinforcement-learning-an-introduction?utm_source
2. https://rl-book.com/learn/?utm_source
3. https://cbmm.mit.edu/learning-hub/tutorials/computational-tutorial/reinforcement-learning?utm_source
4. https://github.com/datascienceid/reinforcement-learning-resources?utm_source
5. https://github.com/dimitarpg13/reinforcement_learning_and_game_theory/blob/main/ReinforcementLearningAndGameTheoryResources.md?utm_source

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201013	PREDICTIVE ANALYTICS	3	-	-	-	3

Pre-Requisite Machine Learning

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The course serves to advance and refine expertise on theories, approaches and techniques related to prediction and forecasting.

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

- CO1.** Understand prediction-related principles, theories and approaches.
- CO2.** Learn model assessment and validation.
- CO3.** Understand the basics of predictive techniques and statistical approaches.
- CO4.** Analyze supervised and unsupervised algorithms.
- CO5.** Analyze unsupervised algorithms.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: LINEAR METHODS FOR REGRESSION AND CLASSIFICATION (09 Periods)

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

Module 2: MODEL ASSESSMENT AND SELECTION (09 Periods)

Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross-validation, Boot strap methods, conditional or expected test error.

Module 3: ADDITIVE MODELS, TREES, AND BOOSTING (09 Periods)

Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, New Zealand fish, Demographic data).

Module 4: NEURAL NETWORKS (NN), SUPPORT VECTOR MACHINES (SVM), AND K-NEAREST NEIGHBOR (09 Periods)

Neural Networks (NN), Support Vector Machines (SVM), and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest-Neighbor classifiers (Image Scene Classification).

Module 5: UNSUPERVISED LEARNING AND RANDOM FORESTS (09 Periods)

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

Total Periods:45

EXPERIENTIAL LEARNING:

1. Lead a project to apply unsupervised learning techniques (e.g., cluster analysis, principal components analysis) to a large, unlabeled dataset (e.g., customer data from a retail store).
2. Host a comparative analysis workshop on SVM for classification and regression tasks. Select two datasets: one for classification (e.g., digit recognition) and another for

regression (e.g., stock price prediction).

RESOURCES

TEXT BOOKS:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning- Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.
2. Gareth James. Daniela Witten. Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R.

REFERENCE BOOKS:

1. C.M.Bishop –Pattern Recognition and Machine Learning, Springer, 2006.
2. L. Wasserman-All of statistics

VIDEO LECTURES:

1. <https://www.investopedia.com/terms/p/predictive-analytics.asp>
2. <https://online.hbs.edu/blog/post/predictive-analytics>

WEB RESOURCES:

1. <https://www.javatpoint.com/predictive-analytics-vs-data-mining>
2. <https://www.geeksforgeeks.org/data-analytics-and-its-type/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202011	AI FOR HEALTHCARE	3	-	2	-	4

Pre-Requisite Artificial Intelligence

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

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

- CO1.** Understand the fundamental concepts of AI in Healthcare sector.
- CO2.** Analyze the present state and future of AI in Healthcare specialties for different Scenarios.
- CO3.** Apply design concepts and metrics for AI in Healthcare.
- CO4.** Demonstrate basic concepts and terminologies of future applications of Healthcare in AI.
- CO5.** Develop AI applications through AI techniques for healthcare.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	-	-	-	-	-
CO2	3	2	3	3	3	-	-	-
CO3	3	3	2	-	-	-	-	-
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

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

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE (09 Periods)

Introduction to AI in Healthcare, Benefits and Risks, AI in the health sector, AI versus Human Intelligence, The future of AI in health sector, AI and Neural networks.

Module 2: THE PRESENT STATE AND FUTURE OF AI IN HEALTHCARE SPECIALTIES (09 Periods)

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

Module 3: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE (09 Periods)

IBM Watson, The role of Google and Deep mind in AI in Healthcare, Baidu, Facebook and AI in Healthcare, Microsoft and AI in Healthcare.

Module 4: FUTURE OF HEALTHCARE IN AI (09 Periods)

Evidence-based medicine, personalized medicine, Connected medicine, Disease and Condition Management, Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Education, Incentivized Wellness, Artificial Intelligence, Block chain, Robots.

Module 5: APPLICATIONS OF AI IN HEALTHCARE (09 Periods)

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study 2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self- Management.

Case Study 3: Delivering a Scalable and Engaging Digital Therapy.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Study of PROLOG Programming Language and its Functions.
2. Write simple fact for the statements using PROLOG.
3. Write a Prolog program for the usage of all arithmetic Operators.
4. Write a Prolog program for solving the Towers of Hanoi problem
5. Write a Prolog program to solve Monkey and banana problem.
6. Write a Prolog program for depicting and inferring from the given Family relationship.
7. Write a Prolog program for implementing the solution for 8-Puzzle problem.

RESOURCES

TEXT BOOKS:

1. Dr. Parag Mahajan, Artificial Intelligence in Healthcare, MedManthra Publications, First Edition 2019.
2. Arjun Panesar, Machine Learning and AI for Healthcare Big Data for Improved Health, Apress Publications, 2019.

REFERENCE BOOKS:

1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril, National Academy of Medicine Publication, First Edition, 2019.

VIDEO LECTURES:

1. <https://www.udacity.com/course/ai-for-healthcare-nanodegree--nd320> (AI for Healthcare)
2. <https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare> (Surgical robots, new medicines and better care: 32 examples of AI in healthcare)

WEB RESOURCES:

1. <https://healthtechmagazine.net/article/2020/02/future-artificial-intelligence-healthcare> (Future of Artificial Intelligence in Healthcare)

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201014	DIGITAL IMAGE PROCESSING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Image Fundamentals, Image Transforms, Image enhancement in spatial and frequency domains, Restoration of images corrupted by noise, Image Compression models with coding, Segmenting images based on properties and Color image processing.

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

- CO1.** Apply various transformations on images by analyzing basic operations on images.
- CO2.** Apply various image enhancement techniques in spatial and frequency domains.
- CO3.** Apply restoration techniques based on noise models and degradation function to restore the images, pertaining to health and societal applications.
- CO4.** Analyze various coding techniques for compression to reduce redundancies in images.
- CO5.** Analyze various segmentation techniques on images for societal applications.
- CO6.** Analyze various color models for different types of images.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-
CO4	2	2	2	3	-	-	-	-
CO5	2	2	3	2	3	-	-	-
CO6	-	3	2	-	-	-	-	-
Course Correlation Mapping	2	2	3	2	3	-	-	-

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

COURSE CONTENT

Module 1: IMAGE FUNDAMENTALS

(10 Periods)

Fundamental steps in Image Processing, Image sampling & quantization, some basic relationships between pixels, Arithmetic operations, Logical operations, Spatial operations.

Module 2: IMAGE ENHANCEMENT

(11 Periods)

Basic Intensity transformation functions, Histogram processing, Fundamentals of Spatial Filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial Enhancement methods.

Module 3: IMAGE RESTORATION

(07 Periods)

Image degradation/Restoration model, Noise models, Restoration in the presence of Noise only- spatial filtering - mean, order- statistic and adaptive filters. Estimating the degradation function, Inverse filtering, Weiner filtering, Constrained least squares filtering.

Module 4: IMAGE COMPRESSION

(08 Periods)

Classification of redundancy in Images, Image Compression models, Run length coding, LZW Coding, Arithmetic coding, Dictionary based compression, bit-plane coding, Transform based coding.

Module 5: IMAGE SEGMENTATION AND COLOR IMAGE PROCESSING

(09 Periods)

Detection of discontinuities- Point, line and edge Detection. Thresholding- global thresholding, adaptive thresholding. Region based Segmentation. Color image fundamentals - RGB, HSI models, conversions, Pseudo Color Image Processing, Color transformations.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image

RESOURCES

TEXT BOOKS:

1. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing, Pearson Education, 4th Edition, 2018.
2. Anil K. Jain, Fundamentals of Digital Image processing, Prentice Hall, 2007.

REFERENCE BOOKS:

1. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, Tata McGraw Hill Education, Second Edition, 2020.
2. Vipula Singh, Digital Image Processing with MATLAB & LabVIEW, Elsevier, 2019.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=1I6kfkY4GyQ>
2. https://www.youtube.com/watch?v=RKE_w0F16ZA

WEB RESOURCES:

1. <https://www.geeksforgeeks.org/digital-image-processing-basics/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201015	GENERATIVE AI AND LARGE LANGUAGE MODELS	3	-	-	-	3

Pre-Requisite Artificial Intelligence

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This Course provides the fundamental concepts of Generative AI and LLM. It also provides an overview of transformers, generative Adversarial network, prompting techniques and ethical considerations.

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

- CO1.** Understand the fundamental concepts and techniques of generative modeling, deep learning, and their applications in various domains.
- CO2.** Understand and analyze GANs.
- CO3.** Understand the Fundamentals of Transformer Architectures and LLMs.
- CO4.** Understand the applications of LLM.
- CO5.** Gaining insights into Ethical Considerations in Large Language Models.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: INTRODUCTION (09 Periods)

Generative Modeling: Generative Versus Discriminative Modeling - Advances in Machine. The Rise of Generative Modeling - The Generative Modeling Framework - Probabilistic Generative Models Hello World! - Understand Probabilistic Generative Model

Module 2: GENERATIVE ADVERSARIAL NETWORKS (09 Periods)

Introduction to GANs - Building First GAN - The Discriminator - The Generator - Training the GAN - GAN Challenges - Oscillating Loss - Mode Collapse - Uninformative Loss - Hyperparameters - Tackling the GAN Challenges - Wasserstein GAN - Wasserstein Loss - The Lipschitz Constraint - Weight Clipping - Training and analyzing WGAN

Module 3: INTRODUCTION TO LLMS AND TRANSFORMERS (09 Periods)

Overview of NLP – Historical Development of Language Models – Introduction to Transformer Architecture: Evolution from RNNs, Self-attention Mechanism and Positional Encoding, multi-head attention mechanisms.

Module 4: INTRODUCTION TO PROMPTING TECHNIQUES (09 Periods)

Overview of prompting techniques – Prompting LLMs – Different prompting strategies – Theoretical Insights into Prompting – Prompt Design Principles – Transfer Learning, Fine-tuning, and Applications in NLP.

Module 5: SAFETY AND TRUSTWORTHINESS OF LLMS (09 Periods)

Ethical considerations – Bias Identification Methods – Bias Mitigation Methods– Fairness Assurance Techniques – LLM Safety Assessment – Robustness Evaluation for LLMs.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Explore and analyze LLM training datasets
2. PyTorch fine-tuning of pre-trained LLM
3. Evaluate the performance of different LLM architectures on benchmark datasets.
4. Train a language model on domain-specific data
5. Experiment with advanced LLM architectures

RESOURCES

TEXT BOOKS:

1. David Foster, Generative Deep Learning-Teaching Machines to Paint, Write, Compose, and Play, O'Reilly, 2019
2. Jay Alammar, Maarten Grootendorst, "Hands-On Large Language Models", O'Reilly Media, Inc 2024.
3. Sebastian Raschka, "Build a Large Language Model (From Scratch)", MEAP December 2023.

REFERENCE BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Jakub Langr and Vladimir Bok, GANs in Action: Deep learning with Generative Adversarial Networks, Manning, 2019
3. Sinan Ozdemir, "Quick Start Guide to Large Language Models: Strategies and Best Practices for Using ChatGPT and Other LLMs", Addison-Wesley Professional, October 2023.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=gwa47ZzhYno>
2. <https://www.youtube.com/watch?v=6g4O5UOH304>
3. https://www.youtube.com/playlist?list=PLZbbT5o_s2xqLagVWRrF7WuG5Gm4U1piH
4. Illustrated Guide to Transformers Neural Network: A step by step explanation

WEB RESOURCES:

1. https://developers.google.com/machine-learning/gan/generative?utm_source
2. https://www.baeldung.com/cs/ml-generative-vs-discriminative?utm_source
3. https://www.unrepo.com/deep-learning/introduction-to-generative-models?utm_source
4. https://arxiv.org/abs/1701.00160?utm_source
5. https://medium.com/@jonathan_hui/gan-whats-generative-adversarial-networks-d96f1d8c529f
6. <http://nlp.seas.harvard.edu/2018/04/03/attention.html>
7. https://github.com/openai/openai-cookbook/blob/main/examples/How_to_generate_effective_prompts.md
8. <https://www.safe.ai/resources>
9. <http://nlp.seas.harvard.edu/2018/04/03/attention.html>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201016	EXPLAINABLE AI (XAI)	3	-	-	-	3

Pre-Requisite Artificial Intelligence

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This Course provides the foundations and importance of XAI. This study provides the knowledge of Explainability of Tabular data, image data, text data and emerging methodologies in XAI.

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

CO1. Understand fundamental concepts and methodologies of Explainable AI (XAI).

CO2. Develop proficiency in implementing and applying XAI methods using python libraries.

CO3. Analyze the ability to interpret and visualize feature attributions effectively.

CO4. Apply XAI techniques for textual data.

CO5. Understand the emerging Technologies in XAI.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: INTRODUCTION TO EXPLAINABLE AI (09 Periods)

Introduction to Explainable AI (XAI): Historical background and evolution, significance, Needs, Challenges Explainability Evaluation – Interpretability and Explainability – Types of Explanations – Themes Throughout Explainability.

Module 2: EXPLAINABILITY FOR TABULAR DATA (09 Periods)

Permutation Feature Importance – Shapley Values and SHAP – Visualizing Feature Attributions – Explaining Tree-Based Models – LIME for Tabular Data – Surrogate Models for Model Interpretation – Partial Dependence Plots and Related Plots

Module 3: EXPLAINABILITY FOR IMAGE DATA (09 Periods)

Integrated Gradients (IG) – XRAI and Grad-CAM – LIME for Image Data – Guided Backpropagation and Grad-CAM – Adversarial Attacks – Robustness in Image Explainability – Attention Mechanisms for Image Explanation

Module 4: EXPLAINABILITY FOR TEXT DATA (09 Periods)

Tokenization and Word Embeddings – LIME for Text Data – Gradient x Input and LRP – Language Interpretability Tool – Transformer Interpretability Methods

Module 5: ADVANCED AND EMERGING TOPICS (09 Periods)

Alternative Explainability Techniques – Evaluation of Explainability Techniques – Interpretable Deep Learning Models – Counterfactual Reasoning for Explainable AI – Explanation by Example Generation – Explainability in Reinforcement Learning

Total Periods: 45

EXPERIENTIAL LEARNING

1. Permutation importance analysis with scikit-learn
2. Shapley values analysis for ML interpretation
3. Visualize feature attributions using bar plots, heatmaps, etc.
4. Interpret decision trees and ensemble models.
5. Adversarial attacks on model interpretability and explore methods for robust explanations.

RESOURCES

TEXT BOOKS:

1. Michael Munn, David Pitman, "Explainable AI for Practitioners", O'Reilly Media, Inc., October 2022.
2. Michael Munn, David Pitman, "Explainable AI for Practitioners", O'Reilly Media, Inc., October 2022. Reference books: John Liu, Uday Kamath, "Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning", Springer Nature Switzerland AG, December 2021.

REFERENCE BOOKS:

1. John Liu, Uday Kamath , "Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning", Springer Nature Switzerland AG, December 2021.

VIDEO LECTURE:

1. https://www.classcentral.com/course/youtube-introduction-to-explainable-ai-ml-tech-talks-127263?utm_source

WEB RESOURCES:

1. <https://arxiv.org/ftp/arxiv/papers/2211/2211.06579.pdf>
2. <https://iphome.hhi.de/samek/pdf/HoIXXAI22b.pdf>
3. diposit.ub.edu/dspace/bitstream/2445/192075/1/tfg_nieto_juscafresa_aleix.pdf

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201017	INTERNET OF THINGS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Internet of Things components, Domain applications, Communication models, Sensors, Connectivity, Prototyping, Hardware, Design Methodology, Development platforms, Data Analytics for IoT, IoT Security and hands-on experience on IoT applications.

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

- CO1.** Understand IoT Architecture, communication technologies and various applications of IoT.
- CO2.** Analyze sensor technologies and IoT related protocols.
- CO3.** Identify suitable hardware platforms and cloud services for developing IoT applications.
- CO4.** Understand generic design methodology for various IoT applications.
- CO5.** Understand data analytics concepts and security issues in the context of IoT.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: INTRODUCTION AND 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 AND CONNECTIVITY (09 Periods)

Sensors: Sensor Technology, Actuators, RFID Technology.

Connectivity: Internet Connectivity, Internet-Based Communications, IP Addressing in the IoT, Medium Access Control, Application Layer Protocols.

Module 3: PROTOTYPING AND HARDWARE (08 Periods)

Prototyping: Embedded Computing Basics, Embedded platforms for prototyping.

Hardware: Things always connected to the Internet/Cloud, Amazon Web Services for IoT.

Module 4: DESIGN METHODOLOGY AND 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 AND SECURITY (09 Periods)

Data Analytics for IoT: Apache Hadoop, Using Hadoop MapReduce 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 NodeMCU device using Arduino IDE.
4. Design and Implementation of Humidity and Temperature Monitoring Using Arduino and upload data to cloud using MQTT.

RESOURCES

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "*Internet of Things – A hands-on approach*," University Press, 2015.
2. Raj Kamal, "*Internet of Things- Architecture and Design Principles*," Mc Graw Hill, 2017.

REFERENCE BOOKS:

1. Adrian McEwen and Hakim Cassimally, "*Designing the Internet of Things*," Wiley Publishing, 2013.
2. Charles Bell, "*Beginning Sensor Networks with Arduino and Raspberry Pi*," Apress, 2013.
3. Marco Schwartz, "*Internet of Things with the Arduino Yun*," Packt Publishing, 2014.
4. Matt Richardson, Shawn Wallace, "*Getting Started with Raspberry Pi*," Maker Media, Inc, 2012.

SOFTWARE/TOOLS:

1. Software: Arduino IDE/ Raspberry Pi OS

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106105166>

WEB RESOURCES:

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. <https://www.javatpoint.com/iot-internet-of-things>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201018	MOBILE COMPUTING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides to develop an understanding of the ways that mobile technologies can be used for teaching and learning. They will also consider the impact of mobile computing on the field of education.

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

- CO1.** Understand concepts of Mobile Communication.
- CO2.** Analyze next generation Mobile Communication System.
- CO3.** Understand network and transport layers of Mobile Communication.
- CO4.** Analyze various protocols of all layers for mobile and ad hoc wireless communication networks.
- CO5.** Understand IP and TCP layers of Mobile Communication.

CO-PO Mapping Table:

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

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

COURSE CONTENT

Module 1: INTRODUCTION

(09 Periods)

Introduction to Mobile Computing — Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing — Spread spectrum -MAC Protocols — SDMA- TDMA- FDMA- CDMA

Module 2: MOBILE TELECOMMUNICATION SYSTEM

(10 Periods)

Introduction To Cellular Systems — GSM — Services & Architecture — Protocols — Connection Establishment — Frequency Allocation — Routing — Mobility Management — Security — GPRS-UMTS — Architecture — Handover — Security

Module 3: MOBILE NETWORK LAYER

(10 Periods)

Mobile IP — DHCP — Adhoc- Proactive Protocol-DSDV, Reactive Routing Protocols — DSR, AODV , Hybrid Routing -ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc Networks (VANET) – MANET Vs VANET — Security.

Module 4: MOBILE TRANSPORT AND APPLICATION LAYER

(08 Periods)

Mobile TCP- WAP — Architecture — WDP — WTLS — WTP -WSP — WAE — WTA Architecture — WML

Module 5: MOBILE PLATFORMS AND APPLICATIONS

(08 Periods)

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

Total Periods: 45

EXPERIENTIAL LEARNING

1. Cisco Certification on Mobility Fundamentals.
2. Cisco Certification on Intro to Packet Tracer Mobile.

RESOURCES

TEXT BOOKS:

1. Mobile Computing Technology, Applications and service creation ,Asoke K Telukder, Roopa R Yavagal by TMH.
2. Mobile Computing, Raj Kamal by Oxford

REFERENCE BOOKS:

1. Wireless Communications & Networks, Second Edition, William Stallings by Pearson
2. Mobile Computing Theory and Practice-Kumkum Garg-Pearson
3. TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition, TMH

VIDEO LECTURES:

1. <http://www.wirelessdevnet.com/>
2. <http://www.protocols.com/>

WEB RESOURCES:

1. <https://developer.apple.com/>
2. <https://www.udemy.com>
3. <http://nptel.ac.in>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202012	PROGRAMMING IN C# AND .NET FRAMEWORK	3	-	2	-	4

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: .Net Framework Overview, C# Programming Concepts, String class, OOPS concepts, Delegates and events, Exception Handling, garbage collector, generics and collection, Basics of Windows Programming, Windows Forms, menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling, ADO.Net-Object Model.

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

CO1. Understand .Net Framework and C# Programming Concepts

CO2. Describe the OOP Concepts and Exception Handling methods.

CO3. Apply multiple Event handling methods.

CO4. Describe ADO.Net-Object Model and Data Bound controls .

CO5. Create ASP.net Framework related applications with valid controls.

CO-PO Mapping Table

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

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

COURSE CONTENT

Module 1: INTRODUCTION TO .NET FRAMEWORK

(9 periods)

.Net Framework Overview- Architecture-.Net Framework class Libraries-CLR-Metadata-Interoperability-Assemblies-the .net Packaging system-CLR-MSIL , Introduction to Visual Studio.Net-C# Programming Concepts-Predefined Types- Value types and reference type, Classes and Objects, Constructors and methods , Conditional statements, loops, arrays , Collection classes: ArrayList , HashTable, Stack ,Queue, indexers and properties.

Module 2: INTRODUCTION TO C#

(9 periods)

String class: methods and properties of string class, enumerations, boxing and unboxing, OOPS concepts: Encapsulation, data hiding, inheritance, interfaces, polymorphism, operator overloading, overriding Methods, Static Class members, Delegates and events. Exception Handling, garbage collector, generics and collection

Module 3: EVENT DRIVEN PROGRAMMING IN WINDOWS

(9 periods)

Basics of Windows Programming- Event Driven Programming, Windows Forms, Using common controls-Labels, textboxes, buttons, check boxes, radio button, progress bar, combo box, list box.Components-timer, imagelist, Menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling.

Module 4: ADO.NET-OBJECT MODEL

(9 periods)

Introduction to ADO.Net-Object Model- System.Data Namespace- Data Bound controls-Connected Mechanism-Disconnected mechanism-.Net Data Providers.

Module 5: FILES, STREAMS AND ASP .NET FRAMEWORK

(9 periods)

Files: System.IO, directory and file types, Stream readers and stream writers, working with binary data. Overview of the ASP.net Framework: Using the Standard Controls, Using the Validation Controls, Using the Rich Controls.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Write a program to C# to find the smallest single digit factor for a given value. factor of that number.
2. Write a program in C# to print a number if it is prime; otherwise display the largest
3. Write a C# programs to demonstrate the concepts of Structures and Enumerations.
4. Write a C# programs to demonstrate the concepts of Constructors and Inheritance.
5. Write a C# programs to demonstrate the concepts of Polymorphism.
6. Write a C# programs to demonstrate the concepts of Label, Text Box and Button controls.
7. Write a C# programs to demonstrate the concepts of Combo Box and List Box controls.
8. Create a Windows application in C# for registration form and fill the details and when you click the submit button it display the details in the message box.
9. Create a Windows application in C# having two text boxes and three buttons named as factorial, prime, factorial series. When you click any button the resultant value will be displayed on the second textbox.
10. Create a ADO.NET application in C# to verify if the connection is established with OLEDB and MS-ACCESS.
11. Create a ADO.NET applications in C# to demonstrate the Data Reader, Data Set, Data Adapter and Data View Objects.
12. write a program in C# using StreamReader to read line from file.

RESOURCES

TEXT BOOKS:

1. C# 4.0 the Complete Reference by Herbert Schildt
2. Latest version of Andrew Trolsens C# text from Apress(Pro C# 5.0 and the .NET Framework 4.5)

REFERENCE BOOKS:

1. Robert Powel, Richard Weeks, C# and the .NET Framework, Techmedia

VIDEO LECTURES:

1. <https://www.nptelvideos.com/video.php?id=1751&c=21>
2. https://www.nptelvideos.com/visualbasic_net/?pn=1

WEB RESOURCES:

1. <https://www.javatpoint.com/net-framework>
2. <https://youtu.be/E1UAorR4Vps>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202013	R PROGRAMMING	3	-	2	-	4
Pre-Requisite	Computational Statistics					
Anti-Requisite						
Co-Requisite						

COURSE DESCRIPTION: Introduction to R, R Programming Structures, Doing Math and Simulation in R, Creating Graphs, Probability Distributions, correlation and Regression and Random Forests.

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

- CO1.** Apply R programming constructs to store and manipulate datasets.
- CO2.** Develop modules using R programming constructs to solve statistical problems.
- CO3.** Perceive data models to perform descriptive and inferential statistical analysis to identify trends, patterns in data.
- CO4.** Create effective visualization using Histograms, Bar plots, Box plots, Scatter plots for exploratory data analysis.
- CO5.** Work independently to solve problems with effective communication.

CO-PO Mapping Table

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

Correlation Level: **3- High** **2-Medium** **1-Low**

COURSE CONTENT

Module1: INTRODUCTION TO R

(08 Periods)

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

Module2: R PROGRAMMING STRUCTURES

(10 Periods)

R Programming Structures, Control Statements, Loops, -Looping Over Nonvector Sets,-If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return-Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.

Module3: DOING MATH AND SIMULATION IN R

(10 Periods)

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima-Calculus, Functions for Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files.

Module4: GRAPHICS

(8 Periods)

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

Module5: PROBABILITY DISTRIBUTIONS AND REGRESSION MODELS

(9 Periods)

Probability Distributions, Normal Distribution-Binomial Distribution-Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA. Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression -Poisson Regression-other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines-Decision-Random Forests.

TotalPeriods:45

EXPERIENTIAL LEARNING:

Datatypes, Variables, Operators, Data structures – Vectors, Arrays, Matrices, Lists, Data frames; Object oriented programming – S3, S4 classes; Selection statements – if statement, if else statement, switch statement; Iterative statements – For loop, While loop, Repeat loop, Nested loops; Functions – Creating functions, Default values for arguments, Return values, Environment and scope issues, Recursion.

1. Create the vectors:
 - a) (1, 2, 3, . . . , 19, 20)
 - b) (20, 19, . . . , 2, 1)
 - c) (1, 2, 3, . . . , 19, 20, 19, 18, . . . , 2, 1)
 - d) (4, 6, 3) and assign it to the name tmp.
For parts (e), (f) and (g) look at the help for the function rep.
 - e) (4, 6, 3, 4, 6, 3, . . . , 4, 6, 3) where there are 10 occurrences of 4.
 - f) (4, 6, 3, 4, 6, 3, . . . , 4, 6, 3, 4) where there are 11 occurrences of 4, 10 occurrences of 6 and 10 occurrences of 3.
 - g) (4, 4, . . . , 4, 6, 6, . . . , 6, 3, 3, . . . , 3) where there are 10 occurrences of 4, 20 occurrences of 6 and 30 occurrences of 3.
2.
 - a) Write R code that will generate a vector with the following elements. "aa" "ba" "ca" "da" "ea" "ab" "bb" "cb" "db" "eb" "ac" "bc" "cc" "dc" "ec" "ad" "bd" "cd" "dd" "ed" "ae" "be" "ce" "de" "ee"
 - b) Write a R program to create a Dataframes which contain details of 5 employees and display summary of the data.
3.
 - a) Create a vector of a data set and treat it as an object. Using the vector and object perform (.) dot product and (x) cross product. Take your own data.
 - b) "Fizzbuzz" is a simple programming challenge often used at interviews to test very basic programming skill. Your goal is the following: for the numbers 1 to 100, print "fizz" if the number is a multiple of 3, "buzz" if the number is a multiple of 5, "fizzbuzz" if the number is a multiple of both 3 and 5, and simply print the number otherwise.
4.
 - a) Imagine a high school with 1000 lockers all in a row, numbered 1 to 1000 in order. At the start, all of them are closed. 1000 students are sent, one after the other, to change the state of a set of lockers (from open to closed or closed to open). The first student changes the state of all lockers. The second changes the state of every other one (2, 4, 6, 8, . . .). The third changes the state of every third one (3, 6, 9, 12, . . .). This process continues until all 1000 students have gone. Write a R program to determine which lockers are open at the end of this process?
 - b) Write a function chomp() that, given a string, removes from the string any occurrence of the character &, as well as the character to the left of each & character. So, for example, your function should return:
> chomp (" a&c ") " c " > chomp (" a&") " " > chomp (" abc ") " abc "

5.
 - a) Write a function which takes a single argument which is a matrix. The function should return a matrix which is the same as the function argument but every odd number is doubled.
 - b) Write a function that takes an array of numbers x and returns the smallest number in the array.

Importance and applications of statistical learning, Types of data, Types of variables, Frequency distributions, Measures of center – Mean, Median, Mode; Measures of spread – Range, Percentile, Quartiles & Interquartile range, Standard deviation, Variance; Correlation and Covariance.

6.
 - a) Compute descriptive statistics for the data given below. X: 14, 20, 22, 19, 15, 18, 30, 27
Y: 16, 25, 27, 20, 16, 18, 27, 23
 - b) Write a R script which will compute the mean and variance of the vector `x<- 1:100`. Compare with R's internal `mean()` and `var()` functions.
7. Write a function to compute running medians. Running medians are a simple smoothing method usually applied to time-series. For example, for the numbers 7, 5, 2, 8, 5, 5, 9, 4, 7, 8, the running medians of length 3 are 5, 5, 5, 5, 5, 5, 7, 7.
The first running median is the median of the three numbers 7, 5, and 2; the second running median is the median of 5, 2, and 8; and so on. Your function should take two arguments: the data (say, x), and the number of observations for each median (say, length).
8. Write a R program to perform data import/export (.csv, .xlsx) operations using data frames in R.
9. Write a R program to create bell curve of a random normal distribution.
10. Write a R program to design correlation matrix by choosing appropriate dataset.

RESOURCES

TEXT BOOKS:

1. The Art of R Programming, Norman Matloff, Cengage Learning
2. R for Everyone, Lander, Pearson

REFERENCE BOOKS:

1. Sandip Rakshit, R for Beginners, McGraw Hill, 2017.
2. Seema Acharya, Data analytics using R, McGraw Hill, 2018.

VIDEO LECTURES:

1. <https://www.classcentral.com/course/rprog-1713>
2. <https://www.youtube.com/playlist?list=PLVext98k2evi8mDNRo4MwIgVgSmwM3cS8>
3. <https://www.udemy.com/topic/r-programming-language/>

WEB RESOURCES:

1. <https://www.stats.ox.ac.uk/~evans/Rprog/LectureNotes.pdf>,
https://www.tutorialspoint.com/r/r_tutorial.pdf
2. <https://www.tutorialsduniya.com/notes/r-programming-notes/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202014	PROGRAMMING WITH ANGULAR JS	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Java Script; Angularjs concepts; Directives and Expressions; Filters; Modules; Forms; services; Server Communication; Views; AngularJS Animation; Deployment Considerations.

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

- CO1.** Demonstrate knowledge on JavaScript, AngularJS and AngularJS Components.
- CO2.** Design and Develop Single Page Applications (SPA) by analyzing AngularJS and JavaScript
- CO3.** Analyze Declarative vs. Procedural Programming, Model View Controller, Filters.
- CO4.** Implement AngularJS applications by analyzing controllers and directives.
- CO5.** Apply CSS Animation, Transforms and Transitions to add animation in AngularJS applications.

CO-PO Mapping Table

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

Correlation Level: **3- High** **2-Medium** **1-Low**

COURSE CONTENT

Module 1: OVERVIEW OF JAVASCRIPT AND BASICS OF ANGULARJS (9 Periods)

JavaScript: Inclusion of Scripts on a Page, Statements, Functions, Parameters and Return Values, Types and Variables, Primitive Types, JavaScript Operators, Working with Objects, Control Flow, Working with Arrays, Callbacks, and JSON.

AngularJS: Framework, Declarative vs. Procedural Programming, Directives and Expressions, Model View Controller (MVC).

Module 2: FILTERS, MODULES AND DIRECTIVES (9 Periods)

Filters: Filter, Built-in Filters- Number Filter, Date Filter, limitTo Filter. Modules: Module, Bootstrapping AngularJS, Creating a Custom Filter Directives: Directives, Usage of Directives, Built-in Directives, Event-Handling Directives, Using the API Documentation, Creating a Custom Directive, AngularJS Data Binding and AngularJS Controllers.

Module 3: WORKING WITH FORMS AND SERVICES (09 Periods)

Forms: HTML Forms, AngularJS Forms, Validating Forms. Services: Services, Use of Services and Creating Services

Module 4: SERVER COMMUNICATION AND VIEWS (09 Periods)

Server Communication: Server Communication, Handling Returned Data, Handling Errors. Views: Installing the ngRoute Module, Usage of URL Routes, Defining Routes, Route Parameters, Eager vs. Conservative Routes, Route Configuration Options and HTML5 Mode.

Module 5: ANGULARJS ANIMATION AND DEPLOYMENT CONSIDERATIONS (09 Periods)

Angula JS Animation: CSS Animation, Transforms, Transitions and Applying Animations. Deployment Considerations: Configuration, Testing, Error Handling, Hide Unprocessed Templates, Minification and Bundling, Managing the Build Process and Deployment.

TotalPeriods:45

EXPERIENTIAL LEARNING:

1. Create a Static Website using HTML
2. Enhance the Static website created with CSS HTML
3. Implement front end form validation with java script Implement percentage calculator with JS DOMHTML,CSS, Basic programming.
4. Implementing JQuery in web application HTML, CSS, Java script
5. Implement a simple calculator with Angular JS Implement shopping cart with Angular JSHTML,CSS
6. Design Order Form with a total price updated in real time, which contains name of five products and their prices. Create a bill amount for all the products and calculate GST on the billing amount and display total amount.

7.

ORDER FORM

Product				
Product Name	Product Price	GST(%)	Quantity	Product Total
ABC	5000	5	1	5250
DEF	6000	5	2	12600
GHI	7000	5	3	22050
JKL	8000	5	2	16800
MNO	9000	5	1	9450
				GROSS TOTAL: 66,150

8.

- Implement AngularJs to create your Resume.
- Use Practical No.06 and initialize prices to 0 (zero) when form loads. (use module, controller & directive).

9.

OUTPUT

ORDER FORM

Product				
Product Name	Product Price	GST(%)	Quantity	Product Total
ABC				
DEF				
GHI				
JKL				
MNO				
				GROSS TOTAL:

10.

- Design a webpage which takes one number as an input and generate its factorial number (use module, controller).
- Design a webpage which takes inputs product name, product quantity and price. Generate table of entered values. When user clicks on table column title , it should sort that column values. (use filter, array).
- Design a webpage which display product name and product price using AngularJS \$http Service from database. Display the content in tabular format.

RESOURCES

TEXT BOOK

1. Andrew Grant, "Beginning AngularJS, " Apress, 1st Edition, 2015.

REFERENCE BOOKS

1. Brad Dayley, "Node.js, MongoDB, and AngularJS Web Development," 2nd Edition, 2018.
2. Agus Kurniawan, "AngularJS Programming by Example," 1st Edition, 2014

VIDEO LECTURES

1. <https://www.youtube.com/watch?v=zKkUN-mJtPQ&list=PL6n9fhu94yhWKHkcL7RJmmYyxkuFB3KSI>
2. <https://www.youtube.com/watch?v=NSWzs-Jt65w>

WEB RESOURCES

1. <https://www.w3schools.com/angular/>
2. <https://www.studocu.com/in/document/government-engineering-college-bhavnagar/electronics-and-communication/190163116026-angular-js-practicals/25526714>
3. <https://www.tutorialspoint.com/angularjs/index.htm>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202015	LINUX PROGRAMMING	3	-	2	-	4

Pre-Requisite Operating Systems

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: LINUX operating system features; Architecture of LINUX operating system; LINUX environment; Shell Script; Signals and Sockets

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

- CO1.** Demonstrate Knowledge on LINUX operating system and utilities.
- CO2.** Analyse the Bourne shell, LINUX files, processes and signals to solve problems in Linux operating system.
- CO3.** Design and develop the programs by using LINUX system tools like vi editor, File, Text, Network and Backup utilities to solve computational problems.
- CO4.** Select and apply appropriate techniques such as semaphores, Messages and Shared Memory to develop inter Process communication in Linux.
- CO5.** Work independently or in teams to solve problems with effective Communication

CO-PO Mapping Table

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

Correlation Level:3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION TO LINUX FILE SYSTEM

(09 Periods)

Linux Utilities- Introduction to Linux file system, vi editor, File handling utilities, security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, seed-scripts, operation, addresses, commands, applications, awk- execution, fields and records, scripts, operation, patterns, actions, functions, using system commands in awk.

Module 2: SHELL PROGRAMMING

(08 Periods)

Working With the Bourne Shell: shell, shell responsibilities, pipes and input Redirection, output redirection, here documents, shell as a programming language, shell meta characters, shell variables, shell commands, the environment, control structures, functions, shell script examples, debugging shell scripts.

Module 3: LINUX FILE, DIRECTORIES and API

(10 Periods)

Linux Files: File types, file systems, File attributes, i-nodes, application program interface to files, kernel support files, relationship of C stream pointers and file descriptors, directory files.

Directories: Creating, removing and changing Directories- mkdir, rmdir, chdir, obtaining current working directory-getcwd, directory contents, scanning directories- opendir, readdir, rewind functions. File API's: General file APIs, file and record locking, directory file APIs, device file APIs, general file class, regfile class for regular class, dirfile class for directory files, FIFO file class, device file class, symbolic link file class, file listing program.

Module 4: LINUX PROCESSES AND SIGNALS

(09 Periods)

Linux Processes: LINUX kernel support for processes, process APIs, process attributes, change process attributes, Process control - Process creation, replacing a process image, waiting for process, Process termination, internal and external commands, process states and zombies, orphan process, system call interface for process management - fork, vfork, exit, wait, wait pid, exec family, process groups, sessions and controlling Terminal, differences between threads and processes.

Signals: LINUX kernel support for signals, signal, signal mask, sigaction, SIGCHLD Signal and the waitpid API, the sig set jmpandsiglongjmp APIs, kill, alarm Interval timers, POSIX. 1b timers, timer class.

Module 5: INTERPROCESS COMMUNICATION AND SOCKETS AND REMOTE PROCEDURE CALLS

(09 Periods)

Inter process Communications: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different system, IPC methods, the UNIX System V IPC methods, UNIX System V messages, Messages Example, UNIX system V semaphores, Semaphore Example, UNIX System V shared memory, Shared memory Example.

Sockets: Introduction to Sockets, Socket Addresses, Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs.

Remote Procedure Calls: RPC library functions, programming interface, classes.

Total Periods:45

EXPERIENTIAL LEARNING:

1. Execute the following Linux commands.
2. File Handling Utilities and Disk utilities
3. Text Processing Utilities and Backup utilities
4. Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions.
5. Write a shell script that deletes all lines containing the specified word in one or more
6. Design Order Form with a total price updated in real time, which contains name of five products and their prices. Create a bill amount for all the products and calculate GST on the billing amount and display total amount.
7. files supplied as arguments to it.
8. Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files.
9. Write a shell script to find factorial of a given number.
10. Write an awk script to implement below using case control structure.
11. Splitting a Line into Fields.
12. Print multiplication table of a given number
13. Write a C program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen.
14. Write a C program to create a Zombie process.

RESOURCES

TEXT BOOK

1. T. Chan, "UNIX system programming using C++", PHI, 2008.
2. Sumitabha Das, "UNIX Concepts and Applications", TMH, 4th Edition, 2008.

REFERENCE BOOKS

1. W.R. Stevens, "UNIX Network Programming", Pearson Education, 2008
2. Graham Glass, King Ables, "UNIX for programmers and users", Pearson Education, 3rd Edition, 2003.
3. Kernighan and Pike, "UNIX programming environment", Pearson Education, 2006.
4. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts," John Wiley and Sons, Inc, 8th Edition, 2009

VIDEO LECTURES

1. https://www.youtube.com/watch?v=_OHi608AbeA&list=PLVIQHNRLfIP8WncRgkwFqTOzRf_GSgl00
2. <https://www.youtube.com/watch?v=xzEd3yojcHo&list=PLWPirh4EWFpGsim4cuJrh9w6-yfuC9XqI>

WEB RESOURCES:

3. <https://nptel.ac.in/courses/117/106/117106113/>
4. <https://www.edx.org/course/linux-basics-the-command-line-interface>
5. <https://training.linuxfoundation.org/resources/free-courses/introduction-to-linux/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202016	NATURAL LANGUAGE PROCESSING	3	-	2	-	4

Pre-Requisite Python Essentials

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Language Modeling, Regular Expressions, Text Normalization, Word level analysis, PoS Tagging and Entropy models; Context free grammars and Parsing techniques; Semantics and pragmatics, Discourse analysis and lexical resources.

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

- CO1.** Show sensitivity to linguistic phenomena and an ability to model them with formal grammars
- CO2.** Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- CO3.** Able to design, implement, and analyze NLP algorithms
- CO4.** Able to design, implement, and analyze NLP algorithms
- CO5.** Able to design different language modeling Techniques.

CO-PO Mapping Table

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

Correlation Level: **3- High** **2-Medium** **1-Low**

COURSE CONTENT

Module 1: FINDING THE STRUCTURE OF WORDS (11 Periods)

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

Module 2: SYNTAX ANALYSIS (09 Periods)

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

Module 3: SEMANTIC PARSING (08 Periods)

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

Module 4: HADOOP ARCHITECTURE (07 Periods)

Predicate-Argument Structure, Meaning Representation Systems, Software.

Module 5: DATA ANALYTICS WITH R (10 Periods)

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohension and Structure
Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling

Total Periods: 45

EXPERIENTIAL LEARNING

1. To Study Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming).
2. To Study Morphological Analysis.
3. N gram Model
4. POS Tagging
5. Chunking
6. Named Entity Recognition
7. Virtual Lab on Word Generator
8. Mini Project based on NLP Processor

RESOURCES

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=d4gGtcobq8M>
2. <https://www.youtube.com/watch?v=fNxaJsNG3-s>

WEB RESOURCES:

1. <https://www.udemy.com/course/data-science-natural-language-processing-in-python/?>
2. https://www.tutorialspoint.com/natural_language_processing/index.htm
3. <https://www.javatpoint.com/nlp>
4. www.udemy.com/learn-today/online-course

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202017	CLOUD PRACTITIONER	3	-	2	-	4
Pre-Requisite	CLOUD COMPUTING					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: A Course provides a detailed discussion on Fundamental of Cloud and AWS Environment. Able to work with AWS Resources along with various services of core computing, Database, and Networking of AWS adopting EC2 Pricing Models. A course also covers to Automate AWS Workloads with the Imperative Approach and the Declarative Approach with launch Configurations and Launch Templates, Auto Scaling Groups, Scaling Actions and Configuration Management.

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

- CO1.** Demonstrate the concepts of Cloud and AWS Environment, Cloud Architectures to work with AWS in Virtual Private Cloud.
- CO2.** Apply AWS resources to work with AWS Management Console for AWS Console Mobile Application.
- CO3.** Analyze core compute services, EC2 pricing models, core storage and database services for AWS Implementation.
- CO4.** Identify and use core networking services for automating AWS Workload with AWS CLI, EC2 in cloud.
- CO5.** Work independently or in team to solve problems with effective communications.

CO-PO Mapping Table

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

Correlation Level: **3- High**

2-Medium

1-Low

COURSE CONTENT

Module 1: FUNDAMENTAL OF CLOUD AND AWS ENVIRONMENT (8 Periods)

Fundamental of Cloud: Concepts of Cloud Computing, Highly Available and Scalable Resources, Professionally Secured Infrastructure, Metered Payment Model.

AWS Environment: AWS Global Infrastructure: AWS Regions, Regionally Based Services, Globally Based Services, Service Endpoint, AWS Global Infrastructure: Availability Zones, Availability Zone Designations, Availability Zone Networking, Availability Zones and High Availability, AWS Global Infrastructure: Edge Locations, Edge Locations and CloudFront, Regional Edge Cache Locations, The AWS Shared Responsibility Model, Managed Resources, Unmanaged Resources, Service Health Status, AWS Acceptable Use Policy.

Module 2: WORKING WITH AWS RESOURCES (9 Periods)

Working with AWS Resources: The AWS Management Console, Accessing the AWS Management Console, Opening a Service Console, Working with Shortcuts, Selecting a Region, The Account Name Menu, Resource Groups, Tag Editor, Tagging Strategies, The AWS Console Mobile Application, The AWS Command Line Interface, Requirements, Installation, Software Development Kits, Mobile Software Development Kits, Internet of Things Device Software Development Kits, CloudWatch, CloudWatch Metrics, CloudWatch Alarms, CloudWatch Dashboards, CloudWatch Logs, CloudWatch Events, API and Non-API Events, Management and Data Events, Event History, Trails, Log File Integrity Validation

Module 3: THE CORE COMPUTE SERVICES AND EC2 PRICING MODELS (8 Periods)

The Core Compute Services: Deploying Amazon Elastic Compute Cloud Servers, Amazon Machine Images, EC2 Instance Types, Server Storage: Elastic Block Store and Instance Store Volumes.

EC2 Pricing Models: Simplified Deployments through managed Services, Amazon Lightsail, AWS Elastic Beanstalk, Deploying Container and Serverless Workloads, Containers, Serverless Functions.

Module 4: THE CORE STORAGE AND DATABASE SERVICES (10 Periods)

The Core Storage Services: Simple Storage Service, Objects and Buckets, S3 Storage Classes, Access Permissions, Encryption, Object Life Cycle Configurations, S3 Glacier, Archives and Vaults, Retrieval Options, AWS Storage Gateway, File Gateways, Volume Gateways, Tape Gateways, AWS Snowball, Hardware Specifications, Security, Snowball Edge.

The Core Database Services: Database Models, Relational Databases, Structured Query Language, Non-relational (No-SQL) Databases, Amazon Relational Database Service, Database Engines Licensing, Instance Classes, Scaling Vertically, Storage, Scaling Horizontally with Read Replicas, High Availability with Multi-AZ, Backup and Recovery, Determining Your Recovery Point Objective, DynamoDB, Items and Tables, Scaling Horizontally.

Module 5: THE CORE NETWORKING SERVICES AND AUTOMATING AWS WORKLOADS (10 Periods)

The Core Networking Services: Virtual Private Cloud, VPC CIDR Blocks, Subnets, Internet Access, Security Groups, Network Access Control Lists, VPC Peering, Virtual Private Networks, Direct Connect, Route, Resource Records, Domain Name Registration, Hosted

Zones, Routing Policies, Health Checks, Traffic Flow and Traffic Policies, CloudFront.

Automating AWS Workloads: The Imperative Approach, The Declarative Approach, Infrastructure as Code, CloudFormation, Templates, Stacks, CloudFormation vs. the AWS CLI, AWS Developer Tools, CodeCommit, CodeBuild, CodeDeploy, CodePipeline, EC2 Auto Scaling, Launch Configurations and Launch Templates, Auto Scaling Groups, Scaling Actions, Configuration Management, Systems Manager.

Total Periods:45

EXPERIENTIAL LEARNING

1. Amazon User Account Creation by access URL with account number. Add Security credentials with Enabling Multi-Factor Authentication to Secure Your Access.
2. Create an EC2 instance and invoke Ubuntu operating system with a set of configuration on amazon web services under IaaS.
Create New Amazon Elastic Block Store (Amazon EBS) EBS Volume to EC2 Instance for provides persistent block storage volumes for use with Amazon EC2 instances in the AWS Cloud.
3. Creating Amazon Machine Image (AMI) for provides the information required to launch an instance, which is a virtual server in the cloud.
4. Create your First EC2 windows instance
5. Assign Elastic IP Addresses to Instance (Static IP Address)
6. Amazon Elastic File System: Amazon Elastic File System (Amazon EFS) provides simple, scalable file storage for use with Amazon EC2. With Amazon EFS, storage capacity is elastic, growing and shrinking automatically as to add and remove files, to applications to store as they require, when they need it.
7. Launch RDS Instance Amazon Relational Database Service (Amazon RDS) which is a web service that makes it easier to set up, operate, and scale a relational database in the cloud.
8. Accessing MySQL Instance Using Workbench.
9. Create AWS S3 Bucket – (Object Storage) Amazon Simple Storage Service (Amazon S3) which is storage for the Internet. Use Amazon S3 to store and retrieve any amount of data at any time, from anywhere on the web.
10.
 - I. AWS S3 Lifecycle Management
 - II. S3 Bucket Replication to Cross-Region
 - III. S3 Bucket Policies to control AccessCreate VPC – Virtual Private Cloud (isolated Network)
11.
 - Create subnets
 - Create Internet gateway and attach to VPC
 - Create Virtual Private Gateway and Attach to VPC

RESOURCES

TEXT BOOKS:

1. Ben Piper and David Clinton "AWS Certified Cloud Practitioner," John Wiley & Sons, Inc., ISBN: 978-1-119-49070-8, 2019.
2. Cloud Practitioner (CLF-C01) Cert Guide, 1/E by Anthony Sequeira, PEARSON INDIA
3. Aws Certified Cloud Practitioner by Neville Dawson, Dilaber Consulting Ltd

REFERENCE BOOKS:

1. Dennis Hutten "AWS: The Beginners Guide to Amazon Web Services", ASIN : B0757XM97V, 2017.
2. Gordon Wong, "AWS Basics: Beginner's Guide," Createspace Independent Pub, ISBN: 978-1542885751, February 2017.
3. Aurobindo Sarkar and Amit Shah, "Learning AWS," ISBN: 978-1784394639, Packt Publishing, 2015
4. Bernard Golden, "Amazon Web Services for Dummies, ISBN: 978-1118571835, Dummies; 1st edition, 2013.
5. Andreas Wittig and Michael Wittig "Amazon Web Services in Action", Manning; 2nd edition, 2018.

SOFTWARE/TOOLS:

1. Amazon EC2
2. Amazon S3
3. Amazon DynamoDB
4. AWS Aurora

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=SOTamWNgDKc>
2. <https://www.youtube.com/watch?v=3hLmDS179YE>
3. <https://www.youtube.com/watch?v=XjPUyGKRjZs>

WEB RESOURCES:

1. https://docs.aws.amazon.com/ec2/index.html?nc2=h_ql_doc_ec2
2. <https://aws.amazon.com/training/digital/aws-cloud-practitioner-essentials/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202018	CLOUD ARCHITECTURE AND DESIGN	3	-	2	-	4

Pre-Requisite Cloud computing

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Topics covered includes 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 Mapping Table

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

Correlation Level: **3- High**

2-Medium

1-Low

COURSE CONTENT

Module 1: COMPUTING PARADIGMS: (07 Periods)

High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.

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.

Module 3: CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT (11 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.

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 MapReduce Job Execution, Hadoop Schedulers.

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.

Total Periods: 45

EXPERIENCE 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 Madiseti, "Cloud Computing A Hands-on 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=2LaAJq1IB1Q&pp=ygUY2xvdWQgY29tcHV0aW5nIHBsYXIsaXN0>

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
25CA202019	CLOUD ARCHITECT	3	-	2	-	4
Pre-Requisite	Cloud computing					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Virtualization and Containerization technologies, VPC, VPN, Cloud architecture design principles, cloud service providers, Hybrid and Multi-cloud strategies, Cloud security and Identity management, Cloud Migration, integration and deployment strategies, Cloud Cost optimization, Cloud Monitoring and governance frameworks.

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

- CO1.** Understand the concepts of cloud architecture, benefits, virtualization and containerization technologies, network architectures to create VPC, VPN.
- CO2.** Analyze the pricing models and cost management strategies to implement cloud architecture design principles.
- CO3.** Design applications by using hybrid and multi-cloud architectures and provide security by using network security and firewalls.
- CO4.** Solve complex problems by cloud migration, integration and deployment strategies by implementing cost optimization tools.
- CO5.** Make use of governance frameworks, self service provisioning and monitoring strategies in the development of applications.

CO-PO Mapping Table

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

Correlation Level: 3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: CLOUD ARCHITECTURE, INFRASTRUCTURE AND NETWORKING (09 Periods)

Introduction to Cloud Architecture: Importance of cloud architecture, cloud adoption, Benefits and challenges of cloud adoption.

Cloud Infrastructure and Networking: Virtualization and containerization technologies, Cloud infrastructure components (compute, storage, network), Network architectures and connectivity options (VPC, VPN, Direct Connect), Cloud-based security and compliance considerations.

Module 2: CLOUD ARCHITECTURE DESIGN PRINCIPLES AND CLOUD SERVICE PROVIDERS (09 Periods)

Cloud Service Providers: Overview of major cloud providers (e.g., AWS, Azure, Google Cloud), Comparison of cloud platforms and services, Pricing models and cost management strategies.

Cloud Architecture Design Principles: Scalability, elasticity, and high availability, Fault tolerance and disaster recovery, Resilient and distributed system design, Performance optimization and monitoring.

Module 3: HYBRID AND MULTI-CLOUD ARCHITECTURES & CLOUD SECURITY AND IDENTITY MANAGEMENT (09 Periods)

Hybrid and Multi-Cloud Architectures: Integrating on-premises infrastructure with the cloud, Hybrid cloud architectures and use cases, Multi-cloud strategies and considerations.

Cloud Security and Identity Management: Cloud security best practices, Identity and Access Management (IAM) in the cloud, Network security and firewall configurations, Data encryption and key management.

Module 4: CLOUD MIGRATION AND DEPLOYMENT STRATEGIES & CLOUD COST OPTIMIZATION (09 Periods)

Cloud Migration and Deployment Strategies: Assessing and planning cloud migration projects, Lift-and-shift, re-platforming, and refactoring approaches, Cloud-native application development and deployment, Continuous integration and deployment (CI/CD) in the cloud.

Cloud Cost Optimization: Cost models and pricing considerations, Resource provisioning and right-sizing, Monitoring and optimization tools, Reserved instances and spot instances.

Module 5: CLOUD GOVERNANCE AND MANAGEMENT (09 Periods)

Cloud Governance and Management: Cloud governance frameworks and best practices, Resource tagging and organization, Service catalog and self-service provisioning, Cloud monitoring, logging, and auditing.

Total Periods: 45

EXPERIENTIAL LEARNING

1. **SETTING UP A VIRTUAL PRIVATE CLOUD (VPC):**

Create a VPC with multiple subnets and define network ACLs (Access Control Lists) and security groups. Configure private and public subnets, internet gateways, and NAT gateways. Establish connectivity between on-premises infrastructure and the cloud VPC using VPN or Direct Connect.

2. **IMPLEMENTING HIGH AVAILABILITY AND LOAD BALANCING:**

Deploy a highly available architecture using load balancers, autoscaling groups, and multiple instances across availability zones. Test the failover and load balancing capabilities by simulating traffic spikes or instance failures.

3. **SECURING CLOUD RESOURCES:**

Implement security best practices by configuring network security groups, implementing SSL/TLS certificates, and setting up Web Application Firewalls (WAF). Use IAM (Identity and Access Management) to manage user access and permissions to different cloud resources. Perform security audits and vulnerability assessments using security tools and services provided by the cloud platform.

4. **IMPLEMENTING SERVERLESS ARCHITECTURE:**

Build a serverless application using services like AWS Lambda, Azure Functions, or Google Cloud Functions.

Implement event-driven architecture by integrating services like SNS (Simple Notification Service), SQS (Simple Queue Service), or Pub/Sub.

5. **DATA STORAGE AND DATABASE MANAGEMENT:**

Set up and configure cloud-based storage services such as Amazon S3, Azure Blob Storage, or Google Cloud Storage.

Provision and manage databases using services like Amazon RDS, Azure SQL Database, or Google Cloud SQL.

Implement backup and disaster recovery strategies for databases.

6. **CONTAINERIZATION AND ORCHESTRATION:**

Use Docker to containerize applications and create Docker images.

Deploy and manage containers using container orchestration platforms like Kubernetes, AWS ECS (Elastic Container Service), Azure Kubernetes Service, or Google Kubernetes Engine.

7. **CLOUD MIGRATION AND HYBRID ARCHITECTURE:**

Perform a lift-and-shift migration of an on-premises application to the cloud platform of your choice.

Implement a hybrid architecture by connecting on-premises infrastructure with cloud resources using VPN or Direct Connect.

8. **COST OPTIMIZATION AND RESOURCE MANAGEMENT:**

Monitor and analyse cloud resource usage to identify cost optimization opportunities. Implement cost-saving techniques such as rightsizing instances, leveraging reserved instances, or using spot instances.

Implement automated resource provisioning and management using Infrastructure as Code (IAC) tools like AWS CloudFormation or Azure Resource Manager.

RESOURCES

TEXT BOOKS:

1. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", PHI publisher, 1st Edition, 2013.
2. Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models", Wiley CIO series, 1st Edition, 2014.
3. Joe Baron, Hisham Baz, and Tim Bixler "AWS Certified Solutions Architect - Official Study Guide", Sybex, Study Guide, 2016.

REFERENCE BOOKS:

1. Ritesh Modi "Azure for Architects", Packt Publishing Limited, Standard Edition, 2017.
2. Dan Sullivan "Google Cloud Certified Professional Cloud Architect Study Guide", Sybex, 1st Edition, 2019.
3. Andrea Mauro and Paolo Valsecchi "Mastering VMware vSphere 6.7", Packt Publishing, 2nd Edition, 2019.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=-8O32k26RWA>
2. <https://www.youtube.com/watch?v=sd0qz4HnbpE>

WEB RESOURCES:

1. www.opengroup.org/subjectareas/cloud-computing
2. www.cloudcomputing-news.net
3. www.reddit.com/r/cloudcomputing
4. www.cncf.io
5. www.thecloudcast.net
6. www.microsoft.com/en-us/ignite

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201019	CRYPTOGRAPHY AND NETWORK SECURITY	3	-	-	-	3
Pre-Requisite	Computer Networks					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION:

This course provides a detailed discussion and study of techniques for secure communication in the presence of third parties. More generally, it is about constructing and analyzing protocols that overcome the influence of attackers or outside people and which are related to various aspects in information security such as data confidentiality, data integrity, authentication, and non-repudiation.

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

- CO1.** Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.
- CO2.** Apply the different cryptographic operations of symmetric cryptographic algorithms
- CO3.** Apply the different cryptographic operations of public key cryptography
- CO4.** Apply the various Authentication schemes to simulate different applications.
- CO5.** Understand various Security practices and System security standards

CO-PO Mapping Table

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

Correlation Level: 3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION

(07 Periods)

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture.

Module 2: SYMMETRIC CRYPTOGRAPHY

(09 Periods)

Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis, Block cipher design principles

Module 3: PUBLIC KEY CRYPTOGRAPHY

(10 Periods)

Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm -RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

Module 4: MESSAGE AUTHENTICATION AND INTEGRITY

(09 Periods)

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

Module 5: SECURITY PRACTICE AND SYSTEM SECURITY

(10 Periods)

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls

Total Periods: 45

EXPERIENTIAL LEARNING

1. Simulate a network attack on a test system and implement basic security mechanisms as per the OSI security architecture. Document the steps and results.
2. Create a set of security policies for a hypothetical organization, focusing on legal, ethical, and professional aspects. Present your policies in a report.
3. Implement the SDES algorithm in a programming language of your choice. Perform encryption and decryption of a sample text and analyze the output.
4. Conduct differential cryptanalysis on a simplified version of the DES algorithm. Report your findings and the implications for DES's security.
5. Implement the RSA algorithm and demonstrate key generation, encryption, and decryption processes with a simple text message.
6. Simulate the Diffie-Hellman key exchange mechanism in a program and discuss its significance in secure communications through a brief report.
7. Implement a digital signature using the DSS algorithm. Test its integrity by modifying the signed document and attempting to verify the signature
8. Develop a simple application that uses SHA-256 for hashing documents. Demonstrate how a small change in the document produces a significant change in the hash.
9. Configure a firewall to block and allow specific types of traffic on a network you set up. Document the configuration process and the rationale behind your rules.
10. Implement basic email security using PGP. Send encrypted and signed emails within a test environment and verify their integrity and authenticity.

RESOURCES

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006
2. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw Hill 2007.

REFERENCE BOOKS:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd

SOFTWARE/TOOLS:

1. <https://www.wireshark.org/>
2. <https://gnupg.org/>

VIDEO LECTURES:

1. <https://www.digimat.in/nptel/courses/video/106105031/L01.html>
2. https://www.youtube.com/watch?v=o_yhTB0kP0Q
3. <https://www.coursera.org/lecture/managing-network-cybersecurity/cryptography-and-network-security-w9SuJ>

WEB RESOURCES:

1. <https://www.tutorialspoint.com/cryptography/index.htm>
2. <https://www.geeksforgeeks.org/cryptography-introduction/>
3. <https://www.gatevidyalay.com/tag/cryptography-and-network-security-tutorial/>

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PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201020	CYBER SECURITY	3	-	-	-	3

Pre-Requisite Computer Networks

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Cybercrime, Cyber offenses, Phishing, Identity theft, Cybercrime in mobile and wireless devices, Organizational measures for handling mobile devices, Security implications on using mobile devices, Tools and methods used in cybercrime, Forensics of computer and organizational implications.

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

- CO1.** Analyze the methods of cybercrime, information security, cyber criminals.
- CO2.** Illustrate the Cyber offenses, Categories of cybercrime and how criminals plan the attacks.
- CO3.** Investigate tools used for cybercrime to protect computational assets
- CO4.** Illustrate the concepts of Cyber forensics, Digital Forensics Science, Digital Evidence, Collecting Electronic Evidence, Network Forensics.
- CO5** Study the IPR issues, web threats for organizations, security and privacy implications, social computing and the associated challenges for organizations.

CO-PO Mapping Table

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT:

Module 1: CYBER CRIME (09 Periods)

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Global perspective on cybercrimes

Module 2: CYBER OFFENSES AND ATTACKS (10 Periods)

Cyber offenses: Categories of cybercrime, How criminals plan the attacks, Social engineering, Cyberstalking, Cybercafe and cybercrimes, Botnets, Attack vector.

Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft)

Module 3: TOOLS AND METHODS USED IN CYBERCRIME (10 Periods)

Proxy servers and anonymizers, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

Module 4: COMPUTER FORENSICS (08 Periods)

Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Digital Forensics Life Cycle -The Digital Forensics Process, The Phases in Computer Forensics/Digital Forensics, Precautions to be Taken when Collecting Electronic Evidence, Network Forensics

Module 5: CYBERCRIME: MOBILE AND WIRELESS DEVICES (08 Periods)

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

Total Periods: 45

EXPERIENTIAL LEARNING

1. steps to attack a victim computer by using "ProRat" trojan tool
2. Perform the packet sniffing mechanism by download the "wireshark" tool and extract the packets
3. Perform the task of creating mail messages by using fake mail id by using the "fake mailer" website (<https://emkei.cz>)

RESOURCES

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. Nilakshi Jain, **Ramesh Menon, Cyber Security and Cyber Laws, Wiley, 2020.**

REFERENCE BOOKS:

1. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, Cybersecurity Essentials, 1st Edition, Sybex, 2018.
2. Erdal Ozkaya, Cybersecurity: The Beginner's Guide, 1st Edition, Packt Publishing, 2019.
3. Yuri Diogenes, Erdal Ozkaya, Cybersecurity: Attack and Defense Strategies, 2nd Edition, Packt Publishing, 2019.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=JcaYwZ5fqjU&t=27s>
2. <https://www.youtube.com/watch?v=z5nc9MDbvkw>

WEB RESOURCES:

1. <http://www.ignou.ac.in/upload/Announcement/programmedetails.pdf>
2. Alessandro Parisi, Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing, 2019.

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201021	ETHICAL HACKING	3	-	-	-	3

Pre-Requisite Computer Networks

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Ethical hacking, Network and computer attacks, Footprinting, Social engineering, Port scanning, System hacking, Sniffers, Denial of service, Hacking web servers, Wireless hacking, Cryptography, Network Protection System.

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

- CO1.** Demonstrate knowledge on the computer security, social engineering and the intent of ethical hacking.
- CO2.** Select and apply foot printing and port scanning tools to discover vulnerabilities of the computer system.
- CO3.** Investigate hacking techniques and tools to maintain computer security.
- CO4.** Analyze Ethical Hacking intrusion prevention.
- CO5.** Analyze cryptosystems and network protection systems for information security.

CO-PO Mapping Table

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT:

Module 1: ETHICAL HACKING, NETWORK AND COMPUTER ATTACKS (9Periods)

Introduction to Ethical Hacking: The role of security and penetration testers, Penetration- Testing methodologies, What you can and cannot do legally.

Network and Computer Attacks: Malicious software, Trojans, Backdoors, Viruses, and Worms, Protection against malware attacks, Intruder attack on networks and computers, Addressing physical security.

Module 2: TCP/IP CONCEPTS AND SOCIAL ENGINEERING (9Periods)

TCP/IP Concepts: Overview of TCP/IP – Application layer, Transport layer, Internet layer; IP addressing – Planning IP address assignments, IPv6 addressing.

Social Engineering: What is social engineering, What are the common types of attacks, Understand insider attacks, Understand identity theft, Describe phishing attacks, Understand online scams, Understand URL obfuscation, Social engineering counter measures.

Module 3: FOOTPRINTING AND PORT SCANNING (9Periods)

Foot printing: Using web tools for foot printing, Conducting competitive intelligence, Using domain name system zone transfers.

Port Scanning: Port scanning, Using port scanning tools, Conducting ping sweeps, Understanding scripting.

Module 4: SYSTEM HACKING (9Periods)

System hacking -Password cracking techniques, Types of passwords, Key loggers and other spyware technologies, Escalating privileges, Rootkits, How to hide files, steganography technologies, How to cover your tracks and evidences; Sniffers- Protocols susceptible to sniffing, Active and passive sniffing, ARP poisoning, Ethernet capture and display filters, MAC flooding, DNS spoofing techniques, Sniffing countermeasures; Denial of Service - Types of DoS attacks, How DDoS attacks work, How BOTs/BOTNETs work, Smurf attack, SYN flooding, DoS/DDoS counter measures; Session hijacking-Spoofing vs. hijacking, Types of session hijacking, Sequence prediction, Steps in performing session hijacking, Preventing session hijacking.

Module 5: CRYPTOGRAPHY, NETWORK PROTECTION SYSTEMS (9Periods)

Cryptography: Understanding Cryptography basics, Symmetric and asymmetric algorithms, Public key infrastructure, Cryptography attacks.

Network Protection Systems: Understanding routers, Firewalls, Honeypots

Total Periods: 45

EXPERIENTIAL LEARNING

1. Analyze Windows Server 2019 vulnerabilities as reported by CVE. Write a detailed report on Memory Corruption Vulnerability.
2. User SQL Injection Build a Web Application running with LAMP (Linux, Apache, MySQL and PHP) architecture introducing 'User SQL Injection' and write injection queries. User Input: Users are presented with a website that has a form with an empty query box. Users put their injection in the box and submit the form. One level does not have an input box, but rather asks the user to perform a SQL injection through a GET request. Each level has a provided query, which is what the user input will be inserted into. The provided query is given for the first few levels but is removed later to provide a challenge.

For the user input, the user should input an injection that allows them to log in as a specific user, in this example, the injection `admin'#` allows the user to log in as admin.

3. **Fetch Entries:** The rows of the table are traversed and entries are retrieved that match the SQL query. When username is given with value `admin'#`, the row of the table with username "admin" will be fetched. Website Output: One or more rows in the requested data is displayed on the website as a tabular form. Display all rows of a table:

In the first level, users may be given a form with an input box asking for a username. After submitting a username, all rows in the table `users_level1` that matched the given username will be retrieved and displayed. The challenge of this level is to use SQL injection to display all rows of this table, even though the user does not know all the usernames. The query with the injection is

`SELECT username FROM users_level1 WHERE username = " OR ""`

where the text in red is the user input. The WHERE clause now checks if the username is the empty string, or if the empty string is equal to the empty string. As the second comparison will always be true, all rows

TEXT BOOKS

1. Michael T. Simpson, Kent Backman, James E. Corley, Hands-On Ethical Hacking and Network Defense, 3rd Edition, Cengage Learning, 2017.
2. Kimberly Graves, CEH: Official Certified Ethical Hacker Review Guide, Wiley, 200

RESOURCES

REFERENCE BOOK

1. Michael Gregg, Certified Ethical Hacker (CEH) Certguide, 3rd Edition, Pearson, 20

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=3Kq1MIftWCE&list=PLWKjhJtqVAbnklGh3FNRLEcx_2_D_vK3mu
2. https://www.youtube.com/watch?v=6d0VY37INfA&list=PL1dx_7g6scPKn5_x2NJ6pONit1d_J1OaYU

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. <https://www.youtube.com/watch?v=t8nwQ6At0CU&list=PL7AT7LU4byRKMBCEWpeZ4QOd2VWvdIHxU>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201022	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 Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION TO 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)

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

EXPERIENTIAL LEARNING:

- 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.
1. 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.htm
2. <https://www.javatpoint.com/software-project-management>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201023	SOFTWARE ARCHITECTURE AND DESIGN PATTERNS	3	-	-	-	3
Pre-Requisite	SOFTWARE ENGINEERING					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION:

The architectural pattern captures the design structures of various systems and elements of software so that they can be reused. During the process of writing software code, developers encounter similar problems multiple times within a project, within the company, and within their careers

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

- CO1.** Understand the architecture, creating it and moving from one to any, different structural patterns.
- CO2.** Analyze the architecture and build the system from the components
- CO3.** Design creational and structural patterns.
- CO4.** Learn about behavioral patterns.
- CO5.** Analyze the architectural structures.

CO-PO Mapping Table

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: **(09 Periods)**

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. Creating an Architecture: Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

Module 2: **(09 Periods)**

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

Module 3: **(09 Periods)**

Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. Creational patterns – Factory, Abstract Factory, Prototype and Singleton

Module 4: **(09 Periods)**

Structural patterns – Composite, Decorator, Adapter, Façade and Flyweight.

Module 5: **(09 Periods)**

Behavioral patterns- Chain of responsibility, Command, Interpreter, Mediator, State, Template and Observer.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Conduct an architectural evaluation of a software system you are familiar with, using the Architecture Tradeoff Analysis Method (ATAM) to assess its quality attributes. Identify at least two architectural decisions that significantly impact the system's performance and security. Propose alternative decisions and predict how they would alter the system's attributes. Summarize the lessons learned about balancing competing quality attributes through architectural design decisions.
2. Create a catalog of creational patterns for your organization or a hypothetical software development context. For each pattern, provide a description, when to use it, its benefits, and potential drawbacks. Present this catalog to peers or stakeholders and gather feedback on its usability and completeness. Reflect on the role of pattern catalogs in solving design problems and facilitating pattern selection and usage.

RESOURCES

TEXT BOOKS:

1. Len Bass, Paul Clements & Rick Kazman, Software Architecture in Practice, 2nd Edition, Pearson Education, 2003.
2. Erich Gamma, Design Patterns, 1st Edition, Pearson Education, 1995.

REFERENCE BOOKS:

1. Luke Hohmann , Beyond Software architecture, Addison wesley, 2003.
2. David M. Dikel, David Kane and James R. Wilson, Software architecture, 1st Edition, Prentice Hall, 2001

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=0DmE2uA1dOw>
2. <https://www.youtube.com/watch?v=ITkL1oIMiaU>
3. <https://www.udemy.com/course/software-architecture-learnit/>

WEB RESOURCES:

1. https://www.tutorialspoint.com/software_architecture_design/software_architecture_design_tutorial.pdf
2. <https://www.cs.toronto.edu/~sme/CSC340F/slides/21-architecture.pdf>
3. https://www.tutorialspoint.com/software_architecture_design/index.htm

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202020	SOFTWARE TESTING AND QUALITY ASSURANCE	3	-	2	-	4

Pre-Requisite Software Engineering

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Software Testing basics: Goals, Defects, Terminology, Methodology, Software Testing Life Cycle (STLC) in Software Development Life Cycle (SDLC), Verification and Validation; Software Testing Techniques: White box testing, Black Box Testing, Regression testing; Test Management: Test Planning, Design and Specifications; Test Automation: Tool selection and Guidelines, Software Quality Assurance.

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

- CO1.** Understand concepts of Software Testing, Terminology and Methodology, Test Management and Metrics to analyze Software testing and Software Quality Assurance concepts for maintain the quality of the software.
- CO2.** Analyze Testing Techniques, Regression Testing and Test Automation strategies to Synthesis the quality of software.
- CO3.** Analyze and apply the Software Quality Factors, Pre- rojectsoftware quality components.
- CO4.** Analyse test metrics and testing tools to measure the quality of software in real time applications.
- CO5.** WorkindependentlyorinteamstosolveproblemswitheffectiveCommunication.

CO-PO Mapping Table

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT:

Module 1: INTRODUCTION TO SOFTWARE TESTING (9 Periods)

Introduction, Evolution of Software Testing, Myths and Facts, Goals and Psychology of Testing, Definitions, Model for Software Testing, Terminology, Software Testing Life Cycle, Software Testing Methodology, Static vs Dynamic Testing.

Verification and Validation: Verification and Validation Activities, Verification of High-Level Design and Low-Level Design.

Module 2: TESTING TECHNIQUES (9 Periods)

White Box Testing

Need of white-box testing, Logic coverage criteria, basis path testing, Graph matrices, Loop testing, Data flow testing, Mutation testing.

Black Box Testing

Boundary Value Analysis (BVA), Equivalence class testing, State table-based testing, Decision table-based testing, Cause-effect graphing based testing, Error guessing.

Module 3: REGRESSION AND AUTOMATION (9 Periods)

Regression Testing: Progressive vs. regressive testing, Regression testing produces quality software, Regression testability, Objectives of regression testing, Regression testing types, Regression testing techniques.

Automation and Testing Tools: Need for automation, Categorization of testing tools, Selection of testing tools, Costs incurred in testing tools, Guidelines for automated testing.

Module 4: INTRODUCTION TO SOFTWARE QUALITY AND ASSURANCE (9 Periods)

Software Assurance: The software quality challenge, Software quality, Software quality factors Management and its role in software quality assurance.

Components of SQA: The components of the software quality assurance system.

Pre-project Software Quality Components: Contract review, Development and quality plans.

Module 5: TEST METRICS AND SOFTWARE QUALITY METRICS (9 Periods)

Test Metrics: Definition of Software Metrics, Classification of Software Metrics, Size Metrics.

Software Quality: Quality metrics, Cost of Quality.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Write the installation procedure of selenium and Java.
2. Develop
3. Design the test cases for testing the e-commerce application
4. Test the e-commerce application and report the defects in it.
5. Develop the test plan and design the test cases for an inventory control system.
6. Execute the test cases against a client server or desktop application and identify the defects.

7. Test the performance of the e-commerce application.
8. Automate the testing of e-commerce applications using Selenium.
9. Integrate TestNG with the above test automation.

Mini Project:

10.
 - a. Build a data-driven frame work using Selenium and TestNG
 - b. Build Page object Model using Selenium and TestNG
 - c. Build BDD frame work with Selenium, Test NG and Cucumber
11. Mini Project:

RESOURCES

TEXTBOOKS

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.
2. Naresh Chauhan, Software Testing: Principles and Practices, Oxford University Press, 2nd Edition, 2016.
3. M. G. Limaye, "Software Testing: Principles and Techniques and Tools," Tata McGraw –Hill Education, 1st Edition, 2012
4. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide"- Second Edition 2018

REFERENCES

1. Kshira sagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance-Theory and Practice," John Wiley and Sons, Inc., 2008, ISBN 978-0-471-78911-6
2. Fenton, Pfleeger, "Software Metrics: A Rigorous and practical Approach", Thomson Brooks/Cole, ISBN 981-240-385-X.
3. Boris Beizer, "Software Testing Techniques," Dream Tech Press, 2nd Edition, 2004.
4. William E. Perry, Effective Methods for Software Testing, WILEY, 3rd Edition
5. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs13/preview
2. <https://www.youtube.com/watch?v=LNSG-yssisA&t=1s>

WEB RESOURCES:

1. <https://www.coursera.org/courses?query=quality%20assurance>
2. <https://www.geeksforgeeks.org/software-testing-vs-quality-assurance/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201024	OPTIMIZATION TECHNIQUES	3	-	-	-	3

Pre-Requisite Computational Statistics

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction to optimization; classical optimization techniques; classification of optimization problems; linear programming; Transshipment and Travelling salesman problem; non-linear programming; un-constrained non-linear programming; constrained non-linear programming; dynamic programming; Genetic Algorithm; Ant Colony Optimization.

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

- CO1.** Model and solve unconstrained optimization problems.
- CO2.** Apply LP Techniques and Conduct Sensitivity analysis for real life Problems.
- CO3.** Apply Non-Linear Programming techniques for real life problems.
- CO4.** Analyze various complex problems by using Dynamic programming approaches.
- CO5.** Model and solve complex problems using evolutionary algorithms to optimize the parameters.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT:

Module 1: CLASSICAL OPTIMIZATION TECHNIQUES (09 periods)

Introduction, Engineering applications of optimization, Statement of an optimization problem, Design vector, Design constraints, Constraint surface, Objective function, Classification of optimization problems, Single variable optimization, Multi variable optimization without constraints, Multi variable optimization with equality constraints - Lagrange multipliers method; Multi variable optimization with inequality constraint - Kuhn Tucker conditions.

Module 2: LINEAR PROGRAMMING (09 periods)

Introduction, Formulation, Primal Simplex Analysis, Goal programming. method, Dual simplex method, Sensitivity

Module 3: NON-LINEAR PROGRAMMING (09 periods)

One dimensional minimization methods, classification - Fibonacci method, quadratic interpolation method; classification of unconstrained minimization methods - Powell's method, steepest descent method (Cauchy's method); classification of constrained optimization techniques - interior and exterior penalty function methods.

Module 4: DYNAMIC PROGRAMMING (09 periods)

Multistage decision processes, Concept of sub optimization and Principle of optimality, Computational procedure in dynamic programming - Calculus method, Tabular method; Linear Programming problem by dynamic programming approach, Applications - reliability problem, shortest path problem, and capital budgeting problem.

Module 5: EVOLUTIONARY OPTIMIZATION ALGORITHMS (09 periods)

Introduction to Evolutionary optimization, genetic algorithm-Mathematical Modeling of Genetic algorithm, Ant Colony Optimization, particle swarm Optimization and differential evolution techniques.

Total Periods:45

EXPERIENTIAL LEARNING:

- 1.Implement a genetic algorithm to optimize the layout and component selection for a small wind farm to maximize energy production under budget constraints.
- 2.Use particle swarm optimization (PSO) to design an optimal marketing campaign for a new product launch.

RESOURCES

TEXT BOOKS:

1. Singiresu S Rao, Engineering Optimization: Theory and Practice, New Age International, 3rd Edition, 2013.
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Engineering Optimization: Methods and applications, Wiley India Pvt. Ltd., 2nd Edition, 2006.
3. Dan Simon, Evolutionary Optimization Algorithms, John Wiley & Sons, 2013.

REFERENCE BOOKS:

1. C Mohan and Kusum Deep, Optimization Techniques, New Age International Publishers, 1st Edition, 2010.
2. Hamdy A. Taha, Introduction to Operations Research, PHI, 10th edition, 2017.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=84HOL_EiJ4M
2. <https://www.youtube.com/watch?v=IBXdFu6Rwn4>

WEB RESOURCES:

1. <https://www.geeksforgeeks.org/optimization-techniques-set-1-modulus/>
2. <https://books.askvenkat.org/optimization-techniques-pdf-free-download/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA203001	OBJECT ORIENTED MODELING AND DESIGN	3	-	-	4	4
Pre-Requisite	Software Engineering					
Anti-Requisite	-					
Co-Requisite	-					

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

CO1. Demonstrate knowledge on Things, principles of Object Oriented Development.

Analyze the specifications of Class, Use case, Activity, Sequence and State

CO2. diagrams and develop models using pre conditions and post conditions.

Design application artifacts to construct the Logical, Behavioral and

CO3. Architectural model of an Application.

CO4. Solve complex system behavior using common modeling techniques of things.

Make use of UML Tool such as Rational Rose or Visual Paradigm to design Class, Use Case, Sequence, Collaboration, Activity, State Chart, Component and

CO5. Deployment Diagrams for an application.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION TO UML (09 Periods)

The meaning of Object Orientation, object identity, Importance of modeling, principles of modeling, object-oriented modeling, An overview of UML, conceptual model of the UML, Architecture.

Classes – Terms and concepts, Common Modeling Techniques.

Relationships – Modeling simple dependencies, single Inheritance and structural relationships, Common Mechanisms and UML Diagrams.

Module 2: STRUCTURAL MODELING (09 Periods)

Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Instances.

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 3 BASIC BEHAVIORAL MODELING (09 Periods)

Use cases – Terms and Concepts, Common Modeling techniques.

Use case Diagrams – Terms and Concepts, Common Modeling Techniques.

Sequence Diagrams – Terms and Concepts, Modeling flows of control by time ordering; **Collaboration Diagrams** – Terms and Concepts, Modeling flows of control by Organization, Forward and Reverse Engineering.

Module 4 ADVANCED BEHAVIORAL MODELING (09 Periods)

Activity Diagrams – Terms and Concepts, Modeling a workflow, Modeling an operation, forward and reverse Engineering.

Events and Signals, State Machines, Processes and Threads, Time and Space, State Chart Diagrams – Modeling Reactive Objects.

Module 5 ARCHITECTURAL MODELING (09 Periods)

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, ATM CASE STUDY

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 System.
6. Draw the UML diagrams using Visual Paradigm for Library Management System.
7. Draw the UML diagrams using Visual Paradigm for Railway Reservation System.

RESOURCES

TEXT BOOK:

1. Grady Booch, James Ram Baugh and Ivar Jacobson, "The Unified Modeling Language User Guide," Pearson Education, 1999.

REFERENCE BOOKS:

1. John W. Satzinger, Robert B. Jackson and Stephen D. Burd, "Object-Oriented Analysis and Design with the Unified Process," Cengage Learning, 2004.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons and David Fado, "UML 2: Toolkit," Wiley India Pvt. Ltd., 2004.

VIDEO LECTURES:

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105153/

WEB RESOURCES

1. <https://courses.cs.washington.edu/courses/cse403/11sp/lectures/lecture08-uml1.pdf>
2. <https://www.uml-diagrams.org/index-examples.html>.

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202021	MOBILE APPLICATION DEVELOPMENT	3	-	2	-	4
Pre-Requisite	Object Oriented Programming through JAVA					
Anti-Requisite	-					
Co-Requisite	-					

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.** Demonstrate knowledge on mobile platforms, mobile user interface and user interface design requirements.
- CO2.** Understanding user interfaces widgets.
- CO3.** Construct mobile applications on the Android Platform using different layouts for playing video and audio.
- CO4.** Acquire the Information Using Dialogs and Fragments by the mobile applications for the Android operating system.
- CO5.** Develop mobile applications involving Menus and Action Bars.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT:

Module 1 : INTRODUCTION TO ANDROID (09 periods)

Android versions, Features and architecture, The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.

Module 2 : BASIC WIDGETS (09 periods)

The Role of Android Application Components, Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

Module 3 : BUILDING BLOCKS FOR ANDROID APPLICATION DESIGN (09 periods)

Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video

Module 4 : SELECTION WIDGETS AND FETCHING INFORMATION USING DIALOGS AND FRAGMENTS (09 periods)

Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control. Dialogs, Selecting the Date and Time in One Application, Fragments, Creating Special Fragments.

Module 5 : BUILDING MENUS (09 periods)

Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar.

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. B.M Harwani, Android Programming, Pearson Education.
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", 2nd edition, Pearson Education.

REFERENCE BOOKS:

1. Neils Smyth "Android Studio Development Essentials," Creative Space Independent publishing platform, Seventh edition 2016.
2. Paul Deitel and Harvey Deitel, "Android How to Program," Deitel associates publishers, First Edition, 2013.
3. James C Sheusi, Android application Development for Java Programmers, Cengage Learning.
4. W.Frank Ableson, Robi Sen, Chris King, C.Enrique Ortiz., Android In Action, Dreamtech.
5. Reto Meier, Professional Android 4 applications development, Wiley India.
6. Wei- Meng Lee, Beginning Android 4 applications development, Wiley India

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
25CA201025	USER EXPERIENCE/ INTERFACE DESIGN (UX/UI)	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: User experience (UX), usability and UI design.

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

- CO1.** Understand Importance and Characteristics of User interface design
- CO2.** Create User Interface Design process AND Business functions
- CO3.** Design System menus, navigation schemes
- CO4.** Demonstrate screen-based controls and device-based controls
- CO5.** Identify prototypes and test plans of user interface

CO-PO Mapping Table :

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: THE IMPORTANCE OF USER INTERFACE: (07 Periods)

Defining the User Interface, The Importance Of Good Design, The Benefits of Good Design, A Brief History of The Human-Computer Interface-Introduction of The Graphical User Interface, The Blossoming of The World Wide Web, A Brief History of Screen Design

CHARACTERISTICS OF GRAPHICAL AND WEB USER INTERFACES: The Graphical User Interface, The Web User Interface, Principles of User Interface Design.

Module 2: THE USER INTERFACE DESIGN PROCESS: (09 Periods)

Obstacles and Pitfalls in the Development Path, Usability, The Design Team.

KNOW YOUR USER OR CLIENT: Understanding How People Interact with Computer Important Human Characteristics in Design, Perception, Memory, Sensory Storage, Visual Acuity, Human Considerations in Design-The User's Knowledge and Experience.

Module 3: UNDERSTAND THE BUSINESS FUNCTION: (11 Periods)

Business Definition and Requirements Analysis, Determining Basic Business Functions, Design Standards or Style Guides, System Training and Documentation Needs.

Understand The Principles Of Good Screen Design Human Considerations In Screen Design, Interface Design Goals, Statistical Graphs

Module 4: DEVELOP SYSTEM MENUS AND NAVIGATION SCHEMES: (09 Periods)

Structures of Menu, Functions Of Menus, Formatting And Phrasing Of Menus, Navigating Menus, Kinds Of Graphical Menus, Window Characteristics, Components Of A Window, Types Of Windows, Window Operations, Web Systems.

Module 5: SELECTING THE PROPER DEVICE-BASED CONTROLS: (09 Periods)

Characteristics of Device-Based Controls, Presentation Controls, Write Clear Text and Messages, Provide Effective Feedback and Guidance and Assistance, Create Meaningful Graphics, Icons and Images.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Assume the role of a UI/UX designer tasked with revamping the user interface of an existing e-commerce website.
2. Create a timeline that traces the evolution of user interfaces from the introduction of the graphical user interface to the current state of web user interfaces.

RESOURCES

TEXT BOOKS:

- 1 The Essential Guide to User Interface Design, Second Edition, Wilbert O. Galitz, 2002.

REFERENCE BOOKS:

- 1 User Interface Design, A Software Engineering Perspective, Soren Lauesen.
- 2 User Interface Design and Evolution, Debbie Stone, Caroline Jarrett, Mark Woodroffe, ShaileyMinocha, 2005

VIDEO LECTURES:

- 1 <https://www.coursera.org/learn/UXdesign>
- 2 <https://www.edx.org/course/UX-design>
- 3 <https://www.udemy.com/course/UX>

WEB RESOURCES:

- 1 <https://www.coursera.org/articles/ui-vs-ux-design>
- 2 <https://www.simplilearn.com/how-to-become-ui-ux-designer-article>
- 3 <https://intellipaat.com/blog/ui-ux-design-tutorial/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201026	BLOCKCHAIN TECHNOLOGIES	3	-	-	-	3
Pre-Requisite	Computer Networks					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Distributed Systems, Blockchain, Types of blockchains, Decentralization, Bitcoin, Alternative Coins, Smart Contracts, Ethereum 101, Applications of Ethereum, Scalability Challenges in Privacy and Security, Current Landscape.

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

- CO1.** Understand the concepts of distributed Systems, decentralization and blockchain technology for the development of an application.
- CO2.** Select and use the Bitcoins, Smart Contracts and Ethereum 101 for the development of distributed systems and decentralized systems.
- CO3.** Analyze the issues and challenges of scalability, privacy and security in monetizing the businesses using blockchain technology.
- CO4.** Develop and deploy the applications using BlockApps, Eris platforms.
- CO5.** Commit to ethics and cyber regulations to perform encryption, multiparty computation, smart governance using Smart contract security.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: DISTRIBUTED SYSTEMS AND DECENTRALIZATION (10 Periods)

Distributed Systems: CAP Theorem, Byzantine Generals Problem, Consensus, History of blockchain, Generic Elements, Features, Applications, Tiers, Types of blockchain, CAP Theorem & blockchain, Benefits and limitations of blockchain.

Decentralization: Decentralization using blockchain, Methods of decentralization, Routes to Decentralization, blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications, Platforms for decentralization.

Module 2: DIGITAL CURRENCY (10 Periods)

Bitcoin: Concepts, Transactions, Blockchain, Bitcoin Payments.

Alternative Coins: Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash.

Module 3: SMART CONTRACTS AND ALTERNATIVE BLOCKCHAINS (08 Periods)

Smart Contracts: History, Ricardian contracts, Smart Contract Templates, Oracles, Smart Oracles, Deployment of Smart Contracts on Blockchains.

Alternative Blockchains: Kadena; Platforms: BlockApps, Eris

Module 4: ETHEREUM 101 (08 Periods)

Ethereum: Ethereum blockchain, Elements of Ethereum blockchain, Precompiled contracts, Accounts, Block, Ether, Messages, Mining, Clients and wallets, Ethereum network, Applications developed on Ethereum, Scalability and Security Issues.

Module 5: CHALLENGES AND CURRENT LANDSCAPE (09 Periods)

Scalability and Other Challenges: **Scalability:** Block size increase, Block internal reduction, Invertible Bloom lookup tables, Sharding, State channels, Private blockchain, Proof of Stake.

Privacy: Indistinguishability obfuscation, Homomorphic encryption, Zero knowledge proofs, State channels, Secure multiparty computation, Usage of hardware to provide confidentiality, Coinjoin, Confidential transactions, MumbleWimble;

Security: Smart contract security.

Current Landscape: Emerging Trends, Improvement proposals; Blockchain research: Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus Algorithms, Scalability, Code Obfuscation.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Use of blockchain technology in different sectors.
2. Application of blockchain technology in higher education.
3. Impact of blockchain technology on economy.

RESOURCES

TEXT BOOK:

1. Imran Bashir, "Mastering Blockchain," Packt Publishing Ltd., 2017

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach," VPT Books, 2017.
2. Josh Thompsons, "Blockchain: The Blockchain For Beginners Guide To Blockchain Technology and Leveraging Blockchain Programming," Create Space Independent Publishing Platform, 2017.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106105184/>
2. <https://medium.com/moatcoin/part-6-blockchain-simplified-notes-nptel-892f13875555>

WEB RESOURCES:

1. <http://www.hands-on-books-series.com/assets/Bahga-Madisetti-Blockchain-Book-Code.zip>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201027	REAL-TIME OPERATING SYSTEMS	3	-	-	-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

This course provides a detailed discussion and understanding real-time operating systems can allow you to Perform tasks within a guaranteed worst-case timeframe. Carefully prioritize different sections of your program. Run loops with nearly the same timing each iteration.

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

- CO1.** Ability to Describe real-time operating system requirements and design issues
- CO2.** Ability to Illustrate role of operating systems in memory and I/O devices Management
- CO3.** Ability to Apply concepts of inter-task communication and synchronization via shared memory, message queues, signals, semaphores
- CO4.** Ability to Examine challenges arising in design problems when developing embedded applications in multi-tasking systems
- CO5.** Ability to Develop programs using system proved timers, signals, mutual exclusion, semaphores, message queues and exception handlers

CO-PO Mapping Table

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION TO OPERATING SYSTEM

(09 Periods)

Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Operating System services, user OS Interface, System Calls, Types of System Calls, OS Structure

Module 2: OPERATING SYSTEM CONCEPTS

(09 Periods)

Process Concept, Process Scheduling, Operations on Processes, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues

Module 3: PROCESS SYNCHRONIZATION

(09 Periods)

Process Synchronization - The critical-section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Memory Management and Virtual Memory and File System Interface.

Module 4: REAL TIME OPERATING SYSTEM

(09 Periods)

Differences between General Purpose OS & RTOS, Real-time concepts, Hard Real time and Soft Real-time systems, Basic architecture of an RTOS, components in RTOS, kernel, objects, scheduler, Multitasking, context switch, Scheduling types, Task states, Task management.

Module 5: RTOS SERVICES

(09 Periods)

Overview- TCP/IP protocol- Stack- File system- Remote procedure calls- RTOS command shell Exceptions and Interrupts- Programmable interrupt controller-Priority scheme- Task and stack Interrupt nesting- Interrupt processing in two contexts.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Create a timeline project that traces the evolution of operating systems from simple batch systems to modern real-time and distributed systems.
2. Develop a small program that creates multiple threads to perform different tasks simultaneously, such as sorting arrays or generating Fibonacci sequences, to demonstrate the concept of multithreading.

RESOURCES

TEXT BOOKS:

1. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne 8th Edition, Wiley Student Edition
2. Real Time Concepts for Embedded Systems– QingLi, Elsevier, 2011

REFERENCE BOOKS:

1. Operating systems -Internal and Design Principles, W. Stallings, 6th Edition, Pearson
2. Embedded Systems- Architecture, Programming and Design by Raj kamal, 2007, TMH.

VIDEO LECTURES:

1. <https://www.digimat.in/nptel/courses/video/106105172/L13.html>
2. <https://www.coursera.org/lecture/real-time-systems/rtos-overview-RIAFe>

WEB RESOURCES:

1. <https://www.freertos.org/tutorial/index.html>
2. <https://embetronicx.com/tutorials/rtos/freertos/rtos-basic-tutorial-for-beginners/>
3. <https://www.javatpoint.com/real-time-operating-system>

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA201028	FULL STACK WEB DEVELOPMENT	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Hypertext markup language (HTML), Features of HTML5, Cascading style sheets (CSS), JavaScript, JQuery, Bootstrap, AJAX, Hypertext preprocessor (PHP), MySQL.

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

- CO1.** Demonstrate knowledge on web page design elements, dynamic content and database interaction.
- CO2.** Analyze user requirements to develop web applications.
- CO3.** Design client-server applications using web technologies.
- CO4.** Demonstrate problem solving skills to develop enterprise web applications.
- CO5.** Use HTML, CSS, JavaScript, JQuery, Bootstrap and PHP technologies for device independent web application development.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: HTML AND CSS (09 Periods)

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.

CSS3: 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.

Module 2: JAVASCRIPT AND JQUERY (10 Periods)

JavaScript: Overview of JavaScript, JavaScript functions, Events, Image maps and animations, JavaScript objects, Working with browser and document objects.

JQuery: Introduction, JQuery Selectors, Events, Methods to access HTML elements and attributes, Introduction to AJAX.

Module 3: BOOTSTRAP (09 Periods)

Getting started with Bootstrap, Creating responsive layouts using Bootstrap CSS - Basic HTML structure for Bootstrap, Responsive classes, Rendering images, The grid system, Constructing data entry forms, Packaged components in Bootstrap - The page header, Glyphicons, The navigation bar, Badges, Alerts, Toolbars and button groups.

Module 4: INTRODUCTION TO PHP (09 Periods)

Introduction, Data types, Variables, Constants, Expressions, String interpolation, Control structures, Functions, Arrays, Embedding PHP code in web pages, Object Oriented PHP.

Module 5: PHP WEB FORMS AND MYSQL (08 Periods)

PHP Web forms: PHP and web forms, Sending form data to a server, Working with cookies and session handlers.

PHP with MySQL: Interacting with the database, Prepared statement, Database transactions.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Explore Basic HTML Tags and Elements.
2. Familiarize with JS, and CSS, Animation using sample webpage
3. Design a Webpage using advance HTML Form tags input–date, time, number, email, HTML5 Header And Footer, spell check and editable areas.
4. Write a JavaScript/JQuery code to validate the following fields of the Registration web page.
 - a. First Name/Last Name - should contain only alphabets and the length should not be less than 8 characters.
 - b. Username - It should contain combination of alphabets, numbers and underscore. It should not allow spaces and special symbols.
 - c. Password - It should not less than 8 characters in length and it contains one uppercase letter and one special symbol.
 - d. Date of Birth - It should allow only valid date; otherwise display a message stating that entered date is invalid. Ex. 29 Feb. 2009 is an invalid date.
 - e. Postal Code: It must allow only 6 digit valid number.
 - f. Mobile No. - It should allow only numbers and total number of digits should be equal to 10.
 - g. e-mail id - It should allow the mail id with the following format: Ex. mailid@domainname.com
5. Design a web page with the following features using HTML5, JavaScript and JQuery
 - a. Displaying of images with Custom animated effects
 - b. Playing of selected video from the list of videos
 - c. Showing the animated text in increasing and decreasing font size
 - d. Changing the size of the area in a web page using DIV tag
 - e. Hiding and Showing elements in a web page.
6. Design a web page with the following features using Bootstrap and Media Query.
 - a. Components
 - b. Responsive tables
 - c. Responsive images and videos
 - d. Toolbars, Buttons and Lists
7.
 - a. Deploy and navigate web pages of online book store using WAMP/XAMPP web server.
 - b. Write a PHP program to read user name and favorite color from the HTML form. Display the name of the user in green color and sets user favorite color as a background for the web page.
8. Change a Content of webpage using AJAX. Perform Different Operations using JQUERY Selectors.
9. Write a PHP code to read user details entered through the registration web page and store the same into MySQL database.
10. Write a PHP code for storing books details like Name of the book, author, publisher, edition, price, etc into MySQL database. Embed a PHP code in catalogue page of the online book store to extract books details from the database.

RESOURCES

TEXT BOOKS:

1. Kogent Learning Solutions Inc, "HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery," Dreamtech Press, 2nd Edition, 2016.
2. W. Jason Gilmore, "Beginning PHP and MySQL, APress," 4th Edition, 2011.

REFERENCE BOOKS:

1. Snig Bahumik, "Bootstrap Essentials," PACKT Publishing, 1st Edition, 2015. (e-book).
2. Thomas A. Powell, "The Complete Reference: HTML and CSS," Tata McGraw Hill, 5th Edition, 2010.
3. Andrea Tarr, "PHP and MySQL," Willy India, 1st Edition, 2012.

SOFTWARE/TOOLS:

1. Editor: Notepad++
2. Programming Language: Javascript, JQuery, PHP

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=Q33KBiDriJY>
2. <https://www.coursera.org/learn/html-css-javascript-for-web-developers?=>
3. <https://www.edx.org/course/using-javascript-jquery-and-json-in-django>
4. <https://www.edx.org/course/building-web-applications-in-django>
5. <https://www.udemy.com/course/web-technology-for-entrepreneurs/>
6. <https://www.edx.org/course/html5-apps-and-games>
7. <https://www.classcentral.com/course/openhpi-web-technologies-3517>
8. <https://www.edx.org/course/css-basics>

WEB RESOURCES:

1. <https://www.w3schools.com/php/DEFAULT.asp>
2. <https://www.w3schools.com/js/>
3. <https://www.geeksforgeeks.org/web-technology/>
4. <https://www.smashingmagazine.com/2021/03/complete-guide-accessible-front-end-components/>
5. <https://css-tricks.com/>
6. <https://davidwalsh.name/css-optional>
7. <https://jquery.com/>

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202022	MERN STACK DEVELOPMENT	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on MERN Stack, Building a Webserver with ExpressJS, Building a Restful API, Building Web Applications with React, MongoDB, NodeJS and Managing state with Redux.

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

- CO1.** Demonstrate knowledge on fundamentals of MongoDB and NodeJS.
- CO2.** Build web server using ExpressJS to configure and customize web applications.
- CO3.** Apply Restful API with ExpressJS and Mongoose.
- CO4.** Apply React to design enterprise web applications.
- CO5.** Develop web applications through MERN stack and Redux store as per societal needs.

CO-PO Mapping Table:

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

Correlation Level: **3- High** **2-Medium** **1-Low**

COURSE CONTENT

Module 1: MERN STACK

(08 Periods)

Introduction to MERN STACK, The Model View Controller (MVC) architectural pattern, Installing and configuring MongoDB, Installing Node.js and Installing npm packages.

Module 2: BUILDING A WEB SERVER WITH EXPRESSJS

(09 Periods)

Routing in ExpressJS, Modular route handlers, Writing middleware functions, Writing configurable middleware functions, Writing router-level middleware functions, Writing error- handler middleware functions, Using ExpressJS' built-in middleware function for serving static as sets, Parsing the HTTP request body, Compressing HTTP responses, Using an HTTP request logger.

Module 3: BUILDING A RESTFUL API

(09 Periods)

CRUD operations using ExpressJS' route methods, CRUD operations with Mongoose, Using Mongoose query builders, Defining document instance methods, Defining static model methods, Writing middleware functions for Mongoose, Writing custom validators for Mongoose's schemas, Building a RESTful API to manage users with ExpressJS and Mongoose.

Module 4: BUILDING WEB APPLICATIONS WITH REACT

(10 Periods)

Understanding React elements and React components, Stateful components and life cycle methods, Working with React.PureComponent, React event handlers, Conditional rendering of components, Rendering lists with React, Understanding refs and how to use them, Understanding React portals, Catching errors with error boundary components..

Module 5: MANAGING STATE WITH REDUX

(09 Periods)

Defining actions and action creators, Defining reducer functions, Creating a Redux store, Binding action creators to the dispatch method, Splitting and combining reducers, Writing Redux store enhancers, Time traveling with Redux, Understanding Redux middleware, Dealing with asynchronous data flow.

Total Periods: 45

EXPERIENTIAL LEARNING

Front-end Web Application Library

1. Installing Node.js framework and configuring Visual Studio (VS) Code Integrated Development Environment (IDE), and its dependencies.
2. Create and Run —Hello World! Application in VS Code.
3. Build two mini applications using Router that will be served in two different sub-domains virtual domains through ExpressJS and Virtual domains.
4. Develop the code for Securing an ExpressJS web application with Helmet.
5. Create a React application that includes simple functional components.
6. Create a React application that includes simple class components.
7. Develop a React application to insert and access props (properties) and state of components.
8. Create a React application to demonstrate event handling.
9. Develop a React application for list rendering.
10. Implement a React application for form handling.

Hosting Web Applications

1. Choosing a hosting server and selecting a plan for web hosting.
2. Choosing and configuring DNS address.
3. Uploading, configuring and running the website over the internet.

RESOURCES

TEXT BOOKS:

1. Eddy Wilson IriarteKoroliova, MERN Quick Start Guide: Build Web Applications with MongoDB, Express.js, React, and Node, Packt, May 2018.
2. Greg Lim, BeginningMERN Stack Development, First Edition, June 2021.

REFERENCE BOOKS:

1. Brad Dayley, Node.js, MongoDB and Angular Web Development, Pearson, 2nd Edition, 2017.
2. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, Dreamtech Press, Second Edition, 2016.

SOFTWARE/TOOLS:

1. Software: Node.js, MongoDB and Visual Studio Code; Express and React modules.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=E-GA9GKJWuE>
2. <https://www.youtube.com/watch?v=Oe421EPjeBE>
3. <https://www.youtube.com/watch?v=KNZZZ3pbqco>
4. <https://www.youtube.com/watch?v=bbkBuqC1rU4>

WEB RESOURCES:

1. Node.js Tutorial - <https://www.w3schools.com/nodejs/>
2. Express.js Tutorial - <https://www.javatpoint.com/expressjs-tutorial>
3. MongoDB Tutorial - <https://www.tutorialspoint.com/mongodb/index.htm>
4. Learn ReactJS Tutorial - <https://www.javatpoint.com/reactjs-tutorial>
5. Redux Tutorial - <https://www.tutorialspoint.com/redux/index.htm>

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202023	GO JAVA FULL STACK WITH SPRING BOOT AND REACT	3	-	2	-	4

Pre-Requisite Full Stack Web Development

Anti-Requisite -

Co-Requisite -

COURSEDESCRIPTION: Basics of Go programming language, Introduction to RESTful architecture, Java and Spring Boot, Building Backend with Spring Boot, Introduction to React.

COURSEOUTCOMES: After successful completion of this course ,the student will be able to:

- CO1.** Understand Go Programming Language Concepts.
- CO2.** Describe Restful application program interface with Go.
- CO3.** Apply OOP concepts and spring boot framework.
- CO4.** Create backend with spring boot.
- CO5.** Understand React library and its concepts.

CO-PO Mapping Table:

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

Correlation Level: **3- High 2-Medium 1-Low**

COURSE CONTENT:

Module 1 : INTRODUCTION TO GO

(09 periods)

Basics of Go programming language, Variables, data types, and control flow in Go, Functions, packages, and error handling in Go, Debugging in Go, Structs, interfaces.

Module 2 : BUILDING RESTFUL APIS WITH GO

(09 periods)

Introduction to RESTful architecture, Setting up a basic Go web server, Handling HTTP requests and responses in Go, CRUD operations with database integration (e.g., PostgreSQL, MySQL) using a Go database driver, Authentication and authorization with JWT (JSON Web Tokens)

Module 3 : INTRODUCTION TO JAVA AND SPRING BOOT

(09 periods)

Introduction to Java programming language, Variables, data types, and control flow in Java, Object-oriented programming (OOP) concepts in Java, Introduction to Spring Boot framework and its features Building RESTful APIs using Spring Boot and Spring Web

Module 4 : BUILDING BACKEND WITH SPRING BOOT

(09 periods)

Setting up a Spring Boot project, Defining data models with JPA (Java Persistence API) and Hibernate, Design Principles, Implementing CRUD operations with Spring Data JPA, JUnit, Securing APIs with Spring Security, Testing and debugging Spring Boot applications.

Module 5 : INTRODUCTION TO REACT

(09 periods)

Introduction to React library and its concepts (components, state, props), Setting up a React project using create-react-app, Building reusable components in React, Handling state management with React hooks, Working with React Router for client-side routing

Total Periods:45

EXPERIENTIAL LEARNING:

- I. Go Lab Programs:
 1. Setting up the Go development environment
 2. Writing a basic Go program with variables, functions, and control flow
 3. Building a command-line application in Go
 4. Creating and using Go packages
 5. Working with JSON data in Go
- II. Java with Spring Boot Lab Programs:
 1. Setting up the Java development environment
 2. Creating a basic Java program with variables, functions, and control flow
 3. Building a simple Java application using object-oriented programming (OOP) concepts
 4. Implementing CRUD operations with Spring Boot and Spring Data JPA
- III. React Lab Programs:
 1. Setting up the React development environment
 2. Creating a basic React application with components and state management
 3. Building a form-based application in React

RESOURCES

TEXTBOOKS:

1. Alan A. A. Donovan and Brian W. Kernighan, "The Go Programming Language", Addison-Wesley.
2. Craig Walls, "Spring Boot in Action", Manning Publications.
3. "Learning React: Modern Patterns for Developing React Apps" by Alex Banks and Eve Porcello.

REFERENCEBOOKS:

1. "Go in Action", William Kennedy with Brian Ketelsen and Erik St. Martin, Manning Publications.
2. Learning Spring Boot 2.0 - Second Edition: by Greg L. Turnquist.

VIDEO Lectures:

1. <https://www.youtube.com/watch?v=dP4goCkKxlw&list=PLGRDMO4rOGcNLnW1L2vgsExTBg-VPoZHr>

WEBRESOURCES:

1. Go: <https://golang.org/doc/ss>
2. Java (Spring Boot): <https://spring.io/projects/spring-boot#learn>
3. React: <https://reactjs.org/docs/getting-started.html>

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202024	FULL STACK CLOUD DEVELOPER	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

Introduction to Full Stack Development, Web Development Fundamentals, Back-End Development, Cloud Computing Basics, Cloud Infrastructure and Front-End Frameworks, Security, Performance Optimization and Scalability

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

CO1. Understand full stack development, Role of a full stack developer.

CO2. Describe Database design and cloud computing platforms.

CO3. Understand Cloud Infrastructure and Services.

CO4. Create Back-End Frameworks and Tools.

CO5. Understand Security, Performance Optimization and Scalability.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT:

Module 1 : INTRODUCTION TO FULL DEVELOPMENT STACK AND WEB (09periods)

Introduction to Full Stack Development: Overview of full stack development, Role of a full stack developer, Understanding the cloud computing paradigm.

Web Development Fundamentals:HTML5, CSS3, and JavaScript, Introduction to front-end frameworks (e.g., React, Angular, or Vue.js), Responsive web design and mobile development

Module 2 : BACK-END DEVELOPMENT AND CLOUD COMPUTING BASICS (09 periods)

Back-End Development: Introduction to server-side programming languages (e.g., Python, Node.js, or Ruby), Database design and management (e.g., SQL, NoSQL), RESTful API development, Authentication and authorization mechanisms Cloud Computing Basics: Introduction to cloud computing platforms (e.g., AWS, Azure, or Google Cloud), Virtualization and containerization (e.g., Docker, Kubernetes), Deployment and scaling strategies

Module 3 : CLOUD INFRASTRUCTURE FRAMEWORKS AND FRONT-END (09periods)

Cloud Infrastructure and Services: Cloud storage and file systems, Serverless computing (e.g., AWS Lambda, Azure Functions), Message queues and event-driven architectures, Load balancing and auto-scaling.

Front-End Frameworks and Tools: Advanced front-end frameworks (e.g., React, Angular, or Vue.js) Build tools (e.g., Webpack, Gulp), Package managers (e.g., npm, Yarn)

Module 4 : BACKEND TOOLS AND DATABASE (09periods)

Back-End Frameworks and Tools: Popular server-side frameworks (e.g., Express.js, Django, or Ruby on Rails), Testing frameworks (e.g., Jest, Mocha), Logging and monitoring tools Database and Data Storage: Relational databases (e.g., MySQL, PostgreSQL), NoSQL databases (e.g., MongoDB, Cassandra), Data Modeling.

Frameworks and Tools: Popular server-side frameworks (e.g., Express.js, Django, or Ruby on Rails), Testing frameworks (e.g., Jest, Mocha), Logging and monitoring tools

Database and Data Storage: Relational databases (e.g., MySQL, PostgreSQL), NoSQL databases (e.g., MongoDB, Cassandra).

Module 5 : PERFORMANCE OPTIMIZATION SECURITY AND SCALABILITY (09periods)

Security and DevOps: Web application security best practices, Continuous integration and deployment (CI/CD), Infrastructure as code (IaC) using tools like Terraform or CloudFormation, Monitoring .

Performance Optimization and Scalability: Caching strategies (e.g., Redis, Memcached) Performance profiling and optimization, Horizontal and vertical scaling techniques.

Total Periods:45

EXPERIENTIAL LEARNING:

1. Build a Full Stack Web Application: Create a web application using a front-end framework like React, Angular, or Vue.js, and a back-end framework like Node.js Django, or Ruby on Rails. Deploy your application to a cloud platform like AWS, Azure, or Google Cloud.
2. Implement User Authentication and Authorization: Add user authentication and authorization functionality to your web application. Use technologies like JSON Web Tokens (JWT) or OAuth to authenticate and authorize users. Store user information securely in a database.
3. Develop a RESTful API: Create a RESTful API using a back-end framework of your choice. Define endpoints for performing CRUD (Create, Read, Update, Delete) operations on a database. Test the API using tools like Postman or Insomnia.
4. Implement Serverless Functions: Use a serverless computing platform like AWS Lambda or Azure Functions to develop and deploy serverless functions. Create functions that perform specific tasks, such as image processing or data transformation.
5. Build a Real-time Chat Application: Create a real-time chat application using technologies like Socket.io or Firebase Realtime Database. Enable users to send and receive messages instantly and see real-time updates.
6. Deploy and Manage Containers: Use containerization technologies like Docker and container orchestration tools like Kubernetes to deploy and manage your application in a containerized environment. Explore concepts like scaling, load balancing, and service discovery.
7. Integrate with Cloud Services: Utilize cloud services like AWS S3 for file storage, AWS SES for email sending, or Google Cloud Vision API for image recognition. Integrate these services into your application to add additional functionality.
8. Implement Continuous Integration and Deployment (CI/CD): Set up a CI/CD pipeline using tools like Jenkins, CircleCI, or GitLab CI/CD. Automate the build, test, and deployment processes for your application.
9. Monitor and Analyze Application Performance: Use monitoring and logging tools like AWS CloudWatch, Azure Monitor, or ELK Stack to track the performance and availability of your application. Set up alerts and visualize metrics to gain insights into your application's behavior.
10. Secure Your Application: Implement security best practices in your application. Protect against common vulnerabilities like cross-site scripting (XSS) and SQL injection. Explore techniques like encryption, secure communication (HTTPS), and user input validation.
11. Develop a RESTful API: Create a RESTful API using a back-end framework of your choice. Define endpoints for performing CRUD (Create, Read, Update, Delete) operations on a database. Test the API using tools like Postman or Insomnia.
12. Implement Serverless Functions: Use a serverless computing platform like AWS Lambda or Azure Functions to develop and deploy serverless functions. Create functions that perform specific tasks, such as image processing or data transformation.

RESOURCES

TEXT BOOKS:

1. "Full Stack Development with JHipster" by Deepu K Sasidharan and Sendil Kumar N
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011

REFERENCE BOOKS:

1. "Full Stack Development with React and Node: Modern Web Development with Universal React" by Tomasz Dyl and Adam Boduch.
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010

ADDITIONAL LEARNING RESOURCES:

1. MDN Web Docs: The MDN (Mozilla Developer Network) Web Docs is an excellent resource for learning web development fundamentals, including HTML, CSS, and JavaScript. It offers comprehensive documentation, tutorials, and guides: <https://developer.mozilla.org/>
2. W3Schools: W3Schools is a popular online learning platform that provides tutorials and references for web development technologies. It covers HTML, CSS, JavaScript, and various frameworks like React, Angular, and Vue.js: <https://www.w3schools.com/>
3. Stack Overflow: Stack Overflow is a community-driven question and answer platform that covers a wide range of programming topics, including full stack development. It can be a valuable resource for troubleshooting and finding solutions to specific development challenges: <https://stackoverflow.com/>
4. AWS Documentation: If you're interested in cloud development with Amazon Web Services (AWS), their official documentation is an invaluable resource. It provides detailed information, tutorials, and guides on various AWS services and features: <https://docs.aws.amazon.com/>
5. Microsoft Azure Documentation: Microsoft Azure offers comprehensive documentation for developers looking to work with their cloud platform. It covers various Azure services, deployment options, and development tools: <https://docs.microsoft.com/azure/>

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=Ow_q1qR9jTw
2. https://www.youtube.com/watch?v=_wiFwn-H39Y

WEB RESOURCES:

1. <https://www.executivelevels.com/full-stack-developer-vs-cloud-computing-full-comparison/>
2. https://www.bing.com/search?q=full+stack+cloud+developer&cvid=82c58938f8174bf6affdccc6735b2e56c&gs_lcrp=EgZjaHJvbWUqBggCEAAyQDIGCAAQRRg5MgYIARAAGEAyBggCEAAyQDIGCAMQABhAMgYIBBAAGEAyBggFEAAyQDIGCAYQABhAMgYIBxAAGEAyBggIEAAyQNIBCDY0MzZqMGo0qAIIsAIB&FORM=ANAB01&PC=U531

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202025	DEVOPS	3	-	2	-	4

Pre-Requisite Software Engineering

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Introduces the methodologies, tools, and insights of the DevOps process and what it can do for an organization. The course covers development, deployment and operations including infrastructure as code, continuous deployment, testing automation, validation, monitoring and security.

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

- CO1.** Understand different actions performed through Version control tools like Git.
- CO2.** Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven& Gradle.
- CO3.** To Perform Automated Continuous Deployment
- CO4.** To do configuration management using Ansible
- CO5.** Understand to leverage Cloud-based DevOps tools using Azure DevOps

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION TO DEVOPS (09 Periods)

Devops Essentials-Introduction To AWS, GCP, Azure-Version control systems: Git and Git hub.

Module 2: COMPILE AND BUILD USING MAVEN & GRADLE (09 Periods)

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile, build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle.

Module 3: CONTINUOUS INTEGRATION USING JENKINS (09 Periods)

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used Plugins (GitPlugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

Module 4: CONFIGURATION MANAGEMENT USING ANSIBLE (09 Periods)

Ansible Introduction, Installation, Ansible master /slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible play books, Ansible Roles, adhoc commands in ansible.

Module 5: BUILDING DEVOPS PIPELINES USING AZURE (09 Periods)

Create Git hub Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure- pipeline. yaml file

Total Periods: 45

EXPERIENTIAL LEARNING

- Create Maven Build pipeline in Azure
- Run regression tests using Maven Build pipeline in Azure
- Install Jenkins in Cloud
- Create CI pipeline using Jenkins
- Create a CD pipeline in Jenkins and deploy in Cloud
- Create an Ansible play book for a simple web application infrastructure
- Build a simple application using Gradle

RESOURCES

TEXT BOOKS:

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in EasyStep-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCE BOOKS:

1. Hands-On Azure DevOps: Cidc Implementation For Mobile, Hybrid, And Web Applications Using Azure DevOps And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.

SOFTWARE/TOOLS:

GitHub, VMware Workstation, VMware Fusion, or Oracle's VirtualBox software should meet the following specifications:

1. **CPU Capabilities** – A dual core 64 bit CPU, with four threads (Intel hyper-threading) is required. An Intel i5 or i7 type chip or the AMD equivalent is recommended.
2. **Computer Memory** – 8 GB of RAM required, 16 GB or more recommended.
3. **Disk** – 500 GB of disk space for your coursework is required. A Solid-state disk is recommended.

VIDEO LECTURES:

1. https://www.classcentral.com/course/youtube-devops-for-beginners-full-course-learn-aws-devops-now-93389?utm_source
2. https://www.mindluster.com/lesson/109381-video?utm_source

WEB RESOURCES:

1. DevOps Tutorial For Beginners | DevOps Tutorial
2. https://github.com/Azure-full-course/realworld-cicd-pipeline-project-gradle?utm_source
3. https://opensource.microsoft.com/blog/2018/09/24/tutorial-devops-on-azure-using-jenkins-and-ansible/?utm_source

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202026	RESPONSIVE WEBSITE DEVELOPMENT AND DESIGN	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

Scripting language's flexibility has allowed developers to create innovative software. Most engineering students were required to learn the scripting languages to promote their study and complex problem solving in order to keep up-to - date with the competition.

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

- CO1.** Ability to differentiate web and website and summarize the importance of web languages in the development of website.
- CO2.** Apply JavaScript, HTML and CSS3 effectively to create interactive and dynamic websites
- CO3.** Ability to build web applications using PHP and submit the form using GET or POST method.
- CO4.** Create layout in websites using Div tags and incorporate pre-designed elements into them.
- CO5.** Ability to develop server side code using PHP and able to connect and manipulate the MySQL database.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION TO WWW (09 Periods)

Introduction to Network, Internet and Intranet, Application and Services, Internet Addressing – IP, DNS, URL. Elements of Web – Web Page, Web Site, Web Client & Server. Web Languages – HTML/DHTML, JavaScript, PHP, XML.

Module 2: BUILDING WEB BASED APPLICATION USING HTML (09 Periods)

Html Document Structure, Various HTML Tags – Document Tag, Text Formatting Tag, Link Tag, List Tag, Image Tag, Table Tag, Line Breaks, Frame, Frameset, HTML Forms.

Module 3: CASCADING STYLE SHEET (09 Periods)

Introduction to Style sheet, Types of Style sheet, concept of class & ID, Different CSS Property-
.Background Property- Font property- Text -DimensionsCombinators- Borders-Margins-Padding- Box Model.

Module 4: CLIENT-SIDE SCRIPTING LANGUAGE (09 Periods)

Concept and types of Scripting language, Introduction to Java script, How to develop Java script, Operators, Conditional Structure & Looping Structure, Dialog Boxes, Arrays, User Define Function, Java script Function keyword, Constructor, Self Invoking Functions, Built-in Functions (String, Math, Date, Array), Built-in Object (window, screen ,location, history, Navigator),DOM, Forms, Objects and its events.

Module 5: PHP COMPONENTS (09 Periods)

Introduction to PHP, Basic PHP syntax: PHP tags, PHP statements and whitespace, comments, Operators, Conditional and Looping Structure, User Define Functions, Arrays. GET and POST Methods. GD Library, Cookies,Server Variables, Database Connectivity with MySQL, PHP My Admin, Regular Expression, PHP with OOP (Class, constructor, inheritance), PHP with AJAX – Introduction-Sending Email using PHP.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Design the static web page using frames, links and tables for any application.
2. Creation of HTML pages using ordered list, unordered list , definition list and hotspots
3. Create webpage to embed audio and video
4. Usage of internal and external CSS along with HTML pages
5. Develop web pages using Background property, Font property, Dimensions, Box model, Combinators and Borders in CSS
6. Developing online applications such as shopping, railway/air/bus, education using HTML, CSS, Java script and PHP
7. Develop programs using control structures and arrays in PHP
8. Any online application using PHP and submit the form using GET or POST method.

RESOURCES

TEXT BOOKS:

1. Developing Web Application, Wiley India Publication, Ralph Moseley, Wiley India, 2007.

REFERENCE BOOKS:

1. Beginning PHP5, Apache, Mysql Web Development, Wrox, Elizabeth Naramore, Michael K. Glass, 2005.
2. PHP Bible, Wiley Publication, Tim Converse, Joyce Park, 2002.
3. Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script, BPB Publications, Ivan Bayross, 2005.
4. Beginning Ajax, Wrox, Chris Ullman, Lucinda Dykes, 2007.

SOFTWARE/TOOLS:

1. <https://getbootstrap.com/>
2. <https://codepen.io/>

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=zAfLvFHKUS0>
2. <https://www.youtube.com/watch?v=EqzUcMzfV1w>
3. <https://www.youtube.com/watch?v=3JluqTojuME>

WEB RESOURCES:

1. <https://careerfoundry.com/en/tutorials/web-development-for-beginners/introduction-to-web-development/>
2. <https://www.w3schools.com/whatis/>
3. <https://www.edureka.co/blog/web-development-tutorial/>

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA204003	MODERN APPLICATION DEVELOPMENT WITH NODE.JS ON AWS	2	-	2	4	4

Pre-Requisite: Cloud Computing

Anti-Requisite:

Co-Requisite:

COURSE DESCRIPTION: This Course provides a detailed discussion on Application Programming Interfaces(APIs), AWS SDK Exploration, AWS Toolkit, Amazon API Gateway authentication and authorization mechanisms, Amazon Cognito, Serverless Computing, AWS Lambda, creating a lambda function using AWS CLI, AWS Step Functions, Step Functions API exploration, Step Function Service Integrations, Call back patterns, Standard vs Express Step functions, Observability, Amazon X-Ray, API Gateway and Lambda Using the AWS X-Ray SDK with (Node), API Gateway and Lambda Logs, Amazon Cloud Watch Logs integration with API Gateway.

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

- CO1.** Understand the concepts of Application Programming Interfaces (APIs) and Amazon Web Services Command Line Interface (CLI).
- CO2.** Analyze the Amazon API Gateway terminology for authentication and authorization of various resources and Amazon Cognito to sign in and call the APIs.
- CO3.** Design and develop applications using AWS Lambda permissions and functions using AWS Toolkit.
- CO4.** Create serverless workflows using Step functions for the integration and call back patterns.
- CO5.** Adhere to ethics and adapt observability using X-Ray and Configuring Cloud Watch Logs in API Gateway.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: APPLICATION PROGRAMMING INTERFACES (APIs) (07 Periods)

Architecting for the Cloud What we are building? AWS Cloud9, AWS Command Line Interface (CLI) and Application Programming Interfaces (APIs), APIs AWS CLI, AWS SDK Exploration (Node), AWS Credentials in Cloud9, Introduction to the Serverless Application Model (SAM), AWS Toolkit for (Cloud9/IntelliJ/PyCharm).

Module 2: AMAZON API GATEWAY TERMINOLOGY (06 Periods)

API Driven Design, API driven development, what is Amazon API Gateway? Amazon API Gateway terminology, Section Readings, Models and Mapping, Creating an API with Mock integration, Using Mappings, Using Models, Section Readings, Publish API, Using Postman to create requests, API Authentication, Amazon API Gateway authentication, Amazon API Gateway access controls, Amazon API Gateway authentication and authorization mechanisms, Amazon Cognito, Amazon Cognito, Using Amazon Cognito to sign in and call Amazon API Gateway.

Module 3: AWS LAMBDA (06 Periods)

Serverless Computing and AWS Lambda, AWS Lambda Execution, AWS Lambda permissions, Section Readings, Triggers, Push, Pull model. AWS Lambda execution context and reuse, AWS Lambda Compliance, Asynchronous vs Synchronous Responses, Versions and Aliases, creating a lambda function using the AWS CLI, Creating and Debugging an AWS Lambda Function using the AWS Toolkit.

Module 4: AWS STEP FUNCTIONS (06 Periods)

Orchestration, Creating a serverless workflow, AWS Step Functions, Step Functions API exploration, Step Function State types, Step Function Service Integrations, Amazon API Gateway and Step function Integration, Call back patterns, Step Function Activities, Standard vs Express Step functions.

Module 5: OBSERVABILITY AND API GATEWAY (05 Periods)

Observability, Amazon X-Ray, API Gateway and Lambda, Using the AWS X-Ray SDK with (Node), API Gateway and Lambda Logs, Amazon Cloud Watch Logs integration with API Gateway, Step Functions and Lambda Configuring, Cloud Watch Logs in API Gateway

Total Periods: 30

EXPERIENTIAL LEARNING

1. Setting Up and Exploring the SDK
2. Amazon API Gateway
3. Amazon Cognito Authentication
4. Create a static website in Amazon S3
5. API
6. AWS Lambda Functions
7. AWS Step Functions
8. Optimizing an Application

RESOURCES

TEXT BOOKS:

1. Nader Dabit "Full Stack Serverless: Modern Application Development with React, AWS, and GraphQL", 1st Edition, O'Reilly Publications, November 2020.

REFERENCE BOOKS:

1. Saurabh Shrivastava, Neelanjali Srivastav and Artasanchez "AWS for Solutions Architects: The definitive guide to AWS Solutions Architecture for migrating to, building, scaling, and succeeding in the cloud," 2nd Edition, Packt Publishing Limited, April 2023.

SOFTWARE/TOOLS:

1. Cloud9 Toolkit
2. SDK

VIDEO LECTURES:

1. <https://youtu.be/9PfCvI6xIOE>
2. <https://youtu.be/iFMLyMgCUTs>
3. <https://youtu.be/clSWroo2snY>

WEB RESOURCES:

1. https://docs.aws.amazon.com/ec2/index.html?nc2=h_ql_doc_ec2
2. <https://docs.aws.amazon.com/AWSEC2/latest/APIReference/Welcome.html>

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202027	EXTREME WEB DEVELOPMENT	3	-	2	-	4
Pre-Requisite	Web Technologies					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Introduction to Basics of Web and Mobile application development, Responsive Web design, Native Web App, Basics of React Native, Native Components, JSX, State, Props, Cross-platform App, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability.

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

CO1. Develop Native applications with GUI Components.

CO2. Develop hybrid applications with basic event handling.

CO3. Implement cross-platform applications with location and data storage capabilities.

CO4. Implement cross platform applications with basic GUI and event handling.

CO5. Develop web applications with cloud database access.

CO-PO Mapping Table

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT (9 periods)

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design

Module 2: NATIVE APP DEVELOPMENT USING JAVA (9 periods)

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX.

Module 3: HYBRID APP DEVELOPMENT (9 periods)

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

Module 4: CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE (9 periods)

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX.

Module 5: NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS (9 periods)

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Using react native, build a cross platform application for a BMI calculator.
2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)
4. Design and develop a cross platform application for day to day task (to-do) management.
5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
6. Design and develop an android application using Apache Cordova to find and display the current location of the user.
7. Write programs using Java to create Android application having Databases. For a simple library application. For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

RESOURCES

TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing

REFERENCES

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2. Native Mobile Development by Shaun Lewis, Mike Dunn
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras
4. Apache Cordova 4 Programming, John M Wargo, 2015 5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=JNz_aWGhAtM&list=PLpLBSl8eY8jRx0Tdqia7o3LG MewswU5XP
2. https://www.youtube.com/watch?v=l1EssrLxt7E&list=PLfqMhTWNBT3H6c9OGXb5_6wcc1M ca52n

WEB RESOURCES:

1. <https://www.udemy.com/course/the-extreme-web-development-course/>

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA202028	ENTERPRISE APP & API DEVELOPMENT WITH ANGULARJS AND SAILS	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Angular JS, Single-Page Application (SPA), AJAX requests and RESTful APIs in AngularJS, Sails JS, Restful APIs, Configuration and Integration of Angular Js and Sails.Js, Testing frameworks and methodologies, Continuous integration and deployment strategies, Performance optimization techniques, Internationalization and localization, third- party libraries and plugins in the apps.

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

- CO1.** Understand the concepts of Angular JS and Sails JS for building applications and APIs.
- CO2.** Analyze the specifications of SPAs, routing and navigation, data binding for handling AJAX requests and RESTful APIs in Angular JS and Sails JS.
- CO3.** Design applications and APIs by configuring and integrating Angular JS and Sails JS.
- CO4.** Solve complex problems by practicing testing frameworks, continuous integration and deployment strategies.
- CO5.** Make use of custom directives, performance optimization techniques, third-party libraries and plugins in the development of applications and APIs.

CO-PO Mapping Table:

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

Correlation Level:

3- High

2-Medium

1-Low

COURSE CONTENT

Module 1: INTRODUCTION TO ANGULAR JS AND BUILDING A SINGLE-PAGE APPLICATION (SPA) WITH ANGULAR JS (09 Periods)

Introduction to AngularJS: Angular JS and its features, Setting up an Angular JS development environment, Angular JS expressions, directives, and modules, Controllers and scopes in Angular JS, Services and dependency injection in Angular JS.

Building a Single-Page Application (SPA) With Angular JS: Introduction to Single-Page Applications (SPAs), AngularJS routing and navigation, Templating and data binding in AngularJS, Working with forms and form validation in AngularJS, Handling AJAX requests and RESTful APIs in AngularJS

Module 2: INTRODUCTION TO SAILS JS AND BUILDING RESTFUL API s WITH SAILS JS (09 Periods)

Introduction to Sails JS : Sails.js and its features, Setting up a Sails.js development environment, Sails.js project structure and configuration, Defining models, controllers, and routes in Sails.js, Handling database operations with Sails.js using Waterline ORM.

Building Restful APIs with Sails JS:

RESTful API design principles, Creating RESTful routes in Sails.js, Implementing CRUD operations with Sails.js, Authentication and authorization in Sails.js, Error handling and validation in Sails.js.

Module 3: INTEGRATING ANGULAR JS AND SAILS.JS (09 Periods)

Configuration and Integration of Angular Js and Sails.Js: Setting up AngularJS and Sails.js integration, Consuming Sails.js APIs from AngularJS, Authentication and session management in the integrated app, Real-time communication with WebSockets in Sails.js and AngularJS, Optimizing performance and handling security in the integrated app.

Module 4: TESTING AND DEPLOYMENT (09 Periods)

Testing And Deployment: Testing frameworks and methodologies, Unit testing AngularJS components with Karma and Jasmine, End-to-end testing with Protractor, Continuous integration and deployment strategies, Best practices for deploying AngularJS and Sails.js apps.

Module 5: ADVANCED TOPICS ON ANGULAR JS AND SAILS JS (09 Periods)

Advanced Topics on Angular JS and Sails JS: Building custom directives in AngularJS, Performance optimization techniques for AngularJS and Sails.js, Internationalization and localization in AngularJS and Sails.js, Using third-party libraries and plugins in the app.

Total Periods: 45

EXPERIENTIAL LEARNING

Lab 1: Setting up the Development Environment

1. Install Node.js and npm (Node Package Manager).
2. Set up a code editor (e.g., Visual Studio Code).
3. Install AngularJS and Sails.js globally.
4. Create a new AngularJS project and a Sails.js project.

Lab 2: Building a Basic AngularJS Application

1. Create a simple AngularJS application with a few components.
2. Implement data binding and display dynamic content.
3. Add form controls and handle user input.
4. Perform basic validation on form inputs.
5. Implement basic routing and navigation between pages.

Lab 3: Building a RESTful API with Sails.js

1. Create models and configure the database connection.
2. Generate API endpoints for CRUD operations.
3. Implement validation and error handling in API endpoints.
4. Test API endpoints using tools like Postman or cURL.
5. Integrate authentication and authorization into API endpoints.

Lab 4: Integrating AngularJS with Sails.js API

1. Create AngularJS services to consume the Sails.js API.
2. Implement HTTP requests (GET, POST, PUT, DELETE) to interact with the API.
3. Handle responses and display data in the AngularJS application.
4. Implement authentication and session management in the integrated app.
5. Test API integration and ensure proper data flow between AngularJS and Sails.js.

Lab 5: Building Real-Time Features with WebSockets

1. Configure Sails.js to use WebSockets for real-time communication.
2. Implement real-time updates in the AngularJS application.
3. Use WebSockets for bidirectional communication between client and server.
4. Test and validate real-time features in the integrated app.

Lab 6: Testing and Debugging

1. Write unit tests for AngularJS components using frameworks like Jasmine.
2. Set up test runners like Karma for running AngularJS tests.
3. Use debugging tools and techniques to identify and fix issues in the application.
4. Perform end-to-end testing using tools like Protractor.
5. Analyze and troubleshoot common issues during testing and debugging.

Lab 7: Deployment and Optimization

1. Prepare the AngularJS and Sails.js application for deployment.
2. Deploy the application to a hosting environment (e.g., Heroku, AWS, or Azure).
3. Optimize the application's performance by minifying and bundling assets.
4. Implement caching strategies to improve the application's speed. Monitor and analyze the application's performance using tools like Google Analytics or New Relic.

Lab 8: Advanced Topics

1. Explore advanced AngularJS concepts like custom directives or reactive programming.
2. Implement advanced features in Sails.js, such as policies or custom hooks.

3. Integrate third-party libraries or plugins into the application.

RESOURCES:

TEXT BOOKS:

1. Shyam Seshadri and Brad Green "AngularJS: Up and Running" ,O'Reilly Media, 2nd Edition, 2014.
2. Josh Kurz "Mastering AngularJS Directives" , Packt Publishing, 2014.Mike McNeil and Irl Nathan "Sails.js in Action", Manning Publisher, 1st Edition, 2017.

REFERENCE BOOKS:

1. Adam Freeman "Pro AngularJS", Apress Publisher, 1st Edition, 2014.
2. Ken Williamson "Learning AngularJS: A Guide to AngularJS Development", O'Reilly Media, 1st Edition, 2015.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=AmjiDC_JUt4
2. <https://www.youtube.com/watch?v=eqc7sYOpWg0&list=PLF8BRFFRWv9VkafkA4JtgY0I5N IzX2ZI9>

WEB RESOURCES:

1. <https://sailsjs.com/documentation>
2. <https://docs.angularjs.org/>

Course Code	Course Title	L	T	P	S	C
25CA201029	SOCIAL NETWORK ANALYSIS	3	-	-	-	3
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: This course offers the knowledge of semantic web related applications. It also provides to analyse extraction and mining communities in web social network. Also includes the human behaviour in social web and related communities.

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

- CO1.** Understand the concept of semantic web and related applications.
- CO2.** Understand to develop semantic web related applications
- CO3.** Analyze Extraction And Mining Communities in Web Social Network
- CO4.** To understand human behaviour in social web and related communities
- CO5.** To learn visualization of social networks

CO-PO Mapping Table:

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

Correlation Level: 3- High 2-Medium 1-Low

COURSE CONTENT

Module 1: INTRODUCTION

(09 Periods)

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks

Module 2:

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION

(09 Periods)

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals

Module 3:

EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORK

(09 Periods)

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities

Module 4:

PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES

(09 Periods)

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis

Module 5:

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

(09 Periods)

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co- Citation networks.

Total Periods: 45

RESOURCES

TEXT BOOKS:

1. Peter Mika, —Social Networks and the Semantic Web ,||First Edition, Springer.

REFERENCE BOOKS:

2. Borko Furht, —Handbook of Social Network Technologies and Applications , 1st Edition Springer.
3. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications, First Edition, Springer.
4. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively ,|| IGI Global Snippet.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, —Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet.
6. John G. Breslin, Alexander Passant and Stefan Decker, —The Social Semantic Web, Springer.

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 Mapping Table:

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

Correlation Level:

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/arviinnndn/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*, Cengage 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
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 RESPONSIBILITY (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

EXPERIENTIAL 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
CO1	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	2	-	-
Course Correlation Level	-	-	-	-	-	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
CO1	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	2	-	-
Course Correlation Level	-	-	-	-	-	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
CO1	2	1	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-
CO4	1	1	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-
Course Correlation Mapping	2	2	3	-	3	-	-	-

Correlation Level:

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

TEXT BOOKS:

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
CO1	2	1	-	-	-	-	-	-
CO2	2	3	-	-	3	-	-	-
CO3	2	2	-	-	3	-	-	-
CO4	1	1	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-
Course Correlation Mapping	2	2	-	-	3	-	-	-

Correlation Level: 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 Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.Oxford and Boston: Blackwell.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International
3. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
- 4.

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:

- C01.** Demonstrate knowledge in Self-Management and Planning Career
- C02.** Analyze the functional knowledge in attitudes and thinking strategies
- C03.** Learn and apply soft skills for professional success.
- C04.** Function effectively as an individual and as a member in diverse teams
- C05.** 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
C01	2	1	-	-	-	-	-	-
C02	2	3	-	-	-	-	-	-
C03	2	2	-	-	3	-	-	-
C04	1	1	-	-	-	-	-	-
C05	-	-	-	-	-	-	-	-
Course Correlation Mapping	2	2	3	-	3	-	-	-

Correlation Level:

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- (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-personality>
- 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 Mapping Table:

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

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