



NPR

College of Engineering and Technology

(AN AUTONOMOUS INSTITUTION)

NBA Accredited (B.E. - CSE, ECE, EEE & Mechanical Engg.) | Accredited by NAAC with 'A' Grade
Recognized by UGC under 2 (f) | ISO 9001:2015 Certified | Approved by All India Council for Technical Education, New Delhi
Affiliated to Anna University, Chennai

Natham, Dindigul (Dist.) - 624 401, Tamil Nadu.



MASTER OF COMPUTER APPLICATIONS

REGULATIONS – 2025

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABUS


Chairperson-Board of Studies,
Department of Computer Science and Engineering,
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DEPARTMENT OF COMPUTER APPLICATIONS
MASTER OF COMPUTER APPLICATIONS
REGULATION – 2025 CHOICE BASED CREDIT SYSTEM (CBCS)
CURRICULUM AND SYLLABI FOR I - IV SEMESTERS

I. DEPARTMENT VISION

- To be a leading centre for computer applications, promoting innovation, research, and ethics, and producing globally skilled IT professionals.

II. DEPARTMENT MISSION

- Provide quality, industry-relevant education in computer applications, strengthened by practical exposure and industry collaboration.
- Promote research, innovation, entrepreneurship, and lifelong learning among students and faculty.
- Instill ethical values, leadership qualities, and social responsibility in graduates.

III. PROGRAM NAME: COMPUTER APPLICATIONS

IV. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The students of MCA programme would be able to

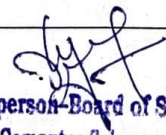
PEO 1: Build successful careers in IT and related fields by applying knowledge of computer applications.

PEO 2: Grow as responsible professionals with skills in research, innovation, ethics, and lifelong learning.

V. PROGRAM OUTCOMES (POs)

1. Ability to independently carry out research/investigation and development work to solve practical problems
2. Ability to write and present a substantial technical report/document
3. Demonstrate a degree of mastery in computer applications beyond undergraduate level
4. Ability to select suitable data models, appropriate architecture, and platform to implement a system with good performance.
5. Ability to design and integrate various system-based components to provide user interactive solutions for various challenges.
6. Ability to develop applications for real time environments using existing and emerging technologies.




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VI. PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Apply computing knowledge to design and develop efficient software solutions.

PSO 2: Use modern tools and technologies to create applications for industry and society.

PSO 3: Demonstrate teamwork, leadership, and ethical responsibility in professional practice.

VII. MAPPING OF PEOs, POs, AND PSO

PEOs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
PEO1	2	2	3	3	3	3	3	3	2
PEO2	3	3	3	2	2	2	2	2	3

VIII - PROGRAM SCOPE

The Master of Computer Applications (MCA) programme is designed to develop students into technically proficient, innovative, and ethically responsible professionals who can address global challenges in the field of information technology. Aligned with the college's vision of nurturing intellectual curiosity and technical expertise, the program focuses on delivering quality education, fostering interdisciplinary research, and enhancing practical skills through strong industry-institute collaboration.

Through a dynamic curriculum and real-world exposure, the MCA programme prepares graduates to analyze, design, and develop software solutions, contribute to societal progress, and adapt to the rapidly changing technology landscape. The program also emphasizes value-based learning, interpersonal skills development, and encourages students to explore innovative solutions to real-time problems, shaping them into globally competent professionals.




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IX - PROGRAM SPECIFIC CRITERIA

- **Core Technical Competence**

Graduates will gain a strong foundation in computer science principles, programming, data structures, algorithms, and system design to build efficient and scalable software solutions.

- **Applied Learning and Industry Relevance**

The program emphasizes hands-on learning, real-time projects, and exposure to industry practices through internships, workshops, and collaborative initiatives with technology partners.

- **Innovation and Research Orientation**

Students will be encouraged to pursue research, innovation, and problem-solving, with opportunities to address real-world and societal challenges through IT-based solutions.

- **Ethics, Communication, and Leadership**

The curriculum integrates value-based education, effective communication, teamwork, and leadership development to ensure holistic student growth.

- **Adaptability and Lifelong Learning**

Graduates will be equipped with critical thinking and self-learning abilities to adapt to emerging technologies and thrive in the dynamic global IT environment.




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SEMESTER I								
S/N	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	25MC101	Computer Organization and Architecture	PCC	3	0	0	3	3
2.	25MC102	Advanced Data Structures and Algorithms	PCC	3	0	2	5	4
3.	25MC103	Advanced Database Technology	PCC	3	0	2	5	4
4.	25MC104	Object Oriented Software Engineering with JAVA	PCC	3	0	0	3	3
5.	25MC105	Applied Probability and Statistics for Computer Applications	FC	3	1	0	4	4
6.	25RM101	Research Methodology and IPR	RMC	3	0	0	3	3
PRACTICALS								
7.	25MC111	Java Programming Laboratory	PCC	0	0	4	4	2
8.	25MC112	Communication Skills Enhancement – I	EEC	0	0	2	2	1
			TOTAL	18	1	10	29	24

SEMESTER II								
S/N	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	25MC201	Python Programming	PCC	3	0	2	5	4
2.	25MC202	Cloud Computing Technologies	PCC	3	0	0	3	3
3.	25MC203	Full Stack Web Development	PCC	3	0	0	3	3
4.	25MC204	Mobile Application Development	PCC	3	0	2	5	4
5.	25MC205	Computer Networks	PCC	3	0	2	5	4
6.		Professional Elective I	PEC	3	0	0	3	3
PRACTICALS								
7.	25MC211	Full Stack Laboratory	PCC	0	0	4	4	2
8.	25MC212	Communication Skills Enhancement – II	EEC	0	0	2	2	1
			TOTAL	18	0	12	30	24



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SUMMER TERM (Evaluation in the III semester)	
Course of Study	Credit
Internship / Industrial Training (4 weeks to 6 weeks)	2

SEMESTER III								
S/N	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	25MC301	Artificial Intelligence & Machine Learning	PCC	3	0	2	5	4
2.	25MC302	Internet of Things	PCC	3	0	2	5	4
3.		Professional Elective II	PEC	3	0	0	3	3
4.		Professional Elective III	PEC	3	0	0	3	3
5.		Professional Elective IV	PEC	3	0	2	5	4
6.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
7.	25MC311	Mini Project	EEC	0	0	4	4	2
8.	25MC312	Internship	EEC	0	0	0	0	2
			TOTAL	18	0	10	28	25

SEMESTER IV								
S/N	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	25MC411	Project Work	EEC	0	0	24	24	12
			TOTAL	0	0	24	24	12

TOTAL NO. OF CREDITS: 85



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**PROFESSIONAL ELECTIVES
SEMESTER II ELECTIVE I**

S/N.	COURSE CODE	COURSE TITLE	CATE-GORY	CONTACT PERIODS	L	T	P	C
1.	25PMC01	Software Project Management	PEC	3	3	0	0	3
2.	25PMC02	Advances in Operating System	PEC	3	3	0	0	3
3.	25PMC03	Soft Computing Techniques	PEC	3	3	0	0	3
4.	25PMC04	E - Learning	PEC	3	3	0	0	3
5.	25PMC05	Professional Ethics in IT	PEC	3	3	0	0	3
6.	25PMC06	Web Technologies	PEC	3	3	0	0	3
7.	25PMC07	Software Engineering and Testing	PEC	3	3	0	0	3
8.	25PMC08	Agile Methods for Software Development	PEC	3	3	0	0	3
9.	25PMC09	Business Intelligence	PEC	3	3	0	0	3
10.	25PMC10	Cyber Security	PEC	3	3	0	0	3

SEMESTER III, ELECTIVE II

S/N.	COURSE CODE	COURSE TITLE	CATE-GORY	CONTACT PERIODS	L	T	P	C
1.	25PMC11	DevOps and Microservices	PEC	3	3	0	0	3
2.	25PMC12	Advances in Networking	PEC	3	3	0	0	3
3.	25PMC13	Digital Image Processing	PEC	3	3	0	0	3
4.	25PMC14	Social Network Analytics	PEC	3	3	0	0	3
5.	25PMC15	Cryptocurrency and Blockchain Technologies	PEC	3	3	0	0	3
6.	25PMC16	Bio Inspired learning	PEC	3	3	0	0	3
7.	25PMC17	Digital Marketing	PEC	3	3	0	0	3
8.	25PMC18	Information Retrieval Techniques	PEC	3	3	0	0	3
9.	25PMC19	Operations Research	PEC	3	3	0	0	3
10.	25PMC20	Business Data Analytics	PEC	3	3	0	0	3




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SEMESTER III, ELECTIVE III

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	25PMC21	Software Architecture	PEC	3	3	0	0	3
2.	25PMC22	Digital Forensics	PEC	3	3	0	0	3
3.	25PMC23	Wireless Networking	PEC	3	3	0	0	3
4.	25PMC24	Data Visualization Techniques	PEC	3	3	0	0	3
5.	25PMC25	Data Mining and Data Warehousing Techniques	PEC	3	3	0	0	3
6.	25PMC26	Ethical Hacking	PEC	3	3	0	0	3
7.	25PMC27	Organizational Behavior	PEC	3	3	0	0	3
8.	25PMC28	Human Computer Interface	PEC	3	3	0	0	3
9.	25PMC29	Natural Language Processing	PEC	3	3	0	0	3
10.	25PMC30	Virtual Reality	PEC	3	3	0	0	3

SEMESTER III, ELECTIVE IV

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	25PMC31	Web Design	PEC	5	3	0	2	4
2.	25PMC32	C# and .NET	PEC	5	3	0	2	4
3.	25PMC33	Big Data Analytics	PEC	5	3	0	2	4
4.	25PMC34	Image Data Analysis	PEC	5	3	0	2	4
5.	25PMC35	Advanced Java Programming	PEC	5	3	0	2	4
6.	25PMC36	Network Programming and Security	PEC	5	3	0	2	4
7.	25PMC37	Unix and Network Programming	PEC	5	3	0	2	4
8.	25PMC38	Deep Learning with Computer Vision	PEC	5	3	0	2	4
9.	25PMC39	Semantic Web Technologies	PEC	5	3	0	2	4
10.	25PMC40	Advanced Visualization Techniques	PEC	5	3	0	2	4




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BRIDGE COURSES

(For the M.C.A students admitted under Non-Computer-Science background)

S/N	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
SEMESTER – I: Classes are to be conducted and completed before the start of the class of First semester, Examinations will be conducted along with first semester							
1.	25BMC01	Data Structures and Algorithms	3	3	0	0	3
2.	25BMC02	Database Management Systems	3	3	0	0	3
SEMESTER – II: Classes are to be conducted and completed before the start of the class of Second Semester, Examinations will be conducted along with second semester							
3.	25BMC03	Fundamentals of Computers	3	3	0	0	3
4.	25BMC04	Basic Computing Laboratory	3	0	0	3	1

LIST OF OPEN ELECTIVES FOR PG PROGRAMMES

S/N	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	25MOE01	Integrated Water Resources Management	3	0	0	3
2.	25MOE02	Water, Sanitation and Health	3	0	0	3
3.	25MOE03	Principles of Sustainable Development	3	0	0	3
4.	25MOE04	Environmental Impact Assessment	3	0	0	3
5.	25MOE05	Vibration and Noise Control Strategies	3	0	0	3
6.	25MOE06	Energy Conservation and Management in Domestic Sectors	3	0	0	3
7.	25MOE07	Additive Manufacturing	3	0	0	3
8.	25MOE08	Electric Vehicle Technology	3	0	0	3
9.	25MOE09	New Product Development	3	0	0	3
10.	25MOE10	Sustainable Management	3	0	0	3
11.	25MOE11	Micro and Small Business Management	3	0	0	3




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12.	25MOE12	Intellectual Property Rights	3	0	0	3
13.	25MOE13	Ethical Management	3	0	0	3
14.	25MOE14	IoT for Smart Systems	3	0	0	3
15.	25MOE15	Machine Learning and Deep Learning	3	0	0	3
16.	25MOE16	Renewable Energy Technology	3	0	0	3
17.	25MOE17	Smart Grid	3	0	0	3
18.	25MOE18	Big Data Analytics	3	0	0	3
19.	25MOE19	Internet of Things and Cloud	3	0	0	3
20.	25MOE20	Medical Robotics	3	0	0	3
21.	25MOE21	Embedded Automation	3	0	0	3
22.	25MOE22	Environmental Sustainability	3	0	0	3
23.	25MOE23	Textile Reinforced Composites	3	0	0	3
24.	25MOE24	Nanocomposite Materials	3	0	0	3
25.	25MOE25	IPR, Biosafety and Entrepreneurship	3	0	0	3

SUMMARY

S/N	NAME OF THE PROGRAMME: M.C.A.					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	16	20	08	00	44
3.	PEC	00	03	10	00	13
4.	RMC	03	00	00	00	03
5.	OEC	00	00	03	00	03
6.	EEC	01	01	04	12	18
TOTAL CREDIT		24	24	25	12	85

FC- Foundation Course

PCC- Professional Core Courses

PEC-Professional Elective Courses

RMC-Research Methodology and IPR Courses

OEC-Open Elective courses

EEC-Employability Courses




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I - Course Name: 25MC101 Computer Organization and Architecture

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic Digital Electronics, Programming Fundamentals	MCA – Master of Computer Applications	I	PCC	3	0	0	3

II - Course Objectives

1	To introduce the principles of digital logic design and memory organization.
2	To understand instruction set architecture and address modes used in computer systems.
3	To explore the functioning of processing units, including execution cycles and pipelining
4	To understand memory hierarchy and cache performance in modern computers.
5	To explain input/output mechanisms and the role of parallelism in computing performance.

III - Course Content

Preamble: This course provides the foundational understanding of how computers work at the hardware level. It explains the logical organization, processor functionality, memory management, and system performance enhancements through pipelining and parallelism.		
Unit – I	DIGITAL LOGIC PRINCIPLES & MEMORY BASICS	9 Periods
Axioms and laws of Boolean algebra – Simplification of Boolean expressions – Canonical forms and conversion – Karnaugh Map (up to 4 variables) – Half Adder and Full Adder – Decoder and Multiplexer – Basics of RAM and ROM – Memory organization overview – Introduction to Flip-Flops: RS, JK, and D-Latch.		
Unit – II	INSTRUCTION SET ARCHITECTURE	9 Periods
Memory locations and byte addressability – Big-endian and little-endian assignments – Word alignment – Types of instructions: Data transfer, arithmetic, and control – Addressing modes: Immediate, direct, indirect, and register – Introduction to assembly language instructions – Subroutines and basic instruction sequencing.		
Unit – III	BASIC PROCESSING UNIT & PIPELINING	9 Periods
Basic processing concepts: ALU, registers, and control unit – Instruction fetch and execution cycle – Hardwired control: basic idea – Overview of CISC-style processors – Introduction to pipelining – Pipeline stages and instruction flow – Pipeline performance basics – Hazards: brief overview of data and control hazards.		
Unit – IV	MEMORY ORGANIZATION	9 Periods
Basics of memory hierarchy – Semiconductor RAM (concept) – Overview of ROM – Cache memory: working principle and importance – Virtual memory: basic idea and need –		



Introduction to memory management – Direct memory access (DMA) concept.		
Unit – V	INPUT OUTPUT & PARALLEL PROCESSING	9 Periods
Accessing I/O devices – I/O mapped I/O and memory mapped I/O – Basic interrupt mechanism – Bus structure and arbitration (concept) – Basics of interface circuits – Introduction to SIMD and shared-memory multiprocessors – Cache coherence (idea only) – Parallel processing concepts and examples.		

TOTAL: 45 PERIODS

Text Books:	• Hennessy, J. L. & Patterson, D. A., Computer Architecture: A Quantitative Approach, 5th Ed., Morgan Kaufmann/Elsevier, 2011. • Mano, M. Morris, Computer System Architecture, Revised 6th Ed., Pearson Education, [year not clearly available]. • Patterson, D. A. & Hennessy, J. L., Computer Organization and Design: ARM Edition, 1st Ed., Morgan Kaufmann/Elsevier, 2016.
Reference Books:	• Stallings, W., Computer Organization and Architecture, 10th Ed., Pearson Education, 2016. • Tanenbaum, A. S., Structured Computer Organization, 6th Ed., Pearson/Prentice Hall, 2012. • Hamacher, V. C., Computer Organization, McGraw-Hill, [multiple editions; e.g., 5th Ed., 2002].
MOOC/Web Platforms:	• https://nptel.ac.in/courses/106102062 – NPTEL: Computer Organization by IIT • https://www.coursera.org/learn/comparch – Coursera: Computer Architecture

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the fundamentals of Boolean logic and digital design principles	Understand (K2)
CO2	Explain instruction set architecture, addressing modes, and instruction sequencing	Understand (K2)
CO3	Solve problems using instruction execution concepts and control signals	Apply (K3)
CO4	Design pipelined instruction execution systems minimizing hazards	Apply (K3)
CO5	Analyze memory and I/O system performance and explain parallel processing techniques	Analyze (K4)



V - Mapping Table Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	1	2	3	2	2	3	2	1
CO2	2	2	2	3	2	2	3	2	1
CO3	3	2	2	3	2	3	3	2	1
CO4	3	2	3	3	3	3	3	3	2
CO5	3	2	3	3	2	3	3	3	2




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I - Course Name: 25MC102 Advanced Data Structures and Algorithms

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic Data Structures and Programming	MCA – Master of Computer Applications	I	PCC	3	0	2	4

II - Course Objectives

1	To introduce algorithm design, time/space complexity, and performance analysis methods.
2	To familiarize students with hierarchical data structures and their applications.
3	To enable students to solve graph-based problems using efficient algorithms
4	To understand the algorithm design techniques such as divide & conquer, dynamic programming, and greedy methods.
5	To impart an understanding of NP-complete problems and computational hardness.

III - Course Content

Preamble: This course builds a strong foundation in algorithmic design and analysis, essential for developing efficient software systems. It covers complexity theory, advanced data structures, graph theory, and problem-solving paradigms used in modern computing applications.

Unit – I	ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS	15 Periods
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Introduction to Algorithms and their Importance - Time and Space Complexity - Asymptotic Notation: Big-O, Omega, Theta - Average vs Worst-case Analysis - Recurrence Relations: Substitution Method, Recursion Tree Method - Basics of Program Performance Measurement

Lab Activities:

- Array, Linked List, Stack, Queue, Map & Hash table
- Implementation of recursive and iterative functions (e.g., Fibonacci series, tree traversal)
- Divide and Conquer
- Sorting Algorithms (Bubble Sort, Counting Sort, Quick Sort, Merge Sort, Radix Sort)

Unit – II	HIERARCHICAL DATA STRUCTURES	15 Periods
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Binary Search Trees: Operations and Queries - Red-Black Trees: Rotations, Insertion, Deletion - B-Trees: Basic Operations and Key Deletion - Heap Structures and Implementations - Disjoint Sets - Fibonacci Heaps: Structure, Operations, and Degree Bounding

Lab Activities:

- Linear & Binary Search
- Binary Search Tree Implementation
- Red-Black Tree Implementation
- Heap and Fibonacci Heap Implementation



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Unit – III	GRAPHS	15 Periods
Graph Representations - BFS and DFS Traversals - Topological Sorting and Strongly Connected Components - Minimum Spanning Trees: Kruskal's and Prim's Algorithms - Single-Source Shortest Paths: Bellman-Ford, Dijkstra's Algorithm - All-Pairs Shortest Paths: Matrix Multiplication and Floyd-Warshall Algorithm Lab Activities: - Graph Traversals: BFS and DFS - Spanning Tree Implementations (Kruskal, Prim) - Floyd-Warshall / Roy-Floyd Algorithm - Shortest Path Algorithms (Dijkstra, Bellman-Ford) - Topological Sorting		
Unit – IV	ALGORITHM DESIGN TECHNIQUES	15 Periods
Dynamic Programming: Matrix-Chain Multiplication, Longest Common Subsequence Greedy Algorithms: Activity Selection, Huffman Coding - Elements and Strategy of Dynamic Programming and Greedy Techniques Lab Activities: - Implementation of Matrix Chain Multiplication - Activity Selection Problem - Huffman Coding Algorithm		
Unit – V	NP-COMPLETE AND NP-HARD PROBLEMS	15 Periods
Polynomial Time and Polynomial-Time Verification - Concepts of NP, NP-Completeness, and NP-Hardness - NP-Completeness Proofs and Reducibility - Examples of NP-Complete Problems Lab Activities: Analysis and understanding of NP-Complete problem examples (theoretical/practical exploration depending on feasibility)		

TOTAL : 75 PERIODS

Text Books:	- Cormen, T. H., Leiserson, C. E., Rivest, R. L. & Stein, C., Introduction to Algorithms, 4th Ed., MIT Press, 2022. - Ahmad, I. & Nikpoor, S., 50 Algorithms Every Programmer Should Know, 2nd Ed., Packt Publishing, 2023. - Sen, S. & Kumar, A., Design and Analysis of Algorithms: A Contemporary Perspective, Cambridge University Press, 2019.
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Reference Books:	- Kleinberg, J. & Tardos, É., Algorithm Design, 2nd Ed., Pearson, 2022. - Mehta, D. & Sahni, S., Handbook of Data Structures and Applications, 2nd Ed., CRC Press, 2018. - Dave, P. H. & Dave, H. B., Design and Analysis of Algorithms, 3rd Ed., Pearson, 2020.
MOOC/ Web Platforms:	https://www.coursera.org/specializations/data-structures-algorithms – Coursera specialization by UC San Diego & National Research University https://www.geeksforgeeks.org/data-structures/ – Detailed tutorials and practice problems

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Design and implement basic and advanced data structures to solve computing problems	Apply (K3)
CO2	Apply suitable data structures and ADTs for solving real-time applications	Apply (K3)
CO3	Implement efficient algorithms using strategies like divide & conquer, DP, and greedy techniques	Apply (K3)
CO4	Develop graph-based algorithms to solve real-world problems	Apply (K3)
CO5	Analyze computational complexity and recognize NP-complete problems	Analyze (K4)

V - Mapping Table Mapping of COs with POs and PSOs

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	–	3	3	–
CO2	3	3	3	2	3	–	3	3	–
CO3	3	3	3	2	3	–	3	3	–
CO4	3	2	2	2	2	–	3	3	–
CO5	3	3	3	3	2	–	3	3	–




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I - Course Name: 25MC103 Advanced Database Technology

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basics of Database Management Systems	MCA – Master of Computer Applications	I	PCC	3	0	2	4

II - Course Objectives

1	To provide knowledge about distributed system architecture and storage mechanisms in distributed databases.
2	To introduce advanced database systems like spatial, temporal, mobile, multimedia, and XML databases.
3	To explore NoSQL paradigms and technologies like MongoDB, Cassandra, Hive, and OrientDB.
4	To implement structured and semi-structured data retrieval using SQL, XQuery, and NoSQL frameworks.
5	To introduce concepts of information retrieval and web search mechanisms using open-source tools

III - Course Content

Preamble: This course introduces modern database systems including distributed, spatial, temporal, NoSQL, XML, and mobile databases. It includes advanced querying and data modeling, supported with practical implementation using tools like MongoDB, Cassandra, Hive, and OrientDB.

Unit – I	DISTRIBUTED DATABASES	15 Periods
Introduction to Distributed Systems and Architectures - Concepts of Distributed Databases - Data Storage and Transactions in Distributed Systems - Commit Protocols and Concurrency Control - Distributed Query Processing. SQL Fundamentals: DDL, DML, DCL, Commit, Rollback, Primary Key, Foreign Key, Unique, Between, Like, Where, Distinct, Joins & their types. Lab Activities: - MySQL Database Creation and Table Operations, Querying in MySQL - Implementing MySQL Replication for Distributed Databases		
Unit – II	SPATIAL AND TEMPORAL DATABASES	15 Periods
Active Database Models and Design Issues - Temporal Databases and Temporal Querying - Spatial Databases: Data Types, Queries, Operators - Spatial Indexing and Mining - Mobile Databases: Location, Handoff, and Transactions - Deductive and Multimedia Databases Lab Activities: - Spatial Data Storage and Retrieval in MySQL - Temporal Data Storage and Retrieval in MySQL		




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Unit – III	NOSQL DATABASES	15 Periods
Introduction to NoSQL and CAP Theorem - Sharding Concepts - Document-based Databases - MongoDB: CRUD, Indexing, Replication, Sharding Lab Activities: • MongoDB: CRUD, Indexing, Sharding		
Unit – IV	COLUMNAR, ANALYTICAL & GRAPH DATABASES	15 Periods
Cassandra: Data Models, Table and CRUD Operations, CQL Types – HIVE: Data Types, Partitioning, HiveQL – OrientDB: Graph Database and Features Lab Activities: • Cassandra: Table Operations, CRUD, CQL Types • HIVE: Data Operations, Partitioning, HiveQL • OrientDB: Graph Database Exploration		
Unit – V	XML DATABASES	15 Periods
Structured, Semi-structured, and Unstructured Data - XML Hierarchical Data Model - DTD and XML Schema - XML Document Creation and Storage - XML Querying with XPath and XQuery Lab Activities: • XML Table Creation • Writing XQuery using FLWOR Expressions • Working with XML Databases		

TOTAL : 75 PERIODS

Text Books:	• Carpenter, J. & Hewitt, E., Cassandra: The Definitive Guide, 3rd Ed., O'Reilly Media, 2022. • Harrison, G. & Harrison, M., MongoDB Performance Tuning, O'Reilly Media, 2021.
Reference Books:	• Harrison, G., Next Generation Databases: NoSQL, NewSQL and Big Data, Apress, 2015. • Han, J., Kamber, M. & Pei, J., Data Mining: Concepts and Techniques, 3rd Ed., Morgan Kaufmann, 2012. • Giamas, A., Mastering MongoDB 6.x, Packt Publishing, 2023.
MOOC/Web Platforms:	• https://www.w3schools.com/xml – XML & XQuery Basics • https://www.coursera.org/learn/information-retrieval – IR Course




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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Design and implement distributed, spatial, temporal, and advanced database systems	Apply (K3)
CO2	Work with NoSQL and big data tools such as MongoDB, Cassandra, Hive, and OrientDB	Apply (K3)
CO3	Formulate and execute complex queries using SQL and NoSQL frameworks	Analyze (K4)
CO4	Create, validate, and query XML documents using XML Schema and XQuery	Apply (K3)
CO5	Apply information retrieval techniques and perform query processing in mobile and web databases using open-source tools	Apply (K3)

V - Mapping Table Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	—	3	2	3
CO2	3	3	3	2	3	—	3	3	3
CO3	3	3	3	3	3	—	3	3	3
CO4	3	3	2	3	2	—	2	3	2
CO5	3	3	3	2	3	—	3	3	3




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I - Course Name: 25MC104 Object Oriented Software Engineering with Java

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic Programming Knowledge in C, Familiarity with basic software development concepts	MCA – Master of Computer Applications	I	PCC	3	0	0	3

II - Course Objectives

1	To introduce software development processes and methodologies with an object-oriented perspective.
2	To enable students to model systems using object-oriented analysis and design techniques.
3	To familiarize students with design principles, patterns, and their applications.
4	To train students in object-oriented testing and software maintenance practices
5	To apply software quality metrics and estimation techniques in real-world scenarios

III - Course Content

Preamble: This course covers object-oriented software engineering concepts using Java as the implementation language. It addresses software development processes, modeling techniques, design patterns, system testing, maintenance, and quality measurement. Practical sessions focus on implementing object-oriented concepts and patterns in Java for real-world applications.

Unit – I	SOFTWARE DEVELOPMENT AND PROCESS MODELS	9 Periods
Introduction to Software Development – Challenges – An Engineering Perspective – Object Orientation – Software Development Process – Iterative Development Process – Process Models – Life Cycle Models – Unified Process – Iterative and Incremental – Agile Processes.		
Unit – II	MODELING OO SYSTEMS	9 Periods
Object Oriented Analysis (OOA / Coad-Yourdon), Object Oriented Design (OOD/Booch), Hierarchical Object-Oriented Design (HOOD), Object Modeling Technique (OMT) – Requirement Elicitation – Use Cases – SRS Document – OOA - Identification of Classes and Relationships, Identifying State and Behavior – OOD - Interaction Diagrams – Sequence Diagram – Collaboration Diagrams - Unified Modeling Language and Tools.		
Unit – III	DESIGN PATTERNS USING JAVA	9 Periods
Introduction to Design Patterns using Java - Benefits of Using Design Patterns - When to Apply Design Patterns - Classification of Design Patterns - Creational Design Patterns – Types & Examples - Structural Design Patterns – Types & Examples - Behavioral Design Patterns – Types & Examples - Best Practices and Pitfalls in Using Patterns - Real-World Applications in Frameworks - Case Study 1: Singleton Pattern - Case Study 2: Observer or Strategy Pattern - Design Principles – Design Patterns – GRASP – GoF – Dynamic Object Modelling – Static Object Modelling.		
Unit – IV	SYSTEM TESTING	9 Periods



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Software testing: Software Verification Techniques – Object Oriented Checklist:- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Levels of Testing – Static and Dynamic Testing Tools - Software Maintenance – Categories – Challenges of Software Maintenance – Maintenance of Object Oriented Software – Regression Testing		
Unit – V	SOFTWARE QUALITY AND METRICS	9 Periods
Need of Object-Oriented Software Estimation – Lorenz and Kidd Estimation – Use Case Points Method – Class Point Method – Object Oriented Function Point – Risk Management – Software Quality Models – Analyzing the Metric Data – Metrics for Measuring Size and Structure – Measuring Software Quality - Object Oriented Metrics		

TOTAL : 45 PERIODS

Text Books:	- Booch, G., Object-Oriented Analysis and Design with Applications, 3rd Ed., Addison-Wesley, 2007. - Gamma, E., Helm, R., Johnson, R. & Vlassises, J., Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1994.
Reference Books:	- Pressman, R. S., Software Engineering: A Practitioner's Approach, 8th Ed., McGraw-Hill, 2024. - Sommerville, I., Software Engineering, 10th Ed., Pearson Education, 2025. - Fowler, M., UML Distilled: A Brief Guide to the Standard Object Modeling Language, 3rd Ed., Addison-Wesley, 2023.
MOOC /Web Platforms:	https://www.geeksforgeeks.org/software-engineering https://www.tutorialspoint.com/software_engineering https://refactoring.guru/design-patterns

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Explain the concepts of software development processes and life cycle models.	Understand (K2)
CO2	Model real-world systems using object-oriented analysis and design techniques.	Apply (K3)
CO3	Apply design patterns and principles for developing maintainable software.	Apply (K3)
CO4	Implement testing strategies and maintenance practices for OO software.	Apply (K3)
CO5	Utilize software quality metrics and estimation methods in project scenarios	Analyze (K4)




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V - Mapping Table Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	–	3	2	3
CO2	3	2	2	2	3	–	2	3	2
CO3	3	3	3	2	2	–	3	3	3
CO4	3	3	3	3	3	–	3	3	3
CO5	3	3	2	3	3	–	3	3	3




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I - Course Name: 25RM101 Research Methodology and IPR

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic understanding of programming, communication, and analytical reasoning	MCA – Master of Computer Applications	I	PCC	3	0	0	3

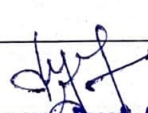
II - Course Objectives

1	To understand the fundamentals of research design and methodology.
2	To introduce qualitative and quantitative data collection techniques.
3	To equip students with data analysis skills and research reporting abilities.
4	To provide in-depth knowledge of Intellectual Property Rights and its importance in innovation.
5	To enable students to draft and file patents as part of research and development.

III - Course Content

Preamble: This course introduces MCA students to systematic research approaches, data handling, and Intellectual Property Rights. The objective is to build research competence, ensure ethical practices, and protect innovation through understanding IPR and patents.		
Unit – I	RESEARCH DESIGN	9 Periods
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.		
Unit – II	DATA COLLECTION AND SOURCES	9 Periods
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.		
Unit – III	DATA ANALYSIS AND REPORTING	9 Periods
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.		
Unit – IV	INTELLECTUAL PROPERTY RIGHTS	9 Periods
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Biodiversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.		
Unit – V	PATENTS	9 Periods
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.		

TOTAL : 45 PERIODS


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Text Books:	- Cooper, D. R., Schindler, P. S. & Sharma, J. K., Business Research Methods, 11th Ed., Tata McGraw Hill Education, 2012. - Holland, C. J., Intellectual Property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.
Reference Books:	- Hunt, D., Nguyen, L. & Rodgers, M., Patent Searching: Tools & Techniques, Wiley, 2007. - The Institute of Company Secretaries of India, Professional Programme – Intellectual Property Rights, Law and Practice, Sept 2013. - Kothari, C. R., Research Methodology: Methods and Techniques, 3rd Ed., New Age International. - Kumar, R., Research Methodology: A Step-by-Step Guide for Beginners, 4th Ed., Pearson Education.
MOOC/Web Platforms:	https://www.udemy.com/topic/intellectual-property/ – Udemy IPR & Research courses

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Formulate and design research problems using appropriate methodologies	Analyze (K4)
CO2	Understand data collection methods and sampling techniques	Understand (K2)
CO3	Perform data analysis and present research insights	Apply (K3)
CO4	Understand the structure and legal aspects of IPR and practice research ethics	Understand (K2)
CO5	Apply knowledge in drafting and filing patents in research and development	Analyze (K4)

V - Mapping Table Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	–	3	2	3
CO2	3	2	2	2	3	–	2	3	2
CO3	3	3	3	3	3	–	3	3	3
CO4	2	2	2	–	–	3	2	3	3
CO5	3	3	2	3	3	–	3	3	3



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I-Course Name: 25MC105 - Applied Probability and Statistics for Computer Applications

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic probability and statistics, and programming fundamentals	Master of Computer Applications	I	FC	3	1	0	4

II - Course Objectives

1.	To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
2.	To provide necessary basic concepts in probability.
3.	To understand the basic concepts of one - dimensional random variable and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
4.	To understand the basic concepts of two - dimensional random variables.
5.	To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.

III - Course Content**Preamble:**

This course provides a foundational understanding of Linear Algebra, Probability, and Statistics for engineering applications. It equips students with tools to model systems, analyze data, and make informed decisions under uncertainty. Key topics include vector spaces, probability distributions, hypothesis testing. The course fosters critical thinking and scientific reasoning through problem-solving and data interpretation.

Unit - I	LINEAR ALGEBRA	12 Periods
Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse – least square approximations.		
Unit – II	PROBABILITY AND RANDOM VARIABLES	12 Periods
Probability – Axioms of probability – Conditional probability – Bayes theorem – Random variables – Probability function – Moments – Moment generating functions and their properties		
Unit - III	STANDARD DISTRIBUTION FUNCTION	12 Periods
Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.		
Unit - IV	TWO DIMENSIONAL RANDOM VARIABLES	12 Periods
Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Correlation -Regression curve.		



Unit - V	TESTING OF HYPOTHESIS	12 Periods
Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.		

TOTAL : 60 PERIODS

Text Books:	- Friedberg, A. H., Insel, A. J. & Spence, L., Linear Algebra, 4th Ed., Prentice Hall of India, New Delhi, 2024. - Gupta, S. C. & Kapoor, V. K., Fundamentals of Mathematical Statistics, 12th Revised Ed., Sultan Chand & Sons, 2020.
Reference Books:	- Kolman, B. & Hill, D. R., Introductory Linear Algebra, First Reprint, Pearson Education, New Delhi, 2019. - Johnson, R. A. & Wichern, D. W., Applied Multivariate Statistical Analysis, 6th Ed., Pearson Education, New Delhi, 2023. - Bronson, R., Matrix Operations, Schaum's Outline Series, Tata McGraw-Hill, New York, 2011. - Ibe, O. C., Fundamentals of Applied Probability and Random Processes, Academic Press, Boston, 2020. - Johnson, R. A. & Gupta, C. B., Miller and Freund's Probability and Statistics for Engineers, 9th Ed., Pearson India Education, New Delhi, 2017.
MOOC/Web Platforms:	https://onlinestatbook.com/2/probability/basic.html https://webpace.maths.qmul.ac.uk/b.bogacka/MS_NotesWeek4.pdf https://onlinecourses.nptel.ac.in/noc22_ee123/preview https://www.math.uh.edu/~jiwenhe/math2331/lectures/sec4_1.pdf https://youtu.be/ERkBp7hiJMY

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Apply the concepts of Linear Algebra to solve practical problems.	Applying (K3)
CO2	To Understand the fundamental concepts of probability.	Understand (K2)
CO3	By applying the knowledge of one-dimensional random variables to standard distributions which can describe real life phenomenon.	Applying (K3)
CO4	Understand the basic concepts of two-dimensional random variables and apply in engineering applications.	Understand (K 2)



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CO5	Apply the concept of testing of hypothesis for small and large samples in real life problems.	Applying (K3)
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V - Mapping Table Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	3	3	2	2
CO2	3	-	3	3	2	2
CO3	3	-	3	3	2	2
CO4	3	-	3	3	2	2
CO5	3	2	3	3	2	3




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I - Course Name: 25MC111 JAVA PROGRAMMING LABORATORY

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Java Programming	MCA – Master of Computer Applications	I	PCC	0	0	4	2

II - Course Objectives

1.	To cultivate software development proficiency through object-oriented programming techniques applicable to real-world scenarios.
2.	To foster understanding and implementation of fundamental concepts including classes, packages, interfaces, inheritance, exception handling, and file processing within software development.
3.	To facilitate comprehension and practical application of event handling and GUI components in Java-based applications.

III - Course Content

EXPERIMENTS
1. Design and Implement Java programs that deals with the following: - Classes, Objects, Abstraction, Encapsulation, Inheritance, Polymorphism and Interfaces. - Exception handling using user defined exceptions. - String Handling (String Class objects – string manipulation functions). - Creation of User Interfaces using SWING and graphic features. - Creation and Manipulation of Generic objects. - Multithreading Concepts with Examples
2. Java socket programming. - Implementation of chat client-server application. - Implementation of simple http client/server application.
3. Reading websites using URL class.
4. Developing JSON based AJAX enabled rich Internet Applications
5. Implementation of SMTP, POP3 & IMAP protocols.
6. Implementation of any Information System using JDBC.
7. Web Application development using JSP and JSF.
8. Session Management and Implementation of Cookies using JSF.
9. Development of Hibernate framework-based application for O/R mapping.
10. Web application development using Spring framework.

TOTAL: 30 PERIODS**LIST OF EQUIPMENTS : (60 Students per Batch)****Tools:** NetBeans IDE/ Eclipse/ Visual Studio/Spring tool SDS

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IV - Course Outcome

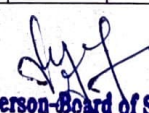
On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Implement the simple java programs using object-oriented programming concepts	Apply (K3)
CO2	Illustrate simple applications using package and exceptions.	Understand (K2)
CO3	Implement the applications using multithreading and files.	Apply (K3)
CO4	Create GUIs and event driven programming applications.	Create (K6)
CO5	Execute the real-world problem in team by applying the appropriate features of object-oriented programming paradigm with best practices and document its methodology	Apply (K3)

Text Books:	- Schildt, H., Java: The Complete Reference, 11th Ed., McGraw Hill Education, New Delhi, 2019. - Schildt, H., Introducing JavaFX 8 Programming, 1st Ed., McGraw Hill Education, New Delhi, 2015.
Reference Books:	- Deitel, P. J. & Deitel, H. M., Java for Programmers, 2nd Ed., Pearson Education, 2012. - Horstmann, C. & Cornell, G., Core Java Volume I: Fundamentals, 9th Ed., Prentice Hall, 2011. - Schildt, H., The Complete Reference Java 2, 5th Ed., Tata McGraw Hill, 2002. - Oracle, The Java Tutorials, Oracle Documentation.
MOOC/Web Platforms:	https:// docs.oracle.com/ javase/tutorial/ index.html. https://www.javatpoint.com/javafx-tutorial

V - Mapping Table Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	1	2	1	2	-	1	2	3
CO2	2	1	3	1	2	-	1	3	1
CO3	2	2	1	2	2	-	2	3	2
CO4	2	2	1	3	2	-	2	1	2
CO5	1	3	3	1	2	-	2	1	2




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I - Course Name:25MC112 - Communication Skills Enhancement - I

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic understanding of English language for reading, writing, listening, and speaking	MCA – Master of Computer Applications	I	EEC	0	0	2	1

II - Course Objectives

OBJECTIVES:	
1.	To provide opportunities to learners to practice English and thereby make them proficient users of the language.
2.	To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology.
3.	To enhance the performance of students listening, speaking, reading and writing and

III - Course Content

Preamble: This course aims to build proficiency in English communication by focusing on practical usage in academic and workplace settings. It enables learners to develop the core language skills required for professional growth.		
Unit – I	LISTENING SKILLS	6 Periods
Practicing neutral accents-Listening to short talks and lectures-Completing listening comprehension exercises-Listening to TED Talks		
Unit – II	SPEAKING SKILLS	6 Periods
Giving one-minute talks-Participating in small group discussions-Making formal presentations		
Unit – III	READING SKILLS	6 Periods
Reading comprehension passages-Reading subject-specific material-Learning and applying technical vocabulary		
Unit – IV	WRITING SKILLS I	6 Periods
Understanding formal vs. informal writing-Paragraph writing-Essay writing		
Unit – V	WRITING SKILLS II	6 Periods
- Email writing - Practicing professional email formats - Writing proficient essays and emails		



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TOTAL: 30 PERIODS

Recommended Software/ MOOC/Web Platforms:	• Globarena Software.
	• Open-Source Software and YouTube Videos in Career Lab.
	Open Source Platforms
	• TED Talks
	• https://www.digitalteacher.in/english-language-lab

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Listen and comprehend Lectures in English	Understand (K2)
CO2	Articulate well and give presentations clearly	Apply (K3)
CO3	Participate in Group Discussions successfully	Apply (K3)
CO4	Communicate effectively in formal and informal writing	Apply (K3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	-	-
CO2	-	3	-	-	3	-	3	3	-
CO3	-	3	-	-	3	-	3	3	3
CO4	-	3	-	-	-	-	3	3	3




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Bridge Course

I-Course Name: 25BMC01 - Data Structures and Algorithms

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic understanding of programming fundamentals	MCA-Master of Computer Applications	I	BC	3	0	0	3

II - Course Objectives

1.	Be familiar with basic techniques of algorithm analysis.
2.	Be exposed to the concept of ADTs.
3.	Learn linear data structures-List, Stack and Queue.
4.	Learn nonlinear data structures-Tree and Graphs.
5.	Be exposed to sorting, searching and hashing algorithms

III - Course Content

Unit - I	INTRODUCTION	9 Periods
Introduction - Abstract Data Types (ADT) – Arrays and its representation – Structures – Fundamentals of algorithmic problem solving – Important problem types – Fundamentals of the analysis of algorithm – analysis framework – Asymptotic notations, Properties, Recurrence Relation.		
Unit – II	L INEAR DATA STRUCTURES - STACK, QUEUE	9 Periods
Stack ADT – Operations on Stack - Applications of stack – Infix to postfix conversion – evaluation of expression - Queue ADT – Operations on Queue - Circular Queue - Applications of Queue.		
Unit – III	LINEAR DATA STRUCTURES – LIST	9 Periods
List ADT - Array-based Implementation - Linked list implementation - Singly Linked Lists – Circularly linked lists – Doubly Linked Lists - Applications of linked list – Polynomial Addition.		
Unit - IV	SEARCHING, SORTING AND HASH TECHNIQUES	9 Periods
Searching: Linear search – Binary Search- comparison of linear search and binary search, Sorting algorithms: Insertion sort - Bubble sort – selection sort - Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing.		
Unit - V	NON LINEAR DATA STRUCTURES - TREES AND GRAPHS	9 Periods
Trees and its representation – left child right sibling data structures for general trees- Binary Tree – Binary		

TOTAL : 45 PERIODS




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Reference Books:	- Levitin, A., Introduction to the Design and Analysis of Algorithms, 3rd Ed., Pearson Education. - Sharma, A. K., Data Structures Using C, 2nd Ed., Pearson Education Asia, 2013. - Horowitz, E., Anderson-Freed & Sahni, S., Fundamentals of Data Structures in C, 2nd Ed., University Press, 2007. - Balagurusamy, E., Data Structures Using C, Tata McGraw Hill, 2015 Reprint. - Weiss, M. A., Data Structures and Algorithm Analysis in C, 2nd Ed., Pearson Education India, 2016. - Tremblay, J. P. & Sorensen, P. G., An Introduction to Data Structures with Applications, 2nd Ed., Tata McGraw Hill, New Delhi, 2017.
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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Analyze algorithms and determines their time complexity.	Analyse (K4)
CO2	Understand the concepts of data types, data structures and linear structures	Understand (K2)
CO3	Apply data structures to solve various problems	Applying (K3)
CO4	Apply different Sorting, Searching and Hashing algorithms.	Applying (K3)
CO5	Understand non-linear data structures	Understand (K2)

V - Mapping Table Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	3	2	1	0	3	1	0
CO2	1	0	3	2	2	0	3	1	0
CO3	1	0	2	3	3	0	3	3	1
CO4	1	0	2	3	3	0	3	3	1
CO5	1	0	2	3	3	0	3	2	1




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I-Course Name: 25BMC02 - Database Management Systems

Prerequisite	Programme Name	Sem	Category	L	T	P	C
Basic knowledge of data handling concepts and fundamental programming skills	MCA-Master of Computer Applications	I	BC	3	0	0	3

II - Course Objectives

1.	To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram.
2.	To make a study of SQL and relational database design.
3.	To know about data storage techniques and query processing.
4.	To impart knowledge in transaction processing, concurrency control techniques and recovery procedures.

III - Course Content

Unit - I	INTRODUCTION	9 Periods
File systems versus Database systems – Data Models – DBMS Architecture – Data Independence – Data Modeling using Entity – Relationship Model –E-R Modeling.		
Unit – II	RELATIONAL MODEL AND QUERY EVALUATION	9 Periods
Relational Model Concepts – Relational Algebra – SQL – Basic Queries – Complex SQL Queries – Views – Constraints		
Unit – III	DATABASE DESIGN & APPLICATION DEVELOPMENT	9 Periods
Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.		
Unit - IV	TRANSACTION PROCESSING	9 Periods
Query Processing-Transaction Processing – Properties of Transactions - Serializability – Transaction support in SQL - Locking Techniques –Validation Techniques — Recovery concepts – Shadow paging – Log Based Recovery.		
Unit - V	FILES AND INDEXING	9 Periods
File operations – Hashing Techniques – Indexing – Single level and Multi-level Indexes – B+ tree – Static Hashing		

TOTAL : 45 PERIODS

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Reference Books:	1. Abraham Silberschatz, Henry F.Korth and S.Sundarshan "Database System Concepts", Seventh Edition, McGraw Hill, 2017. 2. Ramez Elmasri and Shamkant Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education Delhi, 2017 3. Raghu Ramakrishnan, —Database Management Systems , Fourth Edition, McGrawHill College Publications, 2015. 4. Lee Chao, "Database Development and Management", Auerbach Publications, 1st edition, 2010 5. Carlos Coronel, Peter Rob, and Stephen Morris, "Database Principles Fundamentals of Design, Implementation, and Management –10th Edition", Course Technology, Cengage Learning, 2013 6. C.J. Date, "An Introduction to Database Systems", Eighth Edition, Pearson Education Delhi, 2003
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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the basic concepts of the database and data models.	Analyse (K4)
CO2	Design a database using ER diagrams and map ER into Relations and normalize the relations	Understand (K2)
CO3	Acquire the knowledge of query evaluation to monitor the performance of the DBMS.	Applying (K3)
CO4	Develop a simple database applications using normalization.	Applying (K3)
CO5	Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.	Understand (K2)

V - Mapping Table Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	1	1	2	2	1	1	2	2	1
CO2	2	2	2	3	2	2	3	2	1
CO3	2	2	2	3	2	2	3	2	1
CO4	2	2	3	3	3	3	3	3	2
CO5	3	2	3	2	2	2	2	3	2




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I - Course Name: 25MC201 Python Programming

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computer fundamentals and logical thinking skills	MCA – Master of Computer Applications	II	PCC	3	0	2	4

II- Course Objectives

1	To familiarize students with the fundamental concepts, syntax, and structure of Python programming
2	To develop the ability to analyze problems and implement logical solutions using Python
3	To impart knowledge on modular programming techniques, including functions, modules, and packages.
4	To enable students to perform file handling operations and utilize Python libraries for various computational tasks.
5	To equip learners with the skills to apply Python for data processing, web interactions, and basic database connectivity

III - Course Content

Preamble: This course introduces the fundamental concepts and syntax of Python while developing students' problem-solving abilities. It covers modular programming, file handling, and essential libraries to build practical applications. The course also prepares learners to use Python for data processing, web interaction, and basic database connectivity.

Unit – I	BASICS OF PYTHON	9 PERIODS
Introduction to Python Programming – Python Interpreter and Working Environment – Variables and Identifiers – Values and Types – Operators and Expressions – Operator Precedence – Conditional Statements (if, if-else, nested conditions) – Iterative Statements (while, for, range) – break, continue, pass – Functions: definition, parameters, return values – Local and Global Scope – Recursion.		
Unit – II	DATA TYPES IN PYTHON	9 PERIODS
Lists, Tuples, Sets, Strings, Dictionary, Modules: Module Loading and Execution – Packages – Making Your Own Module – The Python Standard Libraries.		
Unit – III	FILE HANDLING AND EXCEPTION HANDLING	9 PERIODS
Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files –File Position –Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions- User -Defined exceptions.		
Unit – IV	PACKAGES AND FRAMEWORKS	9 PERIODS
The Python Libraries for data processing, data mining and visualization- NUMPY, Pandas, Matplotlib, Plotly - Frameworks- Django, Flask, Web2Py		



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Unit – V	OBJECT ORIENTED PROGRAMMING IN PYTHON	9 PERIODS
Classes and Objects – Attributes and Methods – Constructors – Inheritance – Encapsulation – Polymorphism – Class method vs Static method – Python object persistence – Garbage collection – Mutable and Immutable objects.		

TOTAL : 45 PERIODS**Lab Experiments**

1. Write Python programs using conditional and looping statements.
2. Implement functions with parameters and return values.
3. Develop recursive Python programs.
4. Programs using lists, tuples, sets, and dictionaries.
5. Implement list and dictionary comprehensions.
6. Programs using map, filter, and reduce functions.
7. File handling programs for text, CSV, and JSON files.
8. Implement exception handling using try-except blocks.
9. Program demonstrating object serialization.
10. Create and use user-defined modules and packages.
11. Programs using Python standard libraries (OS, Sys, Random).
12. Basic data analysis using NumPy and Pandas.
13. Program demonstrating class creation and object usage.
14. Implement inheritance, polymorphism, and encapsulation.
15. Program demonstrating class and static methods.

TOTAL: 30 PERIODS**TOTAL: 45+30=75 PERIODS**

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Text Books:	1. Allen B. Downey, —Think Python: How to Think Like a Computer Scientist , Second Edition, Shroff, O_Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/) 2. Reema Thareja, Python Programming: Using Problem Solving Approach, 2nd Edition, Oxford University Press, 2023. 3. Paul Barry, Head First Python, 3rd Edition, O'Reilly Media, 2023.
Reference Books:	1. Mark Lutz, Learning Python, 5th Edition (Updated Reprint), O'Reilly Media, 2023. 2. Eric Matthes, Python Crash Course, 3rd Edition, No Starch Press, 2023. 3. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition (Revised Reprint), O'Reilly/Shroff Publishers, 2022. 4. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 3rd Edition, O'Reilly Media, 2022. 5. Jake VanderPlas, Python Data Science Handbook, Updated Edition, O'Reilly Media, 2022.
MOOC/Web Platforms:	• https://nptel.ac.in/courses/106106145 • https://www.coursera.org/learn/python • https://docs.python.org/3/

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Apply basic Python programming constructs such as variables, data types, operators, conditional statements, iterative statements, functions, and recursion to solve computational problems.	Apply (K3)
CO2	Use Python built-in data types, comprehensions, functional programming constructs, and standard libraries for efficient data manipulation and modular programming.	Apply (K3)
CO3	Develop Python programs for file handling and implement exception handling mechanisms to build robust and error tolerant applications.	Analyze (K4)
CO4	Apply and utilize Python packages, libraries, and frameworks for data processing, visualization, and basic web application development.	Apply (K3)
CO5	Design and implement object-oriented Python programs using classes, inheritance, polymorphism, encapsulation, and object persistence concepts.	Analyze (K4)



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V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	3	2	1
CO2	2	3	2	1	1	1	2	2	1
CO3	3	2	3	2	2	1	3	3	1
CO4	2	1	2	3	2	2	3	2	1
CO5	2	1	2	3	3	2	3	3	2




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I - Course Name: 25MC202 Cloud Computing Technologies

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computer fundamentals and networking concepts	MCA – Master of Computer Applications	II	PCC	3	0	0	3

II- Course Objectives

1	To understand the fundamental concepts of distributed systems and cloud computing architectures.
2	To analyze cloud service models, deployment models, and their suitability for different application needs.
3	To apply virtualization techniques for efficient management of server, network, and storage resources in cloud environments.
4	To utilize cloud platforms and tools for deploying, configuring, and managing cloud-based applications.
5	To understand and apply modern cloud technologies such as microservices, containerization, and DevOps practices for scalable application development.

III - Course Content

Preamble: This course provides an introduction to the fundamentals of Cloud Computing, covering service models, deployment models, and virtualization concepts. It equips students with the knowledge of cloud infrastructure, storage, networking, and emerging trends such as microservices and DevOps, enabling them to understand and work with modern cloud-based environments.

Unit – I	BASICS OF CLOUD COMPUTING	9 PERIODS
Cloud Computing Basics – Desired features of Cloud Computing – Elasticity in Cloud – On demand provisioning - Applications – Benefits – Cloud Components: Clients, Datacenters & Distributed Servers – Characterization of Distributed Systems – Distributed Architectural Models - Principles of Parallel and Distributed computing - Applications of Cloud computing –Benefits of cloud services.		
Unit – II	CLOUD SERVICE MODELS AND OPEN-SOURCE CLOUD PLATFORMS	9 PERIODS
Cloud services models: IaaS, PaaS, SaaS (overview) – Open-source Cloud Software: Eucalyptus, Open Nebula, Open stack, Aneka, Cloud sim. Benefits and applications of different cloud services		
Unit – III	CLOUD INFRASTRUCTURE	9 PERIODS
Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system - NIST Cloud computing Reference Architecture – Public, Private and Hybrid clouds.		



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Unit – IV	CLOUD STORAGE	9 PERIODS
Cloud storage providers - Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things Service Oriented Architecture – Web Services – AWS Flexibility in Cloud Storage.		
Unit – V	CLOUD VIRTUALIZATION	9 PERIODS
Basics of Virtualization – Emulation – Types of Virtualization – Implementation levels of Virtualization - Virtualization structures – Tools & Mechanisms – Virtualization of CPU, Memory & I/O Devices – Desktop Virtualization –Server Virtualization – Google App Engine – Amazon AWS - Federation in the Cloud.		

TOTAL : 45 PERIODS

Text Books:	1. Cloud Computing and MicroServices — Jinmin Yang, Springer-Cham, 1st Edition, 2025 SpringerLink. 2. Cloud Computing: Concepts, Technology & Architecture — Thomas Erl, Zaigham Mahmood & Ricardo Puttini, Prentice Hall, 2nd Edition, 2013. 3. Cloud Computing: A Hands-On Approach — Arshdeep Bahga & Vijay Madisetti (ideal for practical labs and understanding virtualization + cloud basics). 4. Building Microservices: Designing Fine-Grained Systems — Sam Newman (for Unit V — microservices and DevOps foundations).
Reference Books:	1. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C. Fox & Jack J. Dongarra, Morgan Kaufmann, 1st Ed., 2012. 2. Architecting the Cloud: Design Strategies for Cloud Computing, Michael Kavis, Wiley, 2014. 3. The Tao of Microservices — Richard Rodger, Manning Publications, 1st Ed., 2017. 4. Microservices Architecture: Aligning Principles, Practices, and Culture, Mike Amundsen & Ronnie Mitra, SPD Publications, 2016.
MOOC/Web Platforms:	• https://onlinecourses.nptel.ac.in/noc21_cs14/preview (NPTEL Online Courses) • https://nptel.ac.in/courses/106105167 (NPTEL) • https://www.coursera.org/browse/information-technology/cloud-computing (Coursera) • https://www.coursera.org/courses?query=devops (Coursera)



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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the fundamentals, features, components, distributed system concepts, and applications of cloud computing.	Understand (K2)
CO2	Explain cloud service models (IaaS, PaaS, SaaS) and open-source cloud platforms along with their benefits and applications.	Understand (K2)
CO3	Analyze cloud architecture, design challenges, networking technologies, deployment models, and NIST cloud reference architecture.	Analyze (K4)
CO4	Describe cloud storage technologies, IoT-enabling technologies, service- oriented architecture, web services, and AWS cloud storage features.	Understand (K2)
CO5	Understand virtualization concepts, types, implementation techniques, tools, and real-world cloud platforms such as Google App Engine and Amazon AWS.	Understand (K2)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	–	2	1	1
CO2	2	2	3	2	2	–	2	2	1
CO3	3	2	3	3	2	1	3	2	1
CO4	2	3	2	2	3	1	2	3	1
CO5	3	2	3	2	3	2	3	3	2




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I - Course Name: 25MC203 Full Stack Web Development

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computer fundamentals and logical thinking skills	MCA – Master of Computer Applications	II	PCC	3	0	0	3

II - Course Objectives

1	To understand the fundamentals of web programming and client-side scripting.
2	To learn server-side development using NodeJS.
3	To understand API development with Express Framework
4	To understand and architect databases using NoSQL and SQL databases
5	To learn the advanced client-side scripting and ReactJS framework

III - Course Content

Preamble: This course introduces the fundamentals of Full Stack Web Development, covering both frontend and backend technologies to build dynamic web applications. It enhances students' problem-solving abilities by enabling them to design, develop, and deploy real-world, interactive, and database-driven web solutions.		
UNIT I	INTRODUCTION TO CSS AND JAVASCRIPT	9 PERIODS
Introduction to Web: Server - Client - Communication Protocol (HTTP) – Structure of HTML Documents – Basic Markup tags – Working with Text and Images with CSS– CSS Selectors – CSS Flexbox - JavaScript: Data Types and Variables - Functions - Events – AJAX: GET and POST		
UNIT II	ADVANCED NODE JS AND DATABASE	9 PERIODS
Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS		
UNIT III	CLIENT-SIDE & SERVER-SIDE PROGRAMMING	9 PERIODS
Introduction to Web Servers- JavaScript Runtime Environment and Node.js- JavaScript on Server Side using Node.js- Node Package Manager (NPM)- Creating Web Servers using HTTP Module-Static Files- Introduction to Express Framework- Middleware and Routing in Express- Asynchronous Programming: Callbacks, Promises, async/await- REST API Development using Express-Fetching and Handling JSON Data.		
UNIT IV	FRONT END FRAMEWORK USING REACT	9 PERIODS
Introduction to Front-End Frameworks- React Architecture and ReactDOM- JSX - Components and Component Structure- Properties- State and Lifecycle-Event Handling in React-Fetch API and Consuming REST APIs- JavaScript Local Storage- Lifting State Up- Composition and Inheritance- UI Development Concepts using React Components.		



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UNIT V	APP IMPLEMENTATION IN CLOUD	9 PERIODS
Cloud Providers Overview - Virtual Private Cloud (VPC) - Scaling Techniques: Horizontal and Vertical Scaling – Virtual Machines – Virtual Networking: Ethernet and Switches- Containerization using Docker- Container Orchestration using Kubernetes-Deployment of Web Applications in Cloud Environment.		

TOTAL: 45 PERIODS

Text Books:	1. Ethan Brown, Web Development with Node and Express: Leveraging the JavaScript Stack, 2nd Edition, O'Reilly Media, 2020. 2. Alex Banks and Eve Porcello, Learning React: Modern Patterns for Developing React Apps, 3rd Edition, O'Reilly Media, 2023.
Reference Books:	1. Mario Casciaro & Luciano Mammino, Node.js Design Patterns, 3rd Edition, Packt Publishing, 2020. 2. Kristina Chodorow, MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, 2023. 3. Jon Duckett, HTML & CSS: Design and Build Websites, 1st Edition, Wiley, 2011. 4. Jon Duckett, JavaScript and jQuery: Interactive Front-End Web Development, 1st Edition, Wiley, 2014. 5. Kelsey Hightower, Brendan Burns, and Joe Beda, Kubernetes: Up and Running, 3rd Edition, O'Reilly Media, 2023. 6. Nigel Poulton, The Kubernetes Book, Updated Edition, 2024.
MOOC/Web Platforms:	• https://www.w3schools.com/ • https://nodejs.org/en/docs • https://expressjs.com/ • https://react.dev/ • https://www.mongodb.com/docs/ • https://docs.docker.com/ • https://kubernetes.io/docs/ • https://nptel.ac.in/courses/106/106/106106182 • https://www.coursera.org/specializations/full-stack-react




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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand HTML, CSS, JavaScript, and AJAX for building interactive web pages.	Understand (K2)
CO2	Apply Node.js to work with databases, handle authentication, and manage data.	Apply (K3)
CO3	Implement client-side and server-side applications using Node.js, Express, REST APIs, and asynchronous programming.	Apply (K3)
CO4	Implement responsive user interfaces using React components and state management	Apply (K3)
CO5	Deploy and manage web applications in cloud environments using virtualization, containers, and orchestration tools.	Analyze(K4)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	3	2	1
CO2	2	3	2	1	1	1	2	2	1
CO3	3	2	3	2	2	1	3	3	1
CO4	2	1	2	3	2	2	3	2	1
CO5	2	1	2	3	3	2	3	3	2



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I - Course Name: 25MC204 Mobile Application Development

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of Mobile Application Development including UI design, client-server interaction, and foundational programming concepts	MCA – Master of Computer Applications	II	PCC	3	0	2	4

II - Course Objectives

1	To understand the need and characteristics of mobile applications.
2	To design the right user interface for mobile applications.
3	To understand the design issues in the development of mobile applications.
4	To understand the development procedure for mobile applications.
5	To develop mobile applications using various tools and platforms

III - Course Content

Preamble: This course introduces the fundamentals of mobile application development, enabling students to design interactive interfaces, implement event-driven programming, and build functional mobile apps with data handling and deployment features.		
Unit – I	INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT	9 PERIODS
Mobile Application Model – Embedded Systems Overview – Market and Business Drivers for Mobile Applications – Mobile Application Infrastructure – Managing Resources – Mobile Device Profiles – Frameworks and Tools – Publishing and Delivery of Mobile Applications – Requirements Gathering and Validation – Design Constraints – Overview of Architecting Mobile Applications.		
Unit – II	USER INTERFACE DESIGN	9 PERIODS
Generic UI Development – Screen Elements and Layouts – Layout Managers – Event Handling – Gesture-Based UI – Touch Events and Gestures – Multimodal and Multichannel UI – Voice XML – UI Design Principles – Usability Considerations.		
Unit – III	APPLICATION DESIGN AND DEVELOPMENT	9 PERIODS
Memory Management – Design Patterns for Limited Memory Devices – Workflow for Mobile Application Development – Java API – Dynamic Linking – Plugins – Rule of Thumb for using DLLs – Multithreading in Java – Concurrency and Resource Management – Achieving Quality Constraints: Performance, Security, Availability and Modifiability.		




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Unit – IV	MOBILE OPERATING SYSTEMS	9 PERIODS
Overview of Mobile OS – Android and iOS (Overview) – Android Application Architecture – Anatomy of a Mobile Application – Android Components – Activities, Services and Intents Data Storage and Retrieval – Packaging and Deployment – Mobile Application Security – Common Threats and Security Practices.		
Unit – V	ADVANCED MOBILE APPLICATION DEVELOPMENT	9 PERIODS
– Communication via Web – Integration with Cloud Services (Overview) – Notification and Alarms – Graphics and Multimedia – Location-Based Services (GPS, WiFi) – Telephony Services – Introduction to Hybrid Mobile Applications – Native vs Hybrid Applications – Overview of Hybrid Frameworks – Case Study.		

TOTAL: 45 PERIODS**Lab Experiment**

1. Installation and configuration of mobile application development environment.
2. Study and comparison of mobile application frameworks and tools.
3. Case study analysis of popular mobile applications and their business models.
4. Develop a mobile application using UI toolkits and frameworks.
5. Design an application using layout managers and event listeners.
6. Implement gesture-based user interaction in a mobile application.
7. Design a mobile application considering memory and resource constraints.
8. Implement multithreading in a mobile application.
9. Develop an application demonstrating dynamic linking.
10. Develop an Android application using SQLite database.
11. Implement an Android application that writes data into the SD card.
12. Deploy and test an Android application on emulator/device.
13. Develop a web-based mobile application accessing internet and location data.
14. Implement an Android application using telephony services (SMS).
15. Mini project: Location-based or cloud-enabled mobile application.

TOTAL: 30 PERIODS**TOTAL: 45+30=75 PERIODS**

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Text Books:	1. Neil Smyth, Android Studio 4.2 Development Essentials – Kotlin Edition, 1st Edition, Payload Media, 2023. 2. John Horton, Android Programming for Beginners, 3rd Edition, Packt Publishing, 2021.
Reference Books:	1. Bill Phillips, Chris Stewart, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, 5th Edition, Addison-Wesley, 2022. 2. Reto Meier & Ian Lake, Professional Android, 4th Edition, Wrox/Wiley, 2018. 3. Dawn Griffiths and David Griffiths, Head First Kotlin, O'Reilly Media, 2020. 4. Ian F. Darwin, Android Cookbook: Problems and Solutions for Android Developers, 3rd Edition, O'Reilly Media, 2021.
MOOC/Web Platforms:	• https://developer.android.com/ (Official Android Developer Documentation) • https://kotlinlang.org/docs/home.html (Kotlin Docs) • https://www.coursera.org/learn/android-app-development • https://nptel.ac.in/courses/106/106/106106198 • https://www.udacity.com/course/new-android-fundamentals--ud851 https://firebase.google.com/docs (For database and cloud integration)

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Explain the need, characteristics, and architecture of mobile applications.	Understand (K2)
CO2	Implement effective and user-friendly mobile application interfaces using appropriate UI components.	Apply (K3)
CO3	Analyze design challenges and apply event-driven and responsive design principles in mobile application development.	Analyze (K4)
CO4	Develop mobile applications using industry-standard development tools like Android Studio with Java/Kotlin.	Apply (K3)
CO5	Integrate storage, API communication, and deployment techniques to build and publish functional mobile applications.	Analyze (K4)




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V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	2	1	1
CO2	2	2	3	2	2	1	2	2	1
CO3	2	2	3	3	2	1	3	2	1
CO4	2	2	3	3	2	2	3	3	2
CO5	1	2	3	3	3	2	3	3	3




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I - Course Name: 25MC205 Computer Networks

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basics of networks	MCA – Master of Computer Applications	II	PCC	3	0	2	5

II- Course Objectives

1	To familiarize students with the fundamentals of data communication, types of computer networks, communication models, protocols, reference models, and basic networking devices.
2	To enable students to understand transmission media, network topologies, link layer concepts, flow and error control mechanisms, and basic wired and wireless networking technologies.
3	To provide knowledge of network and transport layer functions, switching techniques, IP addressing, routing basics, and the roles of TCP and UDP in data transmission.
4	To introduce students to internet-based applications, including client-server architecture, DNS, WWW, email services, and basic API-based network communication in mobile applications.
5	To acquaint students with network security fundamentals, modern network management concepts, SDN, NFV, and emerging 5G technologies along with their features and real-life applications.

III - Course Content

Preamble: This course provides foundational knowledge of computer networking concepts essential for understanding Internet-based applications, mobile computing, and cloud technologies.

Unit – I	INTRODUCTION	9 PERIODS
Introduction to Data Communication- Networks-Uses of Computer Networks – Types of Networks (LAN, MAN, WAN) – Communication Model – Data Transmission Concepts – Protocols and Standards – OSI Reference Model – TCP/IP Model – Network Devices – Hub, Switch, Router.		
Unit – II	DATA COMMUNICATION AND MEDIA	9 PERIODS
Transmission Media – Guided and Unguided Media – Network Topologies- Link Layer – Flow Control – Error Detection – Ethernet – Wireless LAN – Bluetooth – Bridges.		
Unit – III	NETWORK AND TRANSPORT LAYERS	9 PERIODS
Network Layer Functions – Switching Concepts – Circuit Switching and Packet Switching - Internet Protocol (IP) – IP Addressing – IPv4 and IPv6 – Routing Basics – Transport Layer Services – TCP and UDP (Overview).		
Unit – IV	APPLICATION LAYER	9 PERIODS
Application layer-Domain Name System-Case Study: FTP-HTTP-SMTP-SNMP		



Unit – V	EMERGING TRENDS IN NETWORKING	9 PERIODS
Introduction to Network Security – Importance of Security – Basic Security Mechanism - Encryption Techniques– Symmetric and Asymmetric Encryption (DES, RSA – Overview)- Firewall - Network Architecture - Network Functions Virtualization (NFV)- Overview of 5G Networks.		

TOTAL: 45 PERIODS**Lab Experiments**

1. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP.
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. Write an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Implement data encryption and data decryption.
8. Write a program for congestion control using Leaky bucket algorithm.
9. Write a program for frame sorting techniques used in buffers.

TOTAL: 30 PERIODS**TOTAL: 45+30=75 PERIODS**

Text Books:	1. Andrew S. Tanenbaum, —Computer Networks , PHI, 5th Edition, 2013 2. Behrouz A. Forouzan, —Data communication and Networking , TataMcGrawHill, 4th Edition, 2006 3. Teerawat Ussaruyakul, Ekram Hossain, Introduction to Network Simulator NS2, Springer, 2009
Reference Books:	4. William Stallings, —Data and Computer Communication , 7th Edition, Pearson Education, 2007.
MOOC/Web Platforms:	Computer Networks, https://nptel.ac.in/courses/106/106/106106091/



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IV Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Explain the fundamentals of data communication, network types, communication models, protocols, and network devices.	Apply (K3)
CO2	Apply knowledge of transmission media, network topologies, link layer protocols, and error control techniques to network scenarios.	Apply (K3)
CO3	Analyze network and transport layer functions including IP addressing, routing, switching, and TCP/UDP services.	Analyze (K4)
CO4	Apply application layer protocols (FTP, HTTP, SMTP, SNMP, DNS) to design and troubleshoot networked applications.	Apply (K3)
CO5	Analyze emerging networking trends such as network security mechanisms, encryption techniques, firewalls, NFV, and 5G networks.	Analyze (K4)

V Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	–	2	1	1
CO2	2	2	3	2	2	–	2	2	1
CO3	3	2	3	3	2	1	3	2	1
CO4	2	3	2	2	2	–	2	3	1
CO5	3	2	3	2	3	2	3	3	2




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I - Course Name: 25MC211 Full Stack Web Development Laboratory

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computer fundamentals and logical thinking skills	MCA – Master of Computer Applications	II	PCC	0	0	4	2

II - Course Objectives

1	To implement the client side of the web application using javascript
2	To understand Javascript on the desktop using NodeJS.
3	To develop a web application using NodeJS and Express
4	To implement a SPA using React.
5	To develop a full stack single page application using React, NodeJS, and a Database (MongoDB or SQL).

LIST OF EXPERIMENTS:
1. Create a form and validate the contents of the form using JavaScript. 2. Get data using Fetch API from an open-source endpoint and display the contents in the form of a card. 3. Create a NodeJS server that serves static HTML and CSS files to the user without using Express. 4. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars. 5. Create a NodeJS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the user should be obtained from a HTML form. 6. Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form. 7. Create a counter using ReactJS 8. Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads. 9. Create a simple Sign up and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using NodeJS and Express Framework. 10. Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH. 11. Create a docker container that will deploy a NodeJS ping server using the NodeJS image.

TOTAL:60 PERIODS



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SOFTWARE REQUIREMENTS

1. NodeJS/ExpressJS, ReactJS, Docker, any IDE like NOTEPAD++/ VisualStudio code/sublime text etc.,
2. MySQL, MongoDB.

Text Books:	1. Ethan Brown, Web Development with Node and Express: Leveraging the JavaScript Stack, 2nd Edition, O'Reilly Media, 2020. 2. Alex Banks and Eve Porcello, Learning React: Modern Patterns for Developing React Apps, 3rd Edition, O'Reilly Media, 2023.
Reference Books:	1. Mario Casciaro & Luciano Mammino, Node.js Design Patterns, 3rd Edition, Packt Publishing, 2020. 2. Kristina Chodorow, MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, 2023. 3. Jon Duckett, HTML & CSS: Design and Build Websites, 1st Edition, Wiley, 2011. 4. Jon Duckett, JavaScript and jQuery: Interactive Front-End Web Development, 1st Edition, Wiley, 2014. 5. Kelsey Hightower, Brendan Burns, and Joe Beda, Kubernetes: Up and Running, 3rd Edition, O'Reilly Media, 2023. 6. Nigel Poulton, The Kubernetes Book, Updated Edition, 2024.
MOOC/Web Platforms:	• https://www.w3schools.com/ • https://nodejs.org/en/docs • https://expressjs.com/ • https://react.dev/ • https://www.mongodb.com/docs/ • https://docs.docker.com/ • https://kubernetes.io/docs/ • https://nptel.ac.in/courses/106/106/106106182 • https://www.coursera.org/specializations/full-stack-react

III - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Implement and deploy the client side of the web application.	Apply (K3)
CO2	Develop and deploy server-side applications using NodeJS.	Apply (K3)
CO3	Use Express framework in web development	Analyze (K4)
CO4	Implement and architect database systems in both NoSQL and SQL environments.	Apply (K3)
CO5	Develop a full stack single page application using React, NodeJS, and a Database and deploy using containers	Analyze (K4)



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IV - Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	1	3	2	2
CO2	2	2	3	3	2	1	3	3	2
CO3	2	2	3	3	2	1	3	3	2
CO4	2	2	3	3	2	1	3	3	2
CO5	2	2	3	3	3	2	3	3	3




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I - Course Name: 25MC212 COMMUNICATION SKILLS ENHANCEMENT - II

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic understanding of English Knowledge	MCA – Master of Computer Applications	II	EEC	0	0	2	1

II - Course Objectives

1	To provide opportunities to learners to practice their communication skills to make them become proficient users of English.
2	To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology to communicate globally.
3	To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures.

III - Course Content

Preamble: The course Communication Skills Enhancement – II is designed to strengthen learners' proficiency in English communication required for academic, professional, and workplace environments. It focuses on developing advanced listening, speaking, reading, and writing skills through interactive, technology-enabled instructional methods.

List of Experiments**1. SOFT SKILLS**

People skills Interpersonal skills Team building skills Leadership skills
Problem solving skills

2. PRESENTATION SKILLS

Preparing slides with animation related to the topic Introducing oneself to the audience
Introducing the topic
Presenting the visuals effectively – 5 minute presentation

3. GROUP DISCUSSION SKILLS

Participating in group discussions Brainstorming the topic Activities to improve GD skills.

4. INTERVIEW SKILLS

Interview etiquette – dress code – body language Attending job interviews
Answering questions confidently
Technical interview – telephone/Skype interview Emotional and cultural intelligence
Stress Interview



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TOTAL: 15 PERIODS

Recommended Software/MOOC/Web Platforms:	• Globarena Software. • Open-Source Software and YouTube Videos in Career Lab. Open Source Platforms • TED Talks • https://www.digitalteacher.in/english-language-lab
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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Apply effective communication skills in academic and professional contexts to enhance English proficiency.	Apply (K3)
CO2	Demonstrate improved LSRW skills using technology-enabled tools for global communication.	Apply (K3)
CO3	Perform confidently in placement interviews, group discussions, and recruitment tasks through refined speaking and interpersonal skills.	Analyze (K4)
CO4	Use appropriate vocabulary, grammar, and communication strategies to express ideas clearly and professionally.	Understand (K2)
CO5	Collaborate effectively in team-based communication activities, demonstrating improved soft skills and workplace etiquette.	Analyze (K4)

V - Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	1	2	1	1	3
CO2	2	2	2	1	1	2	1	2	3
CO3	3	3	2	1	3	3	1	2	3
CO4	2	3	2	1	2	2	1	1	3
CO5	2	2	1	1	3	3	1	1	3




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PROFESSIONAL ELECTIVES SEMESTER II - ELECTIVE I**I - Course Name: 25PMC01 Software Project Management**

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of software engineering concepts and the software development life cycle (SDLC).	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	To understand the basic concepts in software project management.
2	To know how to do project planning for the software process.
3	To learn the cost estimation techniques during the analysis of the project.
4	To understand the quality concepts for ensuring the functionality of the software
5	To learn the concepts of risk management and globalization issues in project Management.

III - Course Content

Preamble: This course provides fundamental knowledge and skills for planning, organizing, executing, and controlling software projects to ensure timely and quality delivery.

Unit – I	SOFTWARE PROJECT MANAGEMENT CONCEPTS	9 PERIODS
Introduction to Software Project Management - An Overview of Project Planning - Select Project Identifying Project Scope and Objectives - Activities Covered by Software Project Management, Plans, Methods and Methodologies - Project Products and Characteristics. Estimate Efforts - Identify Activity Risks and Allocate Resources – Six Sigma - Software Quality Defining Software Quality - ISO 9126 - External Standards.		
Unit – II	SOFTWARE EVALUATION AND COSTING	9 PERIODS
Project Evaluation - Strategic Assessment - Technical Assessment - Cost-Benefit Analysis - Cash Flow Forecasting - Cost-Benefit Evaluation Techniques - Risk Evaluation - Selection of Appropriate – Project Approach - Choosing Technologies - Choice of Process Models - Structured Methods.		
Unit – III	SOFTWARE ESTIMATION TECHNIQUES	9 PERIODS
Software Effort Estimation - Problems with Over and Under Estimations - Basis of Software Estimation - Software Estimation Techniques - Expert Judgment - Estimating by Analogy - Activity Planning Project Schedules - Projects and Activities - Sequencing and Scheduling Activities.		




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Unit – IV	RISK MANAGEMENT	9 PERIODS
Risk Management - Nature of Risk - Managing Risk - Risk Identification and Analysis - Reducing the Risk - Resource Allocation - Scheduling Resources - Critical Paths - Cost Scheduling - Monitoring and Control - Creating Framework - Cost Monitoring – Prioritizing Monitoring.		
Unit – V	GLOBALIZATION ISSUES IN PROJECT MANAGEMENT	9 PERIODS
Globalization Issues in Project Management - Evolution of Globalization Challenges in Building Global Teams - Models for the Execution of some Effective Management Techniques for Managing Global Teams - Impact of Internet on Project Management - The Effect of The Internet on Project Management -- Managing Projects for the Internet – Effect on Project Management Activities Comparison of Project Management Software.		

TOTAL: 45 PERIODS

Text Books:	1. Gerard O'Regan, Guide to Software Project Management, Springer, 2025. 2. Lawrence J. Peters, Software Project Management: Methods and Techniques, CRC Press, 2024. 3. Kathy Schwalbe, Information Technology Project Management, Latest Edition, Cengage Learning.
Reference Books:	1. Frank Tsui, Managing Software Projects, Jones & Bartlett / Viva Books, Latest Edition. 2. Bob Hughes & Mike Cotterell, Software Project Management, 5th Edition, McGraw Hill, 2009. 3. Pankaj Jalote, Software Project Management in Practice, Pearson Education, 2002. 4. Roger S. Pressman & Bruce Maxim, Software Engineering: A Practitioner's Approach, McGraw Hill, Latest Edition. 5. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 12th Edition, Wiley, 2017. 6. Jon Duckett, JavaScript and jQuery: Interactive Front-End Web Development, 1st Edition, Wiley, 2014. 7. Kelsey Hightower, Brendan Burns, and Joe Beda, Kubernetes: Up and Running, 3rd Edition, O'Reilly Media, 2023. 8. Nigel Poulton, The Kubernetes Book, Updated Edition, 2024.




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MOOC/Web Platforms:	• https://nptel.ac.in/courses/106105218 – NPTEL Software Project Management course (Planning, Scheduling, Risk, Quality). • https://nptel.ac.in/courses/110105167 – NPTEL Project Management (Project lifecycle, Cost, Resource, Evaluation). • https://www.coursera.org/professional-certificates/google-project-management – Google Project Management Professional Certificate (Industry-relevant skills). • https://www.coursera.org/learn/agile-project-management – Agile Project Management (Scrum, Sprints, Modern Software Projects). • https://www.pmi.org/learning/free-online-courses – PMI Free Short Courses (Basics of Project Management). • https://www.edx.org/learn/project-management – edX Project Management Courses (General and software-focused). • https://firebase.google.com/docs – Firebase Documentation (Database and Cloud Integration for software projects).
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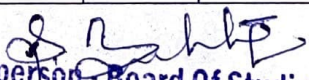
IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the activities during the project scheduling of any software application.	Understand (K2)
CO2	Understand the risk management activities and the resource allocation for the projects.	Understand (K2)
CO3	Apply the software estimation and recent quality standards for evaluation of the software projects.	Apply (K3)
CO4	Acquire knowledge and skills needed for the construction of highly reliable software project.	Analyze (K4)
CO5	Analyze project requirements to prepare reliable and replicable cost estimations for effective project planning and management.	Analyze (K4)

V - Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	2	3	2	2	2	1	1
CO2	2	2	2	3	3	3	2	1	2
CO3	3	3	3	3	3	2	3	2	2
CO4	3	2	3	3	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	2




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I - Course Name: 25PMC02 Advances in Operating System

Prerequisite	Program Name	Sem	Category	L	T	P	C
Fundamental knowledge of Operating Systems, including process management, memory management, file systems, and basic concepts of distributed systems.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II- Course Objectives

1	To review the fundamentals of operating systems.
2	To gain knowledge on distributed operating system concepts that includes issues, mutual exclusion algorithms, deadlock detection algorithms.
3	To gain insight on the distributed resource management components. The algorithms for implementation of distributed shared memory, and distributed scheduling.
4	To know the components and management aspects of real time, mobile operating systems.
5	To acquire knowledge on the basics of Linux and mobile OS like iOS, android.

III - Course Content

Preamble: This course covers advanced concepts in operating systems, including distributed, real-time, and mobile OS, with emphasis on resource management, scheduling, and practical knowledge of Linux, Android, and iOS.

Unit – I	FUNDAMENTALS OF OPERATING SYSTEMS	9 PERIODS
Overview - Functions of Operating System - Types of Advanced Operating System – Synchronization Mechanisms -Concept of Process - Threads - Critical Section - Process Scheduling - Models of Resources - Deadlocks Detection -- Prevention and Recovery		
Unit – II	DISTRIBUTED OPERATING SYSTEMS	9 PERIODS
Issues in Distributed Operating System - Communication Primitives - Lamport's Logical clocks –Causal Ordering of Messages - Distributed Mutual Exclusion Algorithms - Centralized and Distributed Deadlock Detection Algorithms		
Unit – III	DISTRIBUTED RESOURCE MANAGEMENT	9 PERIODS
Distributed File Systems - Design Issues – Implementation-Distributed Shared Memory - Algorithms for Implementing Distributed Shared Memory -- Distributed Scheduling - Issues in Load Distributing - Load Distributing Algorithms.		



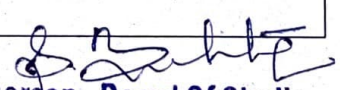
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Unit – IV	REAL TIME AND MOBILE OPERATING SYSTEMS	9 PERIODS
Basic Model of Real Time Systems - Characteristics - Applications of Real Time Systems - Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems - Microkernel Design Client Server Resource Access - Processes and Threads – Memory Management - File System.		
Unit – V	CASE STUDIES	9 PERIODS
Linux System - Design Principles -Kernel Modules -- Process Management - Scheduling – Memory Management - Input Output Management - File System – Inter process Communication - iOS and Android - Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer – File System.		

TOTAL: 45 PERIODS

Text Books:	1. Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, Operating System Concepts, 10th Edition, Wiley, 2018. 2. Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems, 4th Edition, Pearson, 2015. 3. Rajib Mall, Real-Time Systems: Theory and Practice, 2nd Edition, Pearson, 2018.
Reference Books:	1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Pearson, 2018. 2. Gary Nutt, Operating Systems: A Modern Perspective, 3rd Edition, Addison-Wesley, 2014. 3. Achyut S. Godbole and Atul Kahate, Operating Systems, Tata McGraw-Hill, 2011. 4. K. M. Chandy and J. Misra, Distributed Operating Systems, 1st Edition, Addison-Wesley, 1988.
MOOC/Web Platforms:	• https://nptel.ac.in/courses/106106145 – NPTEL: Advanced Operating Systems (Distributed Systems, Synchronization, Deadlock). • https://www.coursera.org/learn/operating-systems – Coursera: Introduction to Operating Systems (Basics + Advanced Topics). • https://www.edx.org/course/operating-systems-and-concurrency – edX: Operating Systems and Concurrency (Practical examples, Linux). • https://linuxjourney.com/ – Linux Journey (Hands-on Linux OS learning). • https://developer.apple.com/learn/curriculum/ios/ – Apple Developer Curriculum: iOS fundamentals. • https://developer.android.com/courses – Android Developers: Learning Android OS fundamentals.




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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Discuss various synchronization, scheduling and deadlock issues.	Understand (K2)
CO2	Demonstrate mutual exclusion and deadlock detection of distributed operating system.	Apply (K3)
CO3	Discuss various resource management techniques for distributed systems.	Understand (K2)
CO4	Demonstrate and apply the features of real-time and mobile operating systems in practical scenarios.	Apply (K3)
CO5	Perform administrative tasks on Linux servers, iOS and android.	Apply (K3)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	2	2	1	1
CO2	3	2	2	2	2	3	2	2	1
CO3	2	2	2	2	2	2	3	2	1
CO4	2	2	1	1	1	2	2	1	1
CO5	3	3	2	2	3	3	3	2	2




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I - Course Name: 25PMC03 Soft Computing Techniques

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of mathematics, algorithms, and programming.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	To gain knowledge of soft computing theories and its fundamentals.
2	To design a soft computing system required to address a computational task.
3	To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience.
4	To introduce the ideas of fuzzy sets, fuzzy logic and to become familiar with neural networks and generalize to form appropriate rules for inferencing systems.
5	To familiarize with genetic algorithms and other random search procedures while seeking global optimum in self-learning situations.

III - Course Content

Preamble: This course provides fundamental knowledge and skills for planning, organizing, executing, and controlling software projects to ensure timely and quality delivery.

Unit – I	FUZZY COMPUTING	9 PERIODS
Basic Concepts of Fuzzy Logic - Fuzzy Sets and Crisp Sets - Fuzzy Set Theory and Operations Properties of Fuzzy Sets - Fuzzy and Crisp Relations - Fuzzy to Crisp Conversion Membership Functions - Interference in Fuzzy Logic - Fuzzy If -- Then Rules – Fuzzy Implications and Fuzzy Algorithms Fuzzification and Defuzzification - Fuzzy Controller.		
Unit – II	FUNDAMENTALS OF NEURAL NETWORKS	9 PERIODS
Neuron - Nerve Structure and Synapse - Artificial Neuron and its Model - Activation Functions Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks – Recurrent Networks. Various Learning Techniques: Perception and Convergence Rule - Auto-Associative and Hetero-Associative Memory.		
Unit – III	BACKPROPAGATION NETWORKS	9 PERIODS
Back Propagation Networks Architecture: Perceptron Model - Solution - Single Layer Artificial Neural Network - Multilayer Perceptron Model; Back Propagation Learning Methods - Effect of Learning Rule Co - Efficient. Back Propagation Algorithm – Factors Affecting Back propagation Training Applications.		
Unit – IV	COMPETITIVE NEURAL NETWORKS	9 PERIODS
Kohonen's Self Organizing Map - SOM Architecture - Learning Procedure - Application. Learning Vector Quantization - Learning by LVQ. Adaptive Resonance Theory -Learning Procedure -Applications.		




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Unit – V	GENETIC ALGORITHM	9 PERIODS
Basic Concepts - Working Principle -- Basic GA Framework- Different GA Architectures – Genetic Representations - Encoding - Initialization and Selection - Genetic Operators – Mutation Generational Cycle - Applications.		

TOTAL: 45 PERIODS

Text Books:	1. S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, 3rd Edition, Wiley, 2023. 2. Oscar Castillo & Patricia Melin, Fuzzy Logic and Neural Networks for Hybrid Intelligent System Design, Springer, 2023. 3. Mohd Anas Wajid, Aasim Zafar, Mohammad Saif Wajid, Akib Mohi Ud Din Khanday, Pronaya Bhattacharya, Soft Computing and Machine Learning: A Fuzzy and Neutrosophic View of Reality, CRC Press, 2025.
Reference Books:	1. S. Rajasekaran & G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI / Prentice Hall India, Latest Edition. 2. Valluru & T. Nageswar, Introduction to Neural Networks, Fuzzy Logic & Genetic Algorithms, Jaico Publishing, Latest Edition. 3. Oscar Castillo & Patricia Melin, Intelligent System Design Based on Soft Computing Models, Springer, 2025.
MOOC/Web Platforms:	• https://nptel.ac.in/courses/108106195 – NPTEL: Soft Computing Techniques (Fuzzy Logic, Neural Networks, Genetic Algorithms). • https://www.coursera.org/learn/machine-learning – Coursera: Machine Learning (Neural Networks and Optimization). • https://www.edx.org/course/artificial-intelligence – edX: Artificial Intelligence (Soft Computing methods). • https://www.tutorialspoint.com/fuzzy_logic/index.htm – Tutorialspoint: Fuzzy Logic tutorials. • https://www.geeksforgeeks.org/genetic-algorithms/ – GeeksforGeeks: Genetic Algorithms (Practical examples and coding). • https://www.tensorflow.org/ – TensorFlow official site (Implement Neural Networks for pattern recognition and regression).




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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Identify and describe soft computing techniques and their roles in building intelligent machines.	Understand (K2)
CO2	Recognize the feasibility of applying a soft computing methodology for a particular problem.	Analyze (K4)
CO3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.	Apply (K3)
CO4	Apply genetic algorithms to optimization problems.	Apply (K3)
CO5	Analyze pattern classification and regression problems to select and configure neural network architectures using a soft computing approach.	Analyze (K4)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	2	2	1	1
CO2	2	2	3	3	2	2	2	2	1
CO3	3	2	2	2	3	2	3	2	2
CO4	3	2	2	2	3	2	3	2	2
CO5	3	3	3	3	3	3	3	3	2




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I - Course Name: 25PMC04 E - Learning

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computers, internet usage, and familiarity with digital learning tools and educational technology concepts.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	Understand the fundamentals and evolution of e-learning technologies.
2	Analyze instructional design principles for effective digital content development.
3	Develop e-learning modules using modern tools and multimedia resources.
4	Evaluate and implement learning management systems (LMS) for academic and corporate learning.
5	Apply assessment strategies and feedback mechanisms to enhance learner engagement.

III - Course Content

Preamble: This course introduces concepts, tools, and methods for designing and delivering effective digital learning through e-learning platforms.

Unit – I	INTRODUCTION TO E-LEARNING	9 PERIODS
Evolution and scope of e-learning - Definitions, benefits, and challenges - Types and models of e-learning: synchronous, asynchronous, blended learning - Digital learning tools overview		
Unit – II	INSTRUCTIONAL DESIGN FOR E-LEARNING	9 PERIODS
Instructional design models: ADDIE, Dick & Carey, Kemp - Principles of effective e-learning content - Multimedia integration: text, audio, video, animations - Cognitive load and learner engagement		
Unit – III	E-LEARNING TOOLS AND CONTENT DEVELOPMENT	9 PERIODS
Authoring tools: Adobe Captivate, Articulate Storyline, Camtasia - Creating interactive modules and simulations - SCORM compliance and standards - Accessibility and usability considerations		
Unit – IV	LEARNING MANAGEMENT SYSTEMS (LMS)	9 PERIODS
Overview of LMS platforms (Moodle, Blackboard, Google Classroom) - User management, course creation, and content delivery - Tracking and reporting learner progress - Integration with third-party tools		
Unit – V	ASSESSMENT, FEEDBACK, AND EVALUATION	9 PERIODS
Assessment strategies: quizzes, assignments, surveys - Formative and summative evaluation – Feedback mechanisms and analytics for learning improvement - Trends and future of e-learning: AI, VR/AR in learning		



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TOTAL: 45 PERIODS

Text Books:	1. Allison Rossett, E-Learning: Strategies for Delivering Knowledge in the Digital Age, 2nd Edition, Wiley, 2021. 2. Tony Bates, Teaching in a Digital Age: Guidelines for Designing Teaching and Learning, 2nd Edition, Tony Bates Associates, 2020. 3. R. P. Tripathi, E-Learning Concepts and Techniques, Oxford University Press, 2019.
Reference Books:	1. William Horton, E-Learning by Design, 2nd Edition, Wiley, 2019. 2. Dr. B. R. Sharma, E-Learning Tools and Techniques, McGraw Hill, 2018. 3. P. Singh, Instructional Design for E-Learning, Cengage Learning, 2020.
MOOC/Web Platforms:	• https://nptel.ac.in/courses/106105218 – NPTEL: E-Learning and Digital Education • https://www.coursera.org/learn/elearning – Coursera: E-Learning Essentials • https://www.edx.org/course/digital-learning – edX: Digital Learning and Instructional Design • https://moodle.org/ – Moodle official site (LMS practice and resources) • https://www.tutorialspoint.com/elearning/index.htm – Tutorialspoint: E-Learning tutorials

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Explain the fundamentals, scope, and models of e-learning.	Understand (K2)
CO2	Analyze instructional design models and multimedia principles for e-learning.	Analyze (K4)
CO3	Develop e-learning content and modules using appropriate tools and software.	Apply (K3)
CO4	Implement and manage learning using LMS platforms	Apply (K3)
CO5	Evaluate learner performance and provide feedback to improve learning outcomes	Evaluate (K5)

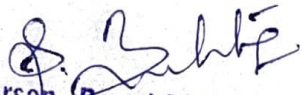



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V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	2	1	1
CO2	3	2	2	2	2	2	2	2	1
CO3	3	2	2	2	3	3	3	2	2
CO4	3	3	2	2	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	2




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I - Course Name: 25PMC05 Professional Ethics in IT

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of Information Technology concepts and understanding of professional work environments.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	To understand the concepts of computer ethics in the work environment.
2	To understand the threats in computing environment
3	To understand the intricacies of accessibility issues
4	To ensure safe exits when designing the software projects
5	To apply ethical principles and professional responsibilities in IT decision-making and problem-solving.

III - Course Content

Preamble: This course introduces ethical principles, professional responsibilities, and legal issues in IT, helping students develop accountability, decision-making skills, and awareness of the social impact of technology.

Unit – I	SOCIAL NETWORKING ETHICS AND ETIQUETTES	9 PERIODS
Definition of Ethics - Right, Good, Just - The Rational Basis of Ethics - Theories of Right: Intuitionist vs. End - Based vs. Duty-Based -Rights, Duties, Obligations - Theory of Value - Conflicting Principles and Priorities -The Importance of Integrity - The Difference Between Morals, Ethics and Laws - Ethics in the Business World - Corporate Social Responsibility - Creating an Ethical Work Environment Including Ethical Considerations in Decision Making.		
Unit – II	ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME	9 PERIODS
IT Professionals - Are IT Workers Professionals - Professional Codes of Ethics - Professional Organizations - Certification - IT Professional Ethics - The Reveton Ransomware Attacks - IT Security Incidents - A Major Concern - Why Computer Incidents are So Prevalent - Types of Exploits - Types of Perpetrators - Risk Assessment - Establishing a Security Policy - Educating Employees and Contract Workers.		
Unit – III	FREEDOM OF EXPRESSION, PRIVACY	9 PERIODS
First Amendment Rights - Obscene Speech-Defamation - Freedom of Expression - Key Issues Controlling Access to Information on the Internet - Strategic Lawsuit Against Public Participation (SLAPP)-Anonymity on the Internet- Information Privacy - Privacy Laws and Applications – Data Breaches - Electronic Discovery - Workplace Monitoring – Advanced Surveillance Technology.		



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Unit – IV	FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS	9 PERIODS
Intellectual Property Rights - Copyrights- Software Copyright Protection - Copyright and Piracy Patents - Software Patents - Cross- Licensing Agreements - Trade Secrets - Trade Secret Laws Employees and Trade Secrets - Key Intellectual Property Issues - Plagiarism - Reverse Engineering Trademark Infringement - Cyber Squatting.		
Unit – V	SOCIAL NETWORKING ETHICS AND ETIQUETTES	9 PERIODS
Social Networking Web Site - Business Applications of Online Social Networking - Social Network Advertising - The Use of Social Networks in the Hiring Process - Social Networking Ethical Issues. Cyber bullying - Crime in Virtual Worlds - Educational and Business Uses of Virtual Worlds.		

TOTAL: 45 PERIODS

Text Books:	1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, Prentice Hall, 5th Edition, 2015. 2. Michael J. Quinn, Ethics for the Information Age, Pearson, 8th Edition, 2020. 3. Joseph Migga Kizza, Ethical and Social Issues in the Information Age, Springer, 6th Edition, 2022.
Reference Books:	1. Richard A. Spinello, CyberEthics: Morality and Law in Cyberspace, Jones & Bartlett Learning, 7th Edition, 2021. 2. Rebecca Herold, Managing an Information Security and Privacy Awareness and Training Program, CRC Press, 2020. 3. Mason, Michael, Computer Ethics, 4th Edition, Pearson, 2018. 4. Tavani, Herman T., Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing, 6th Edition, Wiley, 2021.
MOOC/Web Platforms:	• https://www.coursera.org/courses?query=ethics • https://www.edx.org/learn/ethics • https://ethics-of-ai.mooc.fi/ • https://www.edx.org/learn/cybersecurity




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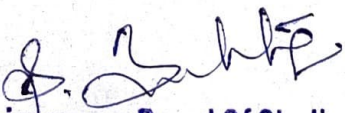
IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the concepts of computer ethics and professional conduct in IT workplaces	Understand (K2)
CO2	Analyze computing threats and ethical challenges in IT environments.	Analyze (K4)
CO3	Examine accessibility, safety, and usability considerations in software projects.	Analyze (K4)
CO4	Apply ethical principles in software design, development, and project management.	Apply (K3)
CO5	Evaluate IT decision-making and problem-solving based on professional and ethical standards	Evaluate (K5)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	3	2	1
CO2	3	3	2	2	2	1	3	3	2
CO3	2	2	2	2	2	1	2	2	2
CO4	3	3	3	2	2	2	3	3	2
CO5	3	3	3	3	2	2	3	3	3




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I - Course Name: 25PMC06 - Web Technologies

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic understanding of computer fundamentals and prior exposure to any programming language	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	To understand the basics of websites, HTML5, CSS3, Web 2.0 and Bootstrap.
2	To learn client-side scripting using JavaScript, DOM, events, validation and JSON.
3	To develop server-side applications using Servlets, sessions, cookies and JDBC.
4	To apply PHP and XML technologies for dynamic pages and structured data processing.
5	To gain familiarity with AngularJS and modern web frameworks like Firebase, Docker, NodeJS, React and Django.

III - Course Content

Preamble: This course introduces the fundamental concepts and tools required for designing and developing modern, responsive and interactive web applications. It covers client-side and server-side technologies, data handling, and contemporary web frameworks essential for full-stack development.

Unit – I	WEBSITE BASICS	9 PERIODS
Web essentials – W3C - Clients – Servers - Communication – Markup Languages – XHTML – Simple XHTML Pages Style Sheets – CSS		
Unit – II	CLIENT-SIDE PROGRAMMING	9 PERIODS
Client-side programming – Java script language – Java Script Objects – Host Objects Browsers And The DOM.		
Unit – III	SERVER-SIDE PROGRAMMING	9 PERIODS
Server-side programming – Java servlets – basics – simple program – separating programming and presentation – ASP/JSP - JSP basics ASP/JSP objects – simple ASP/JSP pages.		
Unit – IV	PHP AND XML	9 PERIODS
An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL and XSLT-Case Studies.		



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Unit – V	INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS	9 PERIODS
Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JSReact- Django- UI & UX.		

TOTAL: 45 PERIODS

Text Books:	1. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011. 2. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011. 3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packet Publishing
Reference Books:	1. Stephen Wynkoop and John Burke —Running a Perfect Website , QUE, 2nd Edition, 1999. 2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009. 3. Gopalan N.P. and Akilandeswari J., —Web Technology , Prentice Hall of India, 2011. 4. UttamK.Roy, —Web Technologies , Oxford University Press, 2011. 5. Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1st edition, O'Reilly.
MOOC/Web Platforms:	1. https://www.coursera.org/ 2. https://www.edx.org 3. https://www.udemy.com/ 4. https://swayam.gov.in/ 5. https://onlinecourses.nptel.ac.in/

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand website basics, HTML5, CSS3 and Bootstrap for building responsive pages.	Understand (K2)
CO2	Apply JavaScript, DOM, events, validation and JSON to develop interactive client-side features.	Apply(K3)
CO3	Develop server-side applications using Servlets, sessions, cookies and JDBC for database connectivity.	Apply(K3)
CO4	Use PHP and XML (DTD, Schema, XSLT) to create dynamic pages and process structured data.	Apply (K3)
CO5	Apply AngularJS and modern frameworks like Firebase, Docker, NodeJS, React and Django to build web applications.	Apply(K3)

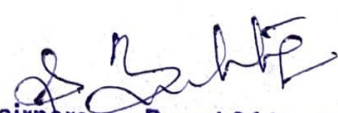


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V Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	3	2	1
CO2	3	2	3	2	2	1	3	3	2
CO3	3	2	3	3	2	2	3	3	3
CO4	2	2	3	3	2	1	2	3	2
CO5	2	1	3	3	3	2	3	3	3




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I - Course Name: 25PMC07 Software Engineering and Testing

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of programming concepts, object-oriented programming, and fundamentals of computer science.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	To understand fundamental concepts of software engineering, software processes, and various SDLC models.
2	To learn requirements engineering processes, feasibility analysis, modeling techniques, and documentation standards.
3	To gain knowledge of software quality concepts, SQA frameworks, verification, validation, and industry models.
4	To understand software testing foundations, testing methodologies, testing life cycle, and correctness principles.
5	To acquire skills in test planning, test strategy development, scheduling, test case design, bug reporting, and metrics.

III - Course Content

Preamble: This course introduces the fundamentals of software engineering and software testing, covering SDLC, requirements engineering, quality assurance, and testing techniques. It equips students with the skills to design, develop, and evaluate reliable and maintainable software systems.

Unit – I	SOFTWARE ENGINEERING FUNDAMENTALS	9 PERIODS
Introduction to Software Engineering - Software Components, Software Characteristics, Software Crisis - An Overview of Project Planning - Select Project - Identifying Project Scope and Objectives - Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.		
Unit – II	REQUIREMENTS ENGINEERING AND SYSTEM MODELING TECHNIQUES	9 PERIODS
Requirement Engineering Process: Elicitation – Analysis – Documentation - Review and Management of User Needs - Feasibility Study - Information Modelling - Data Flow Diagrams - Entity Relationship Diagrams - Decision Tables - SRS Document - IEEE Standards for SRS - Architectural design - component level design - user interface design - WebApp Design		



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Unit-III	SOFTWARE QUALITY CONCEPTS AND QUALITY ASSURANCE FRAMEWORKS	9 PERIODS
Quality concepts, Review techniques, Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.		
Unit – IV	FOUNDATIONS OF SOFTWARE TESTING	9 PERIODS
Foundations of Software Testing -Introduction to test Software - Black-Box Testing and White-Box Testing-Software Testing Life Cycle - V- model of Software Testing - Program Correctness and Verification, Reliability versus Safety - Failures, Errors and Faults - Software Testing Principles, Program Inspections - Stages of Testing - Unit Testing - Integration Testing- System Testing.		
Unit – V	TEST PLANNING	9 PERIODS
The Goal of Test Planning - High Level Expectations - Inter-group Responsibilities – Test Phases - Test Strategy - Resource requirements - Tester Assignments - Test Schedule - Test Cases - Bug Reporting - Metrics and Statistics-Case studies.		

TOTAL: 45 PERIODS

Text Books:	1. R. S. Pressman, —Software Engineering: A Practitioners Approach , McGraw Hill, 7th edition, 2010 2. Rajib Mall, —Fundamentals of Software Engineering , PHI Publication, 3rd edition, 2009 3. Desikan, S., & Ramesh, G. —Software testing: Principles and practices . Pearson Education. 4. Westerveld, D. (2021). —API testing and development with Postman . Packt Publishing. 5. Gundecha, U. —Selenium Web Driver 3 practical guide . Packt Publishing.
Reference Books:	1. —Software Engineering = Ian Sommerville, 10th Edition, Pearson, 2015. 2. —Software Engineering: A Practitioner's Approach – Roger S. Pressman, 8th Edition, McGraw-Hill, 2014. 3. —Software Testing: Principles and Practices – Srinivasan Desikan & Gopalaswamy Ramesh, Pearson, 2006. 4. —Foundations of Software Testing = Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black, 2nd Edition, Cengage, 2008. 5. —Software Quality Assurance: From Theory to Implementation – Daniel Galin, Pearson, 2004. 6. —Software Engineering = K. K. Aggarwal & Yogesh Singh, New Age International, 2012.




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MOOC/Web Platforms:	• https://onlinecourses.nptel.ac.in/noc25_cs108/preview • https://www.coursera.org/learn/introduction-to-software-engineering • https://www.coursera.org/courses?query=software%20testing • https://www.edx.org/learn/software-development • https://ocw.mit.edu/
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IV - Course Outcome

	On completion of the course, the students will be able to	Bloom's Level Mapped
CO1	Understand software engineering principles, software characteristics, project planning concepts, and SDLC models.	Understand (K2)
CO2	Apply requirements engineering activities, feasibility analysis, and system modeling techniques to develop structured system specifications.	Apply (K3)
CO3	Analyze software quality concepts, verification & validation activities, and apply SQA frameworks such as ISO and CMM.	Analyze (K4)
CO4	Apply software testing principles, black-box and white-box testing methods, and testing life cycle practices.	Apply (K3)
CO5	Analyze effective test plans, design test cases, prepare schedules, report bugs, and interpret software testing metrics.	Analyze (K4)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	3	2	1
CO2	3	2	2	3	2	1	3	3	2
CO3	3	2	3	3	2	2	3	3	3
CO4	3	2	3	3	2	2	3	3	2
CO5	3	2	3	3	3	3	3	3	3




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I - Course Name: 25PMC08 Agile Methods for Software Development

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of software engineering concepts and object-oriented programming.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II- Course Objectives

1	To understand the principles, values, and practices that form the foundation of Agile methodologies
2	To explore popular agile process frameworks such as Scrum, XP, Crystal, FDD, and Lean development.
3	To learn how agility supports knowledge management and improves team collaboration and decision-making.
4	To analyze agile approaches for requirements engineering and managing evolving requirements.
5	To acquire skills in agile quality assurance practices including TDD, metrics, interaction design, and global software development.

III - Course Content

Preamble: This course introduces the principles and practices of Agile Methodology for modern software development. It emphasizes agile values, processes, team collaboration, and adaptive planning to handle changing requirements effectively. The syllabus covers major agile frameworks, knowledge management, requirements engineering, and quality assurance practices. The course prepares students to apply agile methods in real-world software projects.

Unit – I	AGILE METHODOLOGY	9 PERIODS
Theories for Agile management – agile software development – traditional model vs. agile model - classification of agile methods – agile manifesto and principles – agile project management – agile team interactions – ethics in agile teams - agility in design, testing – agile documentations – agile drivers, capabilities and values.		
Unit – II	AGILE PROCESSES	9 PERIODS
Lean production - SCRUM, Kanban, Crystal, Feature Driven Development, Adaptive Software Development, and Extreme Programming: Method overview – lifecycle – work products, roles and practices.		




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Unit – III	AGILITY AND KNOWLEDGE MANAGEMENT	9 PERIODS
Agile information systems – agile decision making - Early schools of KM – institutional knowledge evolution cycle – development, acquisition, refinement, distribution, deployment, leveraging – KM in software engineering – managing software knowledge – challenges of migrating to agile methodologies – agile knowledge sharing – role of story-cards – Story-card Maturity Model (SMM) – Concept of Story Points – Purpose of Estimation in Agile Projects – Relative Estimation – Benefits of Story Point Estimation. Project Requirement to Epic Conversion – Epic to Feature Mapping – Feature to User Story Conversion – User Story Structure. User Story to Task Conversion – Creation of Sub-Tasks – Identification, Logging, and Tracking of Bugs.		
Unit – IV	AGILITY AND REQUIREMENTS ENGINEERING	9 PERIODS
Impact of agile processes in RE – current agile practices – variance – overview of RE using agile – managing unstable requirements – requirements elicitation – agile requirements abstraction model – requirements management in agile environment, agile requirements prioritization – agile requirements modeling and generation – concurrency in agile requirements generation.		
Unit – V	AGILITY AND QUALITY ASSURANCE	9 PERIODS
Agile Interaction Design - Agile product development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile approach to Quality Assurance - Test Driven Development – Pair programming: Issues and Challenges – Agile approach to Global Software Development.		

TOTAL: 45 PERIODS

Text Books:	1. Agile Software Development: Trends, Challenges and Applications – Susheela Hooda, Vandana Mohindru Sood, Yashwant Singh, Sandeep Dalal & Manu Sood; Wiley, 1st Edition, 2023. 2. Agile Software Development – Peter Wlodarczak; CRC Press, 2023. 3. Agile Software Development – An Overview – K. Amuthabala, Shantala Devi Patil, Thirumagal E, Thanuja K; MileStone Research Publications, 2023. 4. Agile Processes in Software Engineering and Extreme Programming: 24th International Conference on Agile Software Development, XP 2023 – Edited by Christoph J. Stettina, Juan Garbajosa & Philippe Kruchten; Springer-Cham, 2023.
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Reference Books:	1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), —Agile Software Development, Current Research and Future Directions , Springer-Verlag Berlin Heidelberg, 2010 2. David J. Anderson; Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results , Prentice Hall, 2003 3. Hazza& Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science , Springer, VIII edition, 2009 4. Craig Larman, —Agile and Iterative Development: A manager_s Guidel , Addison-Wesley, 2004 5. Kevin C. Desouza, —Agile information systems: conceptualization, construction, and management , Butterworth-Heinemann, 2007.
MOOC/Web Platforms:	• https://www.edx.org/learn/agile-software-development • https://www.coursera.org/courses?query=agile • https://alison.com/course/agile-project-management • https://www.agile-academy.com/en/e-learning/

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Explain the fundamental concepts, values, and principles of Agile methodology	Understand (K2)
CO2	Compare and differentiate major agile process models and their lifecycle activities.	Analyze(K4)
CO3	Describe the role of knowledge management and story-cards in agile environments.	Understand (K2)
CO4	Apply agile approaches to requirements elicitation, prioritization, and modeling.	Apply (K3)
CO5	Analyze agile quality assurance techniques, TDD, and metrics for product development.	Analyze (K4)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	2	2	1
CO2	2	3	3	2	2	1	3	2	2
CO3	2	2	2	3	2	1	2	3	2
CO4	1	2	3	3	2	1	2	2	3
CO5	1	2	3	2	3	1	3	2	3




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I - Course Name: 25PMC09 Business Intelligence

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of databases, data warehousing concepts, and programming fundamentals.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	Provide a strong foundation in data warehousing concepts, architecture, and operations
2	Develop the ability to apply statistical and analytical techniques for data-driven decision making.
3	Equip learners with essential knowledge of statistical tools used in data engineering.
4	Introduce enterprise BI architecture, metadata management, and data modeling principles.
5	Enable students to design, evaluate, and implement advanced dimensional modeling and BI solutions.

III - Course Content

Preamble: This course introduces the concepts, techniques, and tools of Business Intelligence, including data warehousing, data analytics, statistical methods, and dimensional modeling, enabling students to make informed, data-driven decisions.

Unit – I	DATA WAREHOUSING	9 PERIODS
Introduction – Definition – Multidimensional data model – OLAP operations – Warehouse schema – Data warehousing architecture – Warehouse server – Meta data – OLAP Engine – Data warehouse backend process – Cloud data warehousing - Other features		
Unit – II	DATA ANALYTICS	9 PERIODS
Statistical data analysis – Fact based decision making using statistical data analysis – Descriptive model – Predictive model - Analyze and predict results based on historical patterns-Apply statistical methods to economic data, problems and trends		
Unit – III	STATISTICS FOR DATA ENGINEERS	9 PERIODS
Mean, Median, Variance, Standard Deviation –Regression-Correlation Test: Chi square, Spearman Rank correlation, Pearson correlation coefficient – Parametric Test: period sample t- test, Two Independent t-test, One sample t-test – Non Parametric Test: The wilcoxon rank sum test and mannwhileny test, wilcoxon signed-ranked test		
Unit – IV	FUNDAMENTALS OF BUSINESS INTELLIGENCE AND ENTERPRISE DATA ARCHITECTURE	9 PERIODS
Essentials of Business Intelligence-Origins and drivers of business intelligence, successful BI implementation, characteristics of BI-Architecting the Data, Enterprise Data Model and its Benefits, Granularity of Data in Data Warehouse and Role of Metadata		



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 Natham Dindigul 624 401

Unit – V	ADVANCED DATA WAREHOUSING ARCHITECTURES AND DIMENSIONAL MODELING TECHNIQUES	9 PERIODS
Advanced Data Warehousing principles- Data warehousing architectures, DW development, real time DW and DW Administration and security issues-Visualization of Dimension model-Star, snowflake and other advanced models-Aggregated Fact tables -Relational DBMS Support for Dimensional Modeling.		

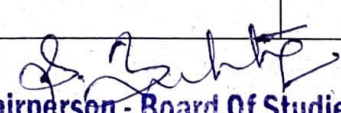
TOTAL: 45 PERIODS

Text Books:	1. Ramesh Sharda, Dursun Delen, Efraim Turban Business Intelligence, Analytics, and Data Science: A Managerial Perspective Pearson, 4th Edition, 2023. 2. Jiawei Han, Micheline Kamber, Jian Pei Data Mining: Concepts and Techniques Morgan Kaufmann, 4th Edition, 2022.
Reference Books:	1. Paulraj Ponniah, Data Warehousing Fundamentals for IT Professionals, Wiley, 2nd Edition, 2021. 2. Ralph Kimball & Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2019. 3. Thomas H. Davenport & Jeanne Harris, Competing on Analytics: The New Science of Winning, Harvard Business Review Press, Updated Edition, 2020. 4. Daniel T. Larose & Chantal D. Larose, Data Science Using Python and R, Wiley, 2023. 5. Anil Maheshwari, Data Analytics Made Accessible, Independently Published, 4th Edition, 2023.
MOOC/Web Platforms:	• https://www.coursera.org/learn/data-warehousing-business-intelligence • https://www.coursera.org/courses?query=data+warehouse • https://www.edx.org/learn/data-warehouse • https://www.coursera.org/browse/data-science/data-analysis • https://www.knowledgehut.com/free-courses/free-data-warehousing-course-with-certificate

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the fundamental concepts of data warehousing, OLAP operations, and cloud data warehousing.	Understand (K2)
CO2	Apply statistical data analysis methods for descriptive, predictive, and fact-based business decision making.	Apply (K3)




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CO3	Use statistical tools such as regression, correlation, and hypothesis testing to solve data engineering problems.	Apply (K3)
CO4	Analyze BI components, enterprise data architecture, metadata, and data granularity to support business processes.	Analyze (K4)
CO5	Analyze and evaluate dimensional models and advanced data warehouse architectures for BI applications.	Analyze (K4)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	3	2	1
CO2	2	3	2	3	2	1	3	3	2
CO3	2	3	2	3	2	1	2	3	2
CO4	3	2	1	2	1	1	3	2	1
CO5	2	2	3	3	2	1	3	3	2




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I - Course Name: 25PMC010 Cyber Security

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computer networks, operating systems, programming concepts, and fundamental IT security principles.	MCA – Master of Computer Applications	II	PEC	3	0	0	3

II - Course Objectives

1	To learn the principles of cyber security and to identify threats and risks.
2	To learn how to secure physical assets and develop system security controls.
3	To understand how to apply security for Business applications and Network Communications.
4	To learn the technical means to achieve security.
5	To learn to monitor and audit security measures.

III - Course Content

Preamble: This course provides fundamental knowledge and skills for planning, organizing, executing, and controlling software projects to ensure timely and quality delivery.

Unit – I	PLANNING FOR CYBER SECURITY	9 PERIODS
Best Practices - Standards and a plan of action - Security governance principles - Components and Approach - Information Risk Management - Asset Identification - Threat Identification – Vulnerability Identification - Risk Assessment Approaches - Likelihood and Impact Assessment - Risk Determination - Evaluation and Treatment - Security Management Function - Security Policy - Acceptable Use Policy Security Management Best Practices. Security Models: Bell La Padula model - Biba Integrity Model Chinese Wall model.		
Unit – II	SECURITY CONTROLS	9 PERIODS
People Management - Human Resource Security - Security Awareness and Education – Information Management - Information Classification and handling - Privacy - Documents and Record Management Physical Asset Management - Office Equipment - Industrial Control Systems – Mobile Device Security -System Development - Incorporating Security into SDLC - Disaster management and Incident response planning.		
Unit – III	CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS	9 PERIODS
Business Application Management - Corporate Business Application Security - End User Developed Applications - System Access - Authentication Mechanisms - Access Control - System Management Virtual Servers - Network Storage Systems - Network Management Concepts -- Firewall - IP Security - Electronic Communications - Case study on OWASP vulnerabilities using OWASP ZAP tool.		



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Unit – IV	TECHNICAL SECURITY	9 PERIODS
Supply Chain Management - Cloud Security - Security Architecture - Malware Protection – Intrusion Detection - Digital Rights Management - Cryptographic Techniques - Threat and Incident Management Vulnerability Management - Security Event Management – Forensic Investigations - Local Environment Management - Business Continuity.		
Unit – V	SECURITY ASSESSMENT	9 PERIODS
Security Monitoring and Improvement - Security Audit - Security Performance – Information Risk Reporting - Information Security Compliance Monitoring - Security Monitoring and Improvement Best Practices.		

TOTAL: 45 PERIODS

Text Books:	1. Noor Zaman Jhanjhi, Khalid Hussain, Mamoon Humayun Azween-bin-Abdullah, João Manuel Tavares, Information Security Handbook, Taylor & Francis, 1st Edition, 2023 2. Keke Gai, Jing Yu, Liehuang Zhu, Introduction to Cybersecurity in the Internet of Things, Springer, 1st Edition, 2024 3. Joseph Migga Kizza, Guide to Computer Network Security, Springer, 1st Edition, 2024 4. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, Prentice Hall, 5th Edition, 2015
Reference Books:	1. William Stallings, "Effective Cyber Security - A guide to using Best Practices and Standards", Addison-Wesley Professional, First Edition, 2019. 2. Adam Shostack, "Threat Modelling - Designing for Security", Wiley Publications, First Edition, 2014. 3. Gregory J. Touhill and C. Joseph Touhill, "Cyber Security for Executives - A Practical Guide", Wiley Publications, First Edition, 2014. 3. Raef Meeuwisse, "Cyber Security for Beginners", Cyber Simplicity Ltd, Second Edition, 2017. 4. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and 4. Penetration Testing Made Easy", Syngress, 2nd Edition, 2013. 5. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, "Security in Computing", Prentice Hall, Fifth Edition, 2015.
MOOC/Web Platforms:	• https://www.coursera.org/courses?query=cybersecurity • https://www.edx.org/ • https://onlinecourses.nptel.ac.in/ • https://www.udemy.com/topic/cyber-security/



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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Implement and Develop a set of risk and security requirements to ensure that there are no gaps in an organization's security practices.	Apply (K3)
CO2	Achieve management, operational and technical means for effective cyber security.	Apply (K3)
CO3	Analyze and monitor the performance of cyber security controls.	Analyze (K4)
CO4	Analyze the system to identify gaps and determine possible improvements.	Analyze (K4)
CO5	Identify and report vulnerabilities in the system	Apply (K3)

V- Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	3	2	2
CO2	3	3	2	2	2	2	3	3	2
CO3	2	3	3	2	2	2	3	3	3
CO4	3	2	3	3	2	2	3	3	2
CO5	3	2	3	2	2	2	3	3	2




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BRIDGE COURSES**(For the M.C.A students admitted under non-computer-science background category)****I - Course Name: 25MC03 - Fundamentals of Computers**

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computer fundamentals	MCA – Master of Computer Applications	II	BC	3	0	0	3

II - Course Objectives

1	To provide students with a solid understanding of computer fundamentals, including hardware, software, and operating systems.
2	To introduce digital fundamentals such as number systems, binary arithmetic, Boolean algebra, and logic gates.
3	To teach the basic elements of the C programming language, including data types, operators, and input/output.
4	To develop the ability to write programs using control statements like loops and conditional constructs in C.
5	To enable students to implement modular C programs using functions, arrays, structures, files, and pointers for problem-solving.

III - Course Content

Preamble: This course introduces the fundamentals of computer science and C programming. It focuses on computer organization, digital concepts, and structured programming to develop problem-solving skills.

Unit – I	COMPUTER FUNDAMENTALS	9 PERIODS
Computer Fundamentals: Basics of computers-basic computer organization-storage hierarchy-storage devices-input-output devices. Computer Software: Introduction to operating systems-Planning the computer program: Purpose of program planning-algorithm-flowcharts-decision tables- pseudocodes.		
Unit – II	DIGITAL FUNDAMENTALS	9 PERIODS
Digital Fundamentals: Information representation - number systems, number system conversion; Computer codes - BCD code, EBCDIC code, ASCII, Unicode; Binary arithmetic; Binary logic - Boolean algebra, Boolean functions, truth table, simplification of Boolean functions , K-map, digital logic gates.		
Unit – III	ELEMENTS OF C LANGUAGE	9 PERIODS
Elements of C language: C character set, identifiers & keywords, data types: declaration & definition. Operators: Arithmetic relational, logical, bitwise, unary, assignment and conditional operators & their hierarchy & associativity, Data input/output.		



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Unit – IV	CONTROL STATEMENTS IN C	9 PERIODS
Control statements: Sequencing, Selection: if and switch statement; iteration: for, while, and do-while loop; break, continue, goto statement.		
Unit – V	FUNCTIONS, DATA STRUCTURES & POINTERS	9 PERIODS
Functions in C language: Definition, prototype, passing parameters, recursion, Data structure: arrays, structures, union, string, data files. Pointers: Declaration, operations on pointers, array of pointers, pointers to arrays.		

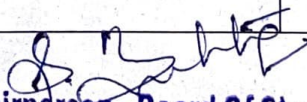
TOTAL : 45 PERIODS

Text Books:	1. Yashwant Kanitkar, Let us C, BPB Publications. 2. Pradeep k. Sinha & Priti Sinha, Computer Fundamentals, BPB Publications 3. Byron S Gottfried, Programming with C, Tata McGrawhill.
Reference Books:	1. Rajaraman V, Fundamentals of Computers, PHI 2. R.G. Dromey, How to solve it by Computer, Pearson Education, 3. Hanly J R & Koffman E.B, Problem Solving and Programm design in C, Pearson.
MOOC/Web Platforms:	• https://nptel.ac.in/courses/106/106/106106144/ • https://www.geeksforgeeks.org/c-programming-language/ • https://www.tutorialspoint.com/computer_fundamentals/index.htm • https://www.programiz.com/c-programming • https://www.khanacademy.org/computing

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the basics of computer systems, hardware, software, and operating systems.	Understand (K2)
CO2	Apply knowledge of number systems, binary arithmetic, Boolean logic, and digital logic gates to solve computational problems.	Apply (K3)
CO3	Use C programming fundamentals, including data types, operators, and input/output statements.	Apply (K3)
CO4	Implement a programs using control statements such as loops, conditional statements, and branching in C.	Apply (K3)
CO5	Analyze and implement modular programs using functions, arrays, structures, files, and pointers in C.	Analyze (K4)

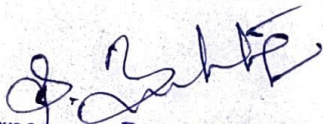



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V- Mapping Table for COs with POs and PSOs

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CO2	2	3	2	1	1	1	2	2	1
CO3	3	2	3	2	2	1	3	3	1
CO4	2	1	2	3	2	2	3	2	1
CO5	2	1	2	3	3	2	3	3	2




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I - Course Name: 25MC04-Basic Computing Laboratory

Prerequisite	Program Name	Sem	Category	L	T	P	C
Basic knowledge of computer fundamentals	MCA – Master of Computer Applications	II	BC	0	0	3	1

II - Course Objectives

1	Enable students to understand the basics of programming constructs such as input/output operations, expressions, and decision-making.
2	Develop logical thinking through hands-on implementation of iterative structures and pattern- generation problems.
3	Provide the ability to handle arrays and strings for real-time data processing applications.
4	Introduce modular programming concepts using functions to design structured programs.
5	Familiarize students with dynamic data handling and memory management using pointers.

List of Experiments

Note: The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. Basic Calculator Using Input / Output and Expressions
2. Simple Voting System Using Decision Making Constructs
3. Number Pattern Generator Using Loops
4. Student Marks Management Using Arrays
5. Text Processing Tool Using String Handling
6. Library Management System Using Functions
7. Contact Management System Using Pointers

TOTAL : 30 PERIODS

Text Books:	1. M. Morris Mano, Computer System Architecture, Pearson Education. 2. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing. 3. S. Tanenbaum, Structured Computer Organization, Pearson Education. 4. Abraham Silberschatz, Peter Baer Galvin & Greg Gagne, Operating System Concepts, Wiley. 5. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill.
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Reference Books:	1. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson. 2. Barry B. Brey, The Intel Microprocessors: Architecture, Programming, and Interfacing, Pearson. 3. Andrew S. Tanenbaum & Herbert Bos, Modern Operating Systems, Pearson. 4. John L. Hennessy & David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann. 5. Ian Sommerville, Software Engineering, Pearson Education.
MOOC/Web Platforms:	• Problem Solving Through Programming in C - https://onlinecourses.nptel.ac.in/noc24_cs42/preview

III - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand how computers use codes and combinations to represent information.	Understand (K2)
CO2	Learn how computers handle data transfer and communicate with input/output devices.	Understand (K2)
CO3	Solve simple problems by writing and using assembly language programs.	Apply (K3)
CO4	Understand the basic working of operating systems and system software.	Understand (K2)
CO5	Apply software development methods to real-world problems.	Apply (K3)

IV - Mapping Table for COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	1	2	1	1
CO2	2	2	1	2	1	1	2	1	1
CO3	3	2	2	2	2	1	3	2	1
CO4	2	2	1	2	1	1	2	1	1
CO5	3	2	2	3	2	2	3	3	2




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