Shree Warana Vibhag Shikshan Mandal's

WARANA UNIVERSITY,

WARANANAGAR

(A State Public University established under Section 3 (6) of MPUA, 2016)

।। विद्या सर्वस्य भूषणम् ।।

Warana University

Established: 2025

Structure &Syllabus

Of

First Year MCA.

Department of Master of Computer Applications

Under

Faculty of Science & Technology

Structure and Syllabus in Accordance With

National Education Policy - 2020

Implemented fromAcademicYear2025-26

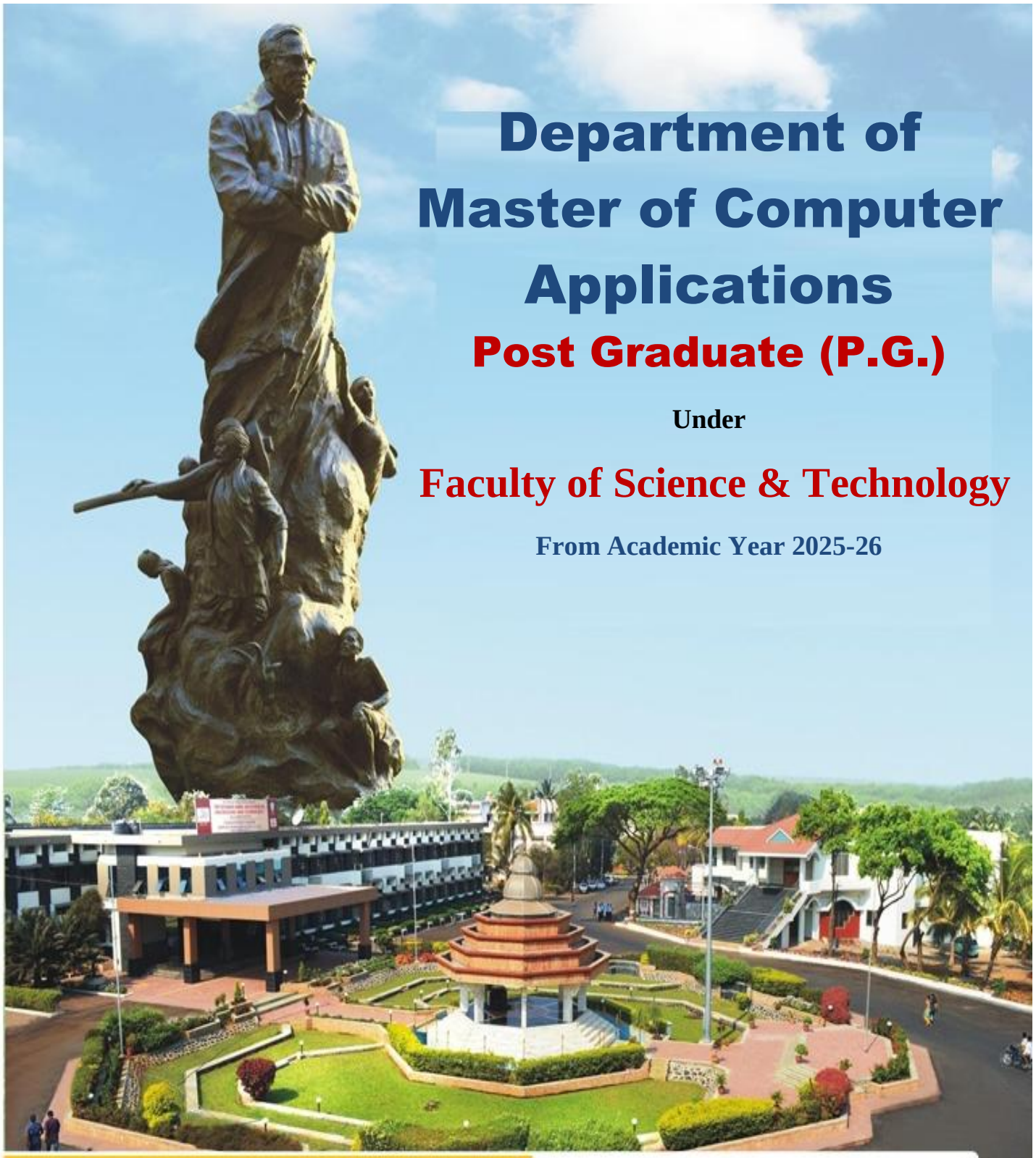
Shree Warana Vibhag Shikshan Mandal's

TATYASAHEB KORE INSTITUTE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS), WARANANAGAR, KOLHAPUR

TKIET
Estd. 1983

Lead Institute of

WARANA UNIVERSITY, WARANANAGAR
(A State Public University)



Department of Master of Computer Applications

Post Graduate (P.G.)

Under

Faculty of Science & Technology

From Academic Year 2025-26

Master of Computer Applications

Structure and Syllabus under Autonomy as perNEP Policy 2020

SWVSM'S

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Abbreviations

Sr. No.	Acronym	Definition
1	ISE	In-Semester Examination
2	ISE-I	In-Semester Examination-I
3	ISE-II	In-Semester Examination-II
4	ESE	End-Semester Examination
5	ISA	In-Semester Assessment(Term Work)
6	L	Lecture
7	T	Tutorial
8	P	Practical
9	CH	Contact Hours
10	C	Credit

Course/Subject Categories

Sr. No.	Acronym	Definition
1	PCC	Professional Core Course
2	OE	Open Electives
3	PE	Program Electives
4	ELC	Experiential Learning Courses
5	VSEC	Vocational and skill Enhancement course
6	AEC	Ability Enhancement Course
7	CV	Comprehensive Viva
8	SW	Seminar and Technical Writing
9	OJT	On Job Training

Course/Subject Code

2	5	0	1	P	M	C	A	P	C	C	1	0	X
Course introduced Year		TKIETI D		Post Graduate	Master in Computer Application			Course Sub Category			Semester	Course Number	

Course Teamwork and POE Code

2	5	0	1	P	M	C	A	P	C	C	1	0	X	T/P /A
Course introduced Year		TKIETI D		Post Graduate	Master in Computer Application			Course Sub Category			Semester	Course Number		T- Term work P- POE A- Audit Course

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

First Year MCA (Semester-I)

Syllabus Structure under Autonomy

(Implemented from 2025-26)

Credit Scheme

Course Code	Cat	Course Title	Teaching Scheme				Credit Scheme			
			TH	Tut	P	Contact Hours	TH	Tut	P	Credit Assigned
2501PMCAPCC101	PCC	Data Structure and Algorithms	4	-	-	4	4	-	-	4
2501PMCAPCC102	PCC	Database Management Systems	4	-	-	4	4	-	-	4
2501PMCAPCC103	PCC	Discrete Mathematics	3	-	-	3	3	-	-	3
2501PMCAOE104X	OE	Open Elective – I	4	-	-	4	4	-	-	4
2501PMCAPE105X	PE	Program Elective - I	4	-	-	4	4	-	-	4
2501PMCAPCC101P	PCC	Data Structure and Algorithms – Lab	-	-	4	4	-	-	2	2
2501PMCAPCC102P	PCC	Database Management Systems - Lab	-	-	4	4	-	-	2	2
2501PMCAPCC103T	PCC	Discrete Mathematics - Tutorial	-	1	-	1	-	1	-	1
2501PMCASW106	SW	Seminar	-	-	4	4	-	-	2	2
2501PMCAELC107	ELC	Field Project – Lab	-	-	4	4	-	-	2	2
			19	1	16	36	19	1	8	28

Evaluation Scheme

Course Code	Cat	Course Title	Examination Scheme							
			ISE-I	ISE-II	Avg	ESE	ISA	O	POE	Total
2501PMCAPCC101	PCC	Data Structure and Algorithms	40	40	40	60	-	-	-	100
2501PMCAPCC102	PCC	Database Management Systems	40	40	40	60	-	-	-	100
2501PMCAPCC103	PCC	Discrete Mathematics	40	40	40	60	-	-	-	100
2501PMCAOE104X	OE	Open Elective – I	40	40	40	60	-	-	-	100
2501PMCAPE105X	PE	Program Elective - I	40	40	40	60	-	-	-	100
2501PMCAPCC101P	PCC	Data Structure and Algorithms – Lab	-	-	-	-	25	-	50	75
2501PMCAPCC102P	PCC	Database Management Systems - Lab	-	-	-	-	25	-	50	75
2501PMCAPCC103T	PCC	Discrete Mathematics - Tutorial	-	-	-	-	25	-	-	25
2501PMCASW106	SW	Seminar	-	-	-	-	50	-	-	50
2501PMCAELC107	ELC	Field Project – Lab	-	-	-	-	25	-	50	75
			200	200	200	300	150	-	150	800

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

First Year MCA (Semester-II)

Syllabus Structure under Autonomy

(Implemented from 2025-26)

Credit Scheme

Course Code	Cat	Course Title	Teaching Scheme				Credit Scheme			
			TH	Tut	P	Contact Hours	TH	Tut	P	Credit Assigned
2501PMCAPCC201	PCC	Network Technology	3	-	-	3	3	-	-	3
2501PMCAPCC202	PCC	Software Project Management	4	-	-	4	4	-	-	4
2501PMCAPCC203	PCC	Feature Engineering	3	-	-	3	3	-	-	3
2501PMCAPCC204	PCC	Java Programming	3	-	-	3	3	-	-	3
2501PMCAPE205X	PEC	Program Elective - II	4	-	-	4	4	-	-	4
2501PMCAPCC204P	PCC	Java Programming - Lab	-	-	4	4	-	-	2	2
2501PMCAPCC208P	PCC	Advanced Python Programming - Lab	-	-	4	4	-	-	2	2
2501PMCAPCC201T	PCC	Network Technology - Tutorial	-	1	-	1	-	1	-	1
2501PMCAVSEC206	VSEC	Advanced Python Programming	2	-	-	2	-	-	-	2
2501PMCAELC207	ELC	Mini Project	-	-	8	8	-	-	4	4
			19	1	16	36	17	1	8	28

Evaluation Scheme

Course Code	Cat	Course Title	Examination Scheme							
			ISE-I	ISE-II	Avg	ESE	ISA	O	POE	Total
2501PMCAPCC201	PCC	Network Technology	40	40	40	60	-	-	-	100
2501PMCAPCC202	PCC	Software Project Management	40	40	40	60	-	-	-	100
2501PMCAPCC203	PCC	Feature Engineering	40	40	40	60	-	-	-	100
2501PMCAPCC204	PCC	Java Programming	40	40	40	60	-	-	-	100
2501PMCAPE205X	PE	Program Elective - II	40	40	40	60	-	-	-	100
2501PMCAPCC204P	PCC	Java Programming - Lab	-	-	-	-	25	-	50	75
2501PMCAPCC208P	PCC	Advanced Python Programming - Lab	-	-	-	-	25	-	50	75
2501PMCAPCC201T	PCC	Network Technology - Tutorial	-	-	-	-	25	-	-	25
2501PMCAVSEC206	VSEC	Advanced Python Programming	-	-	-	-	50	-	-	50
2501PMCAELC207	ELC	Mini Project	-	-	-	-	25	-	50	75
			200	200	200	300	150	-	150	800

First Year MCA (Semester – I)			
Course Code	**Open Elective - I**	**Course Code**	**Program Elective - I**
2501PMCAOE1041	Cyber Security	**2501PMCAPE1051**	Computer Architecture
2501PMCAOE1042	Digital Marketing	**2501PMCAPE1052**	Unix Shell Programming
2501PMCAOE1043	Design Thinking & Problem Solving	**2501PMCAPE1053**	Cryptography & Network Security

First Year MCA (Semester – II)	
Course Code	**Program Elective - II**
2501PMCAPE2051	Data Mining and Data Warehousing
2501PMCAPE2052	Big Data Analytics
2501PMCAPE2053	Advanced Operating System

2501PMCAPCC101: Data Structure and Algorithms

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Understand fundamental techniques for evaluating algorithm efficiency.
2. Explore key methods for data organization, including searching and sorting.
3. Gain knowledge of essential data structures required for problem solving.
4. Examine principles for managing hierarchical and networked data structures.
5. Develop skills in designing algorithms for complex problems.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Describe the fundamentals of algorithm performance analysis	Understand
CO2	Execute various searching and sorting algorithms to solve computational problems	Apply
CO3	Implement algorithms using linear data structures for efficient data handling	Analyze
CO4	Assess the use of tree-based structures in hierarchical data organization	Analyze

Description:

This course covers data structures and algorithm design & analysis. It focuses on performance evaluation, searching & sorting methods, and linear & non-linear data structures. Students will learn to assess algorithm efficiency and apply suitable strategies to solve complex problems, equipping them to design effective algorithms for real-world applications.

Prerequisites:		
	1	Fundamental Mathematics.
	2	Basic Programming Skills.

Unit 1	**Unit 1: Performance Analysis of Algorithms**	
	Definition of Algorithms; Basic Properties of Algorithms Expressing Algorithms (Pseudo code and Flowcharts) Introduction to Algorithm Design Techniques Performance Analysis of Algorithms (Time and Space Complexity, Big O, Θ, Ω Notations) Introduction to Recursion (Basics of Recursive Functions; Examples of Simple Recursive Algorithms)	**10Hrs**
Unit 2	**Unit 2: Searching and Sorting**	
	Introduction to Searching (Linear Search, Binary Search) Sorting Algorithms (Insertion Sort, Selection Sort, Merge Sort, Quick Sort) Analysis of Searching and Sorting Algorithms (Best, Average, Worst Case)	**10Hrs**
Unit 3	**Unit 3: Linear Data Structures**	

	Linked Lists: Definition, Traversal, Searching, Insertion/Deletion (Singly, Doubly, Circular) Stack: Definition, Array & Linked Representation, Applications (Arithmetic Expressions, Polish Notation) Queue: Definition, Array & Linked Representation, Circular Queue, Priority Queue	**6Hrs**
Unit 4	**Unit 4: Non-Linear Data Structures - I**	**8 Hrs**
	Trees: General Tree, Binary Tree, Binary Search Tree (BST) Operations on BSTs: insertion, deletion, traversal, searching Balanced Trees: AVL Trees,	
Unit 5	**Unit 5: Non-Linear Data Structures - II**	**6Hrs**
	Graphs: Representation of Graphs (Adjacency List, Adjacency Matrix) Graph Traversal Methods: Breadth-First Search (BFS), Depth-First Search (DFS) Topological Sort Hashing: Hash Functions, Collision Handling, Static and Dynamic Hashing	
Unit 6	**Unit 6: Algorithm Design Approaches**	**8 Hrs**
	Greedy Algorithms (Introduction, e.g., Knapsack Problem, Minimum Spanning Tree) Backtracking (Introduction, e.g., N-Queens Problem)	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	1	2	-	1
CO2	3	3	3	2	2	-	-	-	-	-	1	1	3	-	2
CO3	3	2	3	2	2	-	-	-	-	-	1	-	3	-	2
CO4	2	3	2	3	1	-	-	-	-	-	-	-	2	-	2

References:

Text Books	
1	• Mark **Allen Weiss**, *Data Structures and Algorithm Analysis in C*, Pearson Education. • **Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed**, *Fundamentals of Data Structures in C*, Universities Press. • **Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein**, *Introduction to Algorithms* (3rd or 4th Edition), PHI / MIT Press.
Reference Books	
1	• **Reema Thareja**, *Data Structures Using C*, Oxford University Press. • **Robert Sedgewick**, *Algorithms in C* (Parts 1–5), Addison Wesley.

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc22_cs71/preview[CMI]
2	https://onlinecourses.swayam2.ac.in/cec22_cs13/preview[UoK]
Additional Web-link	
1	https://docs.oracle.com/cd/E19059-01/stud.10/819-0493/OtherTools.html
2	http://www.uniquecareer.in/computer-algorithm/[TKIET]

2501PMCAPCC102– Database Management System

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. To understand the basic concepts of database management systems.
2. To understand the relational database design principles.
3. To Master the basics of SQL and construct queries using SQL.
4. To become Familiar with the basic issues of transaction processing and concurrency control.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Learn Basics of DBMS and RDBMS	Remember
CO2	Learn and practice data modelling using the entity-relationship and developing database designs.	Understand
CO3	Examine the use of Structured Query Language (SQL) and learn SQL syntax.	Analyze
CO4	Utilize normalization techniques to normalize the database	Apply

Description:		
This Course is designed to understand the Database concepts, RDBMS, SQL and Transaction Processing.		
Prerequisites:	1	Some experience with spreadsheets can help visualize the data you'll be working with.

Unit 1	**Basics of DBMS**	
	Database Concept, Characteristics and architecture of DBMS, Database users, 3-tier architecture of DBMS-its advantages over 2-tier, Introduction of Parallel, Distributed Databases, Mobile databases and Cloud databases.	**8 Hrs**
Unit 2	**Introduction to RDBMS**	
	RDBMS, Entity introduction, characteristics, Comparison between DBMS and RDBMS, Generalization and Aggregation.	**8 Hrs**
Unit 3	**SQL - I**	
	Introduction to SQL, Features of SQL, Basic data types, SQL statements/commands, Set operations in SQL, order by and group by clause, between, in, like, create index,	**8 Hrs**
Unit 4	**Data Constraints and Normalization**	**8 Hrs**
	Primary key, Foreign key, Unique key, Null, Not Null, Default key. Normalization, Functional dependency, types of normalization (1NF, 2NF, 3NF, BCNF).	
Unit 5	**SQL - II**	**8 Hrs**
	View and join command Nested queries, GRANT and REVOKE, Commit, Rollback, Save point. Join concept, Join Types, View.	
Unit 6	**Concurrency Control and Transaction Management**	**8 Hrs**
	Transaction processing and Concurrency, Concept of transaction processing, ACID properties, locking techniques, Timestamp based protocols, Granularity of data items, Deadlocks. Database Recovery & Backup. Programming (Introduction, All Pair Shortest Path).	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	3	2	1	-	-	-	-	-	-	-	-	-	-

References:

Text Books	
1	Introduction to database systems C. J. Date Pearsons Education 8th
2	Database system concept Korth, Silberschatz and Sudarshan MGH 5th
Reference Books	
1	Fundamentals of Database Systems Elmasri Nava the Pearson Education5th
2	Object Oriented analysis& Design, Andrew High, Tata McGraw-Hill Publication
3	ORACLE PL/SQL Programming Scott Ulman TMH 9th
4	SQL, PL/SQL the programming language of Oracle Ivan Bayross BPB 4th
5	Advance Database Management System hakra bharati/DasguptaWileyDreamtech2011
6	Database Management systems Ramak rishnan & Gehrke, McGraw-Hill,3rd Ed..

SWAYAM Courses	
1	https://onlinecourses.swayam2.ac.in/ini24_cs01/preview
2	https://onlinecourses.swayam2.ac.in/cec24_cs08/preview
Additional Web-link	
1	https://www.geeksforgeeks.org/dbms/dbms
2	https://www.tutorialspoint.com/dbms/index.htm

2501PMCAPCC103 –Discrete Mathematics

Lectures	: 3Hrs / Week	**Evaluation Scheme**	
Credit	: 3	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Understand basic logic and set theory concepts.
2. Learn relations, functions, and their properties
3. Explore counting techniques and combinatory.
4. Study graphs and trees and their applications.
5. Understand algebraic structures like groups and rings.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Describe logical reasoning and mathematical proofs.	Understand
CO2	Manipulate sets, relations, and functions efficiently.	Apply
CO3	Solve problems using combinatorial techniques.	Apply
CO4	Examine graphs and trees relevant to computing.	Analyze

Description:		
This course introduces the fundamental concepts of Discrete Mathematics essential for computer science and information technology		
Prerequisites:	1	Basic Mathematics

Unit 1	**Logic and Proof Techniques**	
	Propositions, logical connectives, truth tables, Logical equivalences and laws, Predicates and quantifiers, Methods of proof: direct, indirect, contradiction, and mathematical induction	**6Hrs**
Unit 2	**Set Theory**	
	Sets, subsets, power sets, Set operations and identities, Venn diagrams, Cartesian products	**7Hrs**
Unit 3	**Relations and Functions**	
	Relations: definition, types (reflexive, symmetric, transitive, equivalence relations), Partial orderings, Functions: types (one-one, onto, bijection), composition, inverse functions	**7Hrs**
Unit 4	**Counting and Combinatory**	**6Hrs**
	Basic counting principles, Permutations and combinations, Binomial theorem, Pigeonhole principle	
Unit 5	**Graph Theory**	**7Hrs**
	Graphs: types, terminology (degree, path, cycle, connectedness), Representations of graphs (adjacency matrix/list), Special graphs: bipartite, complete, regular, Trees: properties, spanning trees, minimum spanning tree basics	
Unit 6	**Algebraic Structures**	**6Hrs**

	Algebraic systems and examples, Groups: definition, examples, properties, cyclic groups, Rings and fields (basic introduction only)	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	3	3	2	2	-	-	-	-	-	-	-	-	-	-

References:

Text Books	
1	**Discrete Mathematics and Its Applications** by Kenneth H. Rosen
2	**Discrete Mathematical Structures with Applications to Computer Science** by J.PTremblay and R. Manohar
Reference Books	
1	**Elements of Discrete Mathematics** by C.L. Liu, McGraw Hill
2	**Discrete Mathematics** by Richard Johnson baugh, Pearson
3	**Mathematics for Computer Science** by Eric Lehman, F. Thomson Leighton, and Albert R. Meyer (MIT Open Course Ware - Free)

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc20_cs37/preview
2	https://onlinecourses.swayam2.ac.in/cec20_ma02/preview
Additional Web-link	
1	https://www.tutorialspoint.com/discrete_mathematics/index.htm
2	https://www.geeksforgeeks.org/engineering-mathematics/discrete-mathematics-tutorial/

2501PMCAOE1041 – Cyber Security

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Understand basic concepts and terms in computer security.
2. Identify cyber threats like fraud and stalking and learn protection methods.
3. Analyze attacks like DOS and malware, and ways to detect and remove them.
4. Learn hacker techniques and basics of penetration testing.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Explain core concepts of computer security and common cyber threats	Remember
CO2	Identify and describe types of cybercrimes, including stalking, fraud, and malware.	Understand
CO3	Contrast methods for detecting and protecting against cyber-attacks.	Analyze
CO4	Justify the Indian cyber laws and discuss their importance in preventing cybercrimes.	Evaluate

Description:		
This course covers fundamental concepts of cyber security and cyber laws, focusing on identifying cyber threats, understanding preventive measures, and exploring legal frameworks. Students will learn about types of cyber-attacks, protective strategies, and the basics of digital forensics, equipping them to navigate and respond to security challenges in the digital world responsibly.		
Prerequisites:	1	Basic Computer and Internet Knowledge. Awareness of Common Cyber Threats.

Unit 1	**Introduction to Computer Security**	
	Introduction to Cyber Security, Types of Cyber Threats, Basic Security Terminology, Security Concepts and Approaches, Real-World Applications of Computer Security	**8 Hrs**
Unit 2	**Cyber Stalking, Fraud, and Abuse**	
	Cyber Stalking, Internet Fraud, Identity Theft, Protecting Against Cyber Crime, Cyber Abuse	**8 Hrs**
Unit 3	**Denial of Service Attacks and Malware**	
	Introduction to DOS, Illustrating an Attack, Types of Malwares (Viruses, Trojan Horses, Buffer Overflow, Spyware), Detecting and Eliminating Malware.	**8 Hrs**
Unit 4	**Techniques Used by Hackers**	**8 Hrs**
	Hacker Techniques, Reconnaissance Phase, Actual Attacks, Malware Creation, Basics of Penetration Testing.	
Unit 5	**The Legal Perspectives of Cyber Crime**	**6 Hrs**

	Importance of Cyber Laws, Indian IT Act Overview, Challenges in Indian Cyber Law, Cybercrime Scenario in India, Legal Procedures in Handling Cybercrime	
Unit 6	**Introduction to Forensics**	**8 Hrs**
	Basics of Digital Forensics, Evidence Collection on PC, System Logs, Data Recovery Techniques, Mobile Forensics, Case Studies / Practical Demonstration.	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	-	-	-	-	-	-	2	-	-
CO2	2	3	-	-	-	-	-	-	-	1	-	-	-	3	2
CO3	2	2	-	-	1	-	-	-	-	-	-	-	-	3	-
CO4	-	-	2	2	-	-	-	-	-	-	-	1	-	-	3

References:

Text Books	
1	Computer Security Fundamentals - Chuck East tom, Pearson, Third edition (Unit I to IV &VI).
Reference Books	
1	Jason Luttgens, Matthew Pepe, Kevin Mandia, Incident Response & Computer Forensics, McGraw- Hill Osborne Media, 3rd edition, 2014.
2	Handbook of Applied Cryptography - Menezes, an Oorschot, and S.A. Vanstone

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc25_cs116/preview
2	https://onlinecourses.nptel.ac.in/noc25_cs117/preview
Additional Web-link	
1	https://www.cybrary.it/free-content
2	https://www.cyberdegrees.org/resources/free-online-courses

2501PMCAOE1042 – Digital Marketing

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. To understand the fundamentals and scope of digital marketing in modern business.
2. To design and implement strategies for search engine optimization (SEO), social media, and content marketing.
3. To apply tools for online advertising, analytics, and campaign performance measurement.
4. To develop integrated marketing plans for brand promotion and customer engagement.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Implement digital marketing concepts and tools to real-world business scenarios.	Apply
CO2	Design and manage effective online marketing campaigns across multiple platforms.	Understand
CO3	Assess digital marketing metrics to assess and improve campaign performance.	Analyze
CO4	Demonstrate skills in SEO, social media marketing, and content strategy development.	Remember

Description:

This course introduces the fundamentals of digital marketing, including SEO, social media, and analytics tools.

Prerequisites:	1	Basic knowledge of marketing principles and familiarity with internet or social media usage.

Unit 1	**Introduction to Digital Marketing**	
	Fundamentals and scope of digital marketing in modern business, differences between traditional and digital marketing, overview of digital marketing channels including SEO, SEM, social media, content, email, and mobile marketing, roles, career opportunities, and emerging industry trends.	**6 Hrs**
Unit 2	**Website Planning and Optimization**	
	Website design principles and landing pages, content marketing strategy including blogs, videos, podcasts, and info graphics, storytelling and content creation for engagement, content planning and editorial calendars.	**8 Hrs**
Unit 3	**Search Engine and Content Marketing**	
	On-page and off-page SEO techniques, keyword research, link building, and optimization tools, Google Ads and PPC campaigns, paid search strategies, monitoring SEO/SEM performance using analytics tools.	**9 Hrs**
Unit 4	**Social Media Marketing**	**8 Hrs**
	Major social media platforms such as Facebook, Instagram, LinkedIn, Twitter, YouTube, organic versus paid social strategies, community management and audience engagement, social media campaign planning, content scheduling, and analytics.	
Unit 5	**Email and Mobile Marketing**	**6 Hrs**
	Email campaign strategy and automation, mobile marketing including apps, push notifications, and SMS campaigns, personalization and segmentation techniques, metrics to track campaign effectiveness.	

Unit 6	**Web Analytics and Digital Strategy** Digital marketing KPIs and metrics, tools for campaign performance measurement such as Google Analytics and social media insights, A/B testing, conversion rate optimization and reporting, designing integrated digital marketing campaigns aligned with brand promotion and customer engagement goals.	**9 Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	-	-	-	-	-	-	_	_	-
CO2	2	3	-	-	-	-	-	-	-	1	-	-	_	_	-
CO3	2	2	-	-	1	-	-	-	-	-	-	-	_	_	-
CO4	-	-	2	2	-	-	-	-	-	-	-	1	_	_	-

References:

Text Books	
1	Philip Kotler, Hermawan Kartajaya, and Iwan Setiawan, *Marketing 5.0: Technology for Humanity*, Wiley, 2021.
Reference Books	
1	Ryan, D., *Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation*, Kogan Page, 2022.
2	Chaffey, D., and Ellis-Chadwick, F., *Digital Marketing: Strategy, Implementation and Practice*, Pearson, 2023.

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc19_cs69/preview
2	https://onlinecourses.nptel.ac.in/noc19_cs70/preview
Additional Web-link	
1	https://alison.com/course/introduction-to-software-project-management
2	https://alison.com/tag/software-engineering

2501PMCAOE1043 – Design Thinking & Problem Solving

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. To develop computational and digital thinking skills for analyzing complex problems.
2. To apply structured problem-solving techniques using digital tools and technologies.
3. To enhance decision-making through logical reasoning, data analysis, and algorithmic approaches.
4. To foster creativity and innovation in designing effective digital solutions for real-world challenges.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Recall key concepts and stages of design thinking.	Remember
CO2	Explain user needs and problem definition using empathy and research.	Understand
CO3	Implement design thinking methods to develop practical solutions.	Apply
CO4	Evaluate feedback and refine solutions for improved outcomes.	Analyze

Description:		
Prerequisites:	1	Basic understanding of computers, familiarity with digital tools, and elementary problem-solving skills.

Unit 1	**Foundations of Design Thinking and Problem Solving**	
	Introduction to design thinking, human-centered approach, stages of design thinking process, analytical versus design thinking, creativity and innovation, role of empathy and iteration, applications in computing and business innovation.	**8 Hrs**
Unit 2	**Empathize – Understanding Users and Their Needs**	
	User research methods, observation and interviews, empathy mapping, user journey mapping, persona development, identifying user needs and pain points, understanding user motivation and context.	**7 Hrs**
Unit 3	**Define – Problem Identification and Framing**	
	Data synthesis and insight generation, clustering and thematic analysis, defining problem statements, "How Might We" questions, user-centered problem framing, prioritizing design challenges, converting needs into opportunities.	**8 Hrs**
Unit 4	**Ideate – Generating and Evaluating Ideas**	**8 Hrs**
	Brainstorming techniques, mind mapping, lateral thinking, SCAMPER method, divergent and convergent thinking, creativity tools, idea evaluation and selection, feasibility and desirability analysis.	
Unit 5	**Prototype – Developing and Refining Concepts**	**8 Hrs**
	Prototyping principles, low-fidelity and high-fidelity prototypes, sketches and wireframes, storyboarding, rapid prototyping tools, iterative refinement, feedback-driven design improvement, visualization of solutions.	
Unit 6	**Test and Implement – Validation and Real-World Integration**	**8 Hrs**

	User testing methods, usability evaluation, feedback analysis, iteration and improvement, linking design thinking with agile and lean approaches, implementation planning, case studies in IT and product design, project-based application of design thinking.	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	-	-	-	1	-	-	-	-	-	-	_	_	-
CO2	2	2	1	-	-	-	-	-	-	1	-	-	_	_	-
CO3	2	2	-	-	1	-	-	-	-	-	-	-	_	_	-
CO4	-	-	2	2	-	-	-	-	-	-	-	1	_	_	-

References:

Text Books	
1	Jeannette M. Wing, *Computational Thinking*, MIT Press, 2020.
Reference Books	
1	Grover, S., & Pea, R., *Computational Thinking in K-12: A Review of the State of the Field*, Springer, 2018.
2	Selby, C., & Woollard, J., *Computational Thinking: The Developing Definition*, Routledge, 2019.

SWAYAM Courses	
1	https://swayam.gov.in/nd1_noc22_mg32/preview
2	https://swayam.gov.in/nd1_noc20_hs08/preview
Additional Web-link	
1	https://www.open.edu/openlearn/science-maths-technology/design-innovation/design-thinking/content-section-0
2	https://alison.com/course/problem-solving-and-critical-thinking-skills

2501PMCAPE1051–Computer Architecture

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. To understand the fundamental concepts and components of computer systems.
2. To analyze the design and organization of processors, memory, and input/output systems.
3. To study instruction sets, pipelining, and performance optimization techniques
4. To evaluate modern computer architectures and emerging trends in computing technology.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Explain the basic structure and functioning of computer systems and their components.	Understand
CO2	Examine processor design, memory hierarchy, and input/output mechanisms.	Analyze
CO3	Execute instruction set architecture and pipelining concepts to optimize performance.	Apply
CO4	Justify modern and emerging computer architectures for efficiency and scalability.	Evaluate

Description:		
This course covers the design and organization of modern computer systems, including processors, memory, and I/O mechanisms.		
Prerequisites:	1	Basic knowledge of computer organization, digital logic design, and programming fundamentals.

Unit 1	**Introduction to Computer Architecture**	
	This unit introduces the basic concepts of computer architecture, including the structure and function of computer systems. It covers the history and evolution of computers, types of computers, and the role of hardware and software in system performance.	**7 Hrs**
Unit 2	**Instruction Set Architecture (ISA)**	
	Students learn about instruction sets, addressing modes, and instruction formats. The unit emphasizes how ISA defines the interface between hardware and software and its impact on processor design and efficiency.	**8 Hrs**
Unit 3	**Processor Design and Organization**	
	This unit focuses on processor components, including the arithmetic logic unit (ALU), control unit, and registers. Topics include CPU design, single-cycle and multi-cycle processors, and techniques for improving processing speed.	**8 Hrs**
Unit 4	**Pipelining and Performance Optimization**	**8 Hrs**
	Students study pipelining concepts, hazards, and techniques to enhance processor throughput. The unit also covers performance metrics, benchmarking, and strategies to minimize delays and maximize efficiency.	
Unit 5	**Memory Hierarchy and Storage Systems**	**8 Hrs**
	This unit explores memory organization, including cache, main memory, and secondary storage. It addresses memory access techniques, virtual memory, and methods to optimize data retrieval and storage performance.	
Unit 6	**Input/output Systems and Emerging Architectures**	**7 Hrs**

	The final unit examines input/output devices, interfaces, and communication with processors. It also discusses recent trends in computer architecture, such as multicore processors, parallel computing, and energy-efficient designs.	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	-	-	-	1	-	-	-	-	-	-	_	_	-
CO2	2	2	1	-	-	-	-	-	-	1	-	-	_	_	-
CO3	2	2	-	-	1	-	-	-	-	-	-	-	_	_	-
CO4	-	-	2	2	-	-	-	-	-	-	-	1	_	_	-

References:

Text Books	
1	David A. Patterson and John L. Hennessy, *Computer Organization and Design: The Hardware/Software Interface*, 6th Edition, Morgan Kaufmann, 2020.
Reference Books	
1	Stallings, W., *Computer Organization and Architecture: Designing for Performance*, 11th Edition, Pearson, 2020.
2	Mano, M. M., & Kime, C. R., *Logic and Computer Design Fundamentals*, 5th Edition, Pearson, 2017.

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc25_cs83/preview
2	https://onlinecourses.nptel.ac.in/noc23_cs113/preview
Additional Web-link	
1	https://www.youtube.com/watch
2	https://www.youtube.com/watch

2501PMCAPE1052–Unix Shell Programming

Lectures : 4 Hrs / Week

Credit : 4
Tutorials : -

Evaluation Scheme

ISE : 40 Marks
ESE : 60 Marks

Course Objectives: The objective of the course is to
1. Understand the basics of UNIX operating system and its commands.
2. Master file system structure and file manipulation commands.
3. Learn shell programming fundamentals and scripting techniques.
4. Develop skills to write and debug shell scripts for automation.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Operate the UNIX system efficiently using commands and utilities.	Apply
CO2	Manage files, directories, and permissions in UNIX.	Evaluate
CO3	Write shell scripts using various programming constructs.	Understand
CO4	Automate system tasks and troubleshoot scripts.	Analyze

Description:		
This course teaches Unix/Linux commands and shell scripting to automate tasks and manage system operations efficiently.		
Prerequisites:	1	Basic knowledge of operating systems and familiarity with command-line interfaces.

Unit 1	**Introduction to UNIX**	
	History and features of UNIX, UNIX architecture and file system overview, Logging in, shells overview (Bourne, Korn, Bash), Basic UNIX commands (pwd, ls, cd, mkdir, rmdir, cat, more, file)	**6 Hrs**
Unit 2	**File and Directory Management**	
	File types and permissions, Commands: cp, mv, rm, chmod, chown, chgrp, Directory commands and navigation, Links: hard and symbolic File system hierarchy	**8Hrs**
Unit 3	**Process Management and Editors**	
	Process concepts and states, Commands: ps, top, kill, bg, fg, jobs, File editors: vi editor basics, Searching files: grep, find, locate	**6 Hrs**
Unit 4	**Filters, Pipes, and Redirection**	**8Hrs**
	Standard input, output, and error, Redirection operators: >, >>, <, 2>, Filters: sort, uniq, head, tail, cut, paste, wc, Pipes and their usage	
Unit 5	**Shell Programming Basics**	**8Hrs**
	Introduction to shell scripting, Writing simple shell scripts Variables, constants, and user input, Conditional statements: if, if-else, case, Looping constructs: for, while, until, Functions in shell scripts, Debugging scripts	
Unit 6	**Advanced Shell Scripting**	

	Working with files and directories in scripts, Command line arguments and parameters, String operations and pattern matching, Handling signals and traps, Automating system tasks using shell scripts	**9Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	-	-	-	1	-	-	-	-	-	-	_	_	_
CO2	2	2	-	-	-	-	-	-	-	1	-	-	_	_	_
CO3	2	2	-	-	1	-	-	-	-	-	-	-	_	_	_
CO4	-	2	2	2	-	-	-	-	-	-	1	1	_	_	_

References:

Text Books	
1	**Stephen G. Kochan**, *Unix Shell Programming*, 3rd Edition, Addison-Wesley, 2014.
Reference Books	
1	**Arnold Robbins and Nelson H. F. Beebe**, *Classic Shell Scripting: Hidden Commands that Unlock the Power of Unix*, O'Reilly Media, 2005.
2	**Christopher Negus**, *Linux Bible*, 10th Edition, Wiley, 2020

SWAYAM Courses	
1	https://onlinecourses.swayam2.ac.in/aic20_sp05/preview
2	https://nptel.ac.in/courses/117106113
Additional Web-link	
1	https://www.tutorialspoint.com/unix/shell_scripting.htm
2	https://www.geeksforgeeks.org/linux-unix/introduction-linux-shell-shell-scripting/

2501PMCAPE1053 – Cryptography & Network Security

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Understand foundational concepts of cryptography and common encryption techniques.
2. Identify various types of network attacks and the principles of network security.
3. Analyze cryptographic algorithms and their applications for secure communication.
4. Learn methods for securing data integrity, confidentiality, and authentication in networks.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Explain fundamental concepts of cryptography and network security.	Understand
CO2	Identify and describe different types of encryption techniques and their applications.	Remember
CO3	Demonstrate understanding of methods for ensuring data confidentiality, integrity, and authentication in network communications.	Apply
CO4	Examine common network attacks and explain strategies to protect against them.	Analyze

Description:		
This course introduces fundamental concepts of cryptography and network security, focusing on encryption, network vulnerabilities, and protective measures. Students will learn security protocols and methods to ensure data confidentiality, integrity, and authentication, and will be able to **examine and respond to network security challenges.**		
Prerequisites:	1	Basic Understanding of Computer Networks and Data Communication., Familiarity with Mathematics, especially Number Theory and Algebra.

Unit 1	**Introduction to Cryptography and Mathematical Foundations**	
	Fundamentals of Cryptography: definition, significance, applications, Cryptographic Paradigms: symmetric vs. asymmetric. Mathematical Foundations: number theory, modular arithmetic, basic probability theory.	**6 Hrs**
Unit 2	**Classical Cryptography and Symmetric Key Algorithms**	
	Classical Cryptographic Systems: Caesar Cipher, Vigenère Cipher, substitution and permutation methods, Symmetric Key Cryptography: overview of symmetric encryption techniques, modern block ciphers like DES and AES, operational principles.	**8 Hrs**

Unit 3	**Stream Ciphers and Hash Functions**	
	Stream Ciphers: RC4, pseudo-random number generators, Hash Functions key characteristics, applications of SHA family, Message Authentication Codes - MACs)	**6 Hrs**
Unit 4	**Introduction to Asymmetric Key Cryptography**	**8 Hrs**
	Asymmetric Key Cryptography: fundamentals, comparison with symmetric systems, RSA Algorithm: operational mechanisms, Diffie-Hellman Key Exchange: protocol significance in secure communications.	
Unit 5	**Digital Signatures and Emerging Cryptographic Techniques**	**9 Hrs**
	Digital Signatures: purpose, mechanisms, examples, Elliptic Curve Cryptography: principles, advantages, Block chain Technology: introduction, cryptographic implications.	
Unit 6	**Network Security Fundamentals and Protocols**	**9 Hrs**
	Network Security Objectives: confidentiality, integrity, availability, Network Security Protocols: SSL/TLS, IPSec, VPNs, Security Infrastructure: firewalls, Intrusion Detection Systems - IDS, secure communication protocols, Additional Security Mechanisms: Pretty Good Privacy - PGP, Kerberos.	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	-	-	-	-	-	-	2	-	-
CO2	2	3	-	-	-	-	-	-	-	1	-	-	-	3	2
CO3	2	2	-	-	1	-	-	-	-	-	-	-	-	-	3
CO4	-	2	2	2	-	-	-	-	-	-	1	1	-	-	3

References:

Text Books	
1	Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.
Reference Books	
1	William Stallings, "Cryptography and Network Security", Pearson Education.
2	Dr. B. B. Meshram, TCP/IP & Network Security, SPD Publication.

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc22_cs90/preview
2	https://onlinecourses.nptel.ac.in/noc20_cs02/preview
Additional Web-link	
1	https://www.ucertify.com/p/cryptography-and-network-security.html
2	https://ischoolonline.berkeley.edu/cybersecurity/curriculum/cryptography/

2501PMCAPCC101P: Data Structure and Algorithms - Lab

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. To understand fundamental techniques for evaluating algorithm efficiency.
2. To explore key methods for data organization, including searching and sorting.
3. To gain knowledge of essential data structures for problem solving.
4. To examine principles for managing hierarchical data structures.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Describe the fundamentals of algorithm performance analysis	Apply
CO2	Apply various searching and sorting algorithms to solve computational problems	Apply
CO3	Implement algorithms using linear data structures for efficient data handling	Apply
CO4	Analyze the use of tree-based structures in hierarchical data organization	Apply

Description:

This course covers algorithm design and analysis, focusing on performance evaluation, searching and sorting methods, and linear and non-linear data structures. Students will learn to assess algorithm efficiency and apply strategies to solve complex problems, equipping them to design effective algorithms forreal-world applications.

Prerequisites:	1	Computer Programming in C

Sr. No.	**Practical Topic**	**Hrs.**	**Bloom's Taxonomy**
1	Implementation of Sorting Techniques – Part I (Insertion, Selection)	2	Apply
2	Implementation of Sorting Techniques – Part II (Merge, Quick)	2	Apply
3	Implementation of Stack operations (push, pop, display)	2	Apply
4	Implementation of Linear Queue operations (enqueue, de queue, display)	2	Analyze
5	Implementation of Singly Linked List operations (create, insert, delete)	2	Analyze
6	Implementation of Doubly Linked List operations (create, insert, delete)	2	Analyze
7	Implementation of Tree operations (create, insert, delete, traversal)	2	Analyze
8	Implementation of Binary Search Tree operations (create, insert, delete, search)	2	Evaluate
9	Implementation of Graph operations (representations, BFS/DFS, traversal)	2	Evaluate
10	Implementation of Sorting Techniques – Part I (Insertion, Selection)	2	Evaluate

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	1	2	-	1
CO2	3	3	3	2	2	-	-	-	-	-	1	1	3	-	2
CO3	3	2	3	2	2	-	-	-	-	-	1	-	3	-	2
CO4	2	3	2	3	1	-	-	-	-	-	-	-	2	-	2

References:

Text Books	
1	Introduction to algorithms, ThirdEdition.by ThomasH.Cormen,CharlesE.Leiserson,RonaldL.Rivest,CliffordStein,PHI
Reference Books	
1	Introduction to the Design and Analysis of Algorithms", Anany Levitin, 3rd Edition, Pearson.
2	Fundamentals of Algorithms Gilles Brassard, Paul Bratley Pearson Education

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc22_cs71/preview[CMI]
2	https://onlinecourses.swayam2.ac.in/cec22_cs13/preview[UoK]
Additional Web-link	
1	https://docs.oracle.com/cd/E19059-01/stud.10/819-0493/OtherTools.html
2	http://www.uniquecareer.in/computer-algorithm/[TKIET]

2501PMCAPCC102P–Database Management System - Lab

Lectures : 4 Hrs / Week
Credit : 2

Evaluation Scheme
ISA : 25 Marks
POE : 50 Marks

Course Objectives: The objective of the course is to
1. To expose the students to the fundamentals of Database Management System.
2. To understand the practical applicability of database management system concepts
3. To work on existing database systems, designing of database, creating relational database, analysis of table design
To provide practical knowledge to understand transaction processing.
4. To expose the students to the fundamentals of Database Management System.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	To get practical knowledge on designing and creating relational database systems.	Remember
CO2	To implement various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.	Apply
CO3	To understand and apply transactions.	Apply
CO4	To be able to design and implement database applications on their own	Analyze and Apply

Description:		
This Course is designed to understand and apply various DBMS concepts.		
Prerequisites:	1	Computer knowledge, Data Structures and algorithms, Programming.

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	To understand and design Entity Relationship Diagrams (ERDs) for modeling real-world database systems. Model a database for a **College Management System** showing entities such as *Student*, *Faculty*, *Course*, and *Registration* with appropriate relationships, attributes, and cardinalities.	2	Understand
2	To study the process of normalization and apply normal forms to eliminate data redundancy and improve database design Given an **Unnormalized Student Database**, normalize it step-by-step up to **3NF** to remove redundancy and anomalies.	2	Apply
3	To implement Data Definition Language (DDL) queries for creating, altering, and dropping database tables. Design and execute DDL queries for creating, altering, and dropping tables for a **Library Management System**.	2	Apply

4	To implement Data Manipulation Language (DML) queries for inserting, deleting, updating, and displaying records in a database table Implement DML queries (inserting, deleting, updating, and displaying records) on the **Library Management System** database created in the previous practical to perform data operations on the `Author`, `Book`, and `Member` tables.	2	Apply
5	To implement SQL set operations such as UNION, INTERSECT, and MINUS (or EXCEPT) to retrieve data from multiple queries Consider two tables `Students` and `Student_IT` representing students enrolled in **Computer Science** and **Information Technology** departments. Perform SQL set operations to combine and compare their data.	2	Apply
6	To implement various SQL join operations including Cross Join, Self-Join, Inner Join, Left Outer Join, Right Outer Join, and Full Outer Join to retrieve related data from multiple tables Design two tables — `Department` and `Employee` — and demonstrate all SQL join operations to retrieve related data.	2	Apply
7	To implement SQL aggregate functions such as MIN, MAX, AVG, SUM, and COUNT, along with GROUP BY and HAVING clauses for data summarization and filtering Create a table named **Employee** and demonstrate the use of aggregate functions along with **GROUP BY** and **HAVING** clauses.	2	Apply
8	To implement and use SQL functions (built-in and/or user-defined) for performing operations on data and enhancing query capabilities. Create and demonstrate the use of **built-in** and **user-defined functions** in SQL using an **Employee** table.	2	Apply
9	To implement exception handling in SQL/PL-SQL to manage runtime errors and ensure robust database operations. Write PL/SQL blocks to demonstrate **predefined** and **user-defined** exception handling.	2	Apply
10	To implement stored procedures for encapsulating SQL statements and improving modularity, reusability, and performance in database applications Create and execute stored procedures to perform different operations such as inserting, updating, and displaying employee records.	2	Apply

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	3	-	-	-	-	-	-	-	-	-	-	-

References:

Text Books	
1	Introduction to database systems C.J.Date Pearsons Education8th
2	Database system concept Korth, Silber schatzand Sudarshan MGH5th
Reference Books	
1	SQL,PL/SQL the programming language of OracleI van Bayross BPB4th

2	ORACLEPL/SQLProgrammingScottUlmanTMH9th

SWAYAMCourses	
1	https://onlinecourses.swayam2.ac.in/ini24_cs01/preview
2	https://onlinecourses.swayam2.ac.in/cec24_cs08/preview
AdditionalWeb-link	
1	https://www.geeksforgeeks.org/dbms/dbms
2	https://www.tutorialspoint.com/dbms/index.htm

2501PMCAPCC103T– Discrete Mathematics - Tutorial

Lectures : 1Hrs / Week
Credit : 1

Evaluation Scheme
ISA : 25 Marks
POE : -

Term Work & Tutorial
Complete 10-12 assignments covering core topics from each unit. The assignments should be practical and focus on understanding fundamental concepts and their real-world applications.
This tutorial on Discrete Mathematics introduces fundamental concepts such as sets, relations, functions, logic, combinatorics, and graph theory. It equips students with the mathematical tools and reasoning skills needed for computer science and problem-solving applications.
Students should complete exercises on core topics from each unit: • **Unit 1:** Solving problems on set operations, Venn diagrams, and logical equivalences. • **Unit 2:** Determining properties of relations (reflexive, symmetric, transitive) and mapping exercises for functions. • **Unit 3:** Problems on permutations, combinations, and the application of the Pigeonhole Principle. • **Unit 4:** Solving linear recurrence relations and writing recursive algorithms for sequences. • **Unit 5:** Exercises on graph representation, traversals (BFS, DFS), and finding Eulerian and Hamiltonian paths. • **Unit6:** Simplifying Boolean expressions, Karnaugh maps, and designing basic logic circuits.
Students are expected to actively apply concepts to solve problems, demonstrate logical reasoning, and use correct mathematical notation. Collaborative learning on complex exercises is encouraged. By the end, students should confidently model problems and apply set theory, logic, combinatorics, recursion, graph theory, and Boolean algebra in computational contexts.

2501PMCASW106 – Seminar

Lectures : 4 Hrs / Week
Credit : 2

Evaluation Scheme
ISA : -
POE : 50 Marks

Course Objectives: The objective of the course is to
1. To develop skills in researching and analyzing advanced topics in computer applications.
2. To enhance technical writing and documentation abilities.
3. To improve oral communication and presentation skills in a professional setting.
4. To encourage independent learning and awareness of recent technological trends.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Explore cutting edge technology topics in computer applications.	Analyze
CO2	Prepare a well-structured technical report based on thorough literature review.	Create
CO3	Deliver an effective seminar presentation using appropriate tools and techniques.	Apply
CO4	Respond confidently to questions and engage in technical discussions.	Evaluate

Nature of Seminar

The aim of this seminar is to make the students to study regarding industrial project. They are expected to go through the latest trend pertaining to computer and allied fields, to do the literature survey and deliver the seminar on their work done in an industrial project. The other important aim of the seminar is to encourage and develop the personality, aptitude and knowledge of the students

- Seminar work should be continually evaluated based on the contributions of an individual student, originality of the work, innovations brought in, research and developmental efforts, depth and applicability, etc.
- Three mid-term evaluations should be done, which includes presentations and demos of the work done.

Project Report Format:

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point Bold Face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.
11. Index of Report:
    a. Title Sheet
    b. Certificate
    c. Acknowledgement
    d. Table of Contents
    e. List of Figures
    f. List of Tables
12. References: References should have the following format

For Books: “Title of Book”, Authors, Publisher, Edition

For Papers: “Title of Paper”, Authors, Journal/Conference Details, Year

2501PMCAOJT107 – Field Project - Lab

Lectures : 4 Hrs / Week
Credit : 2

Evaluation Scheme
ISA : 25 Marks
POE : 50 Marks

Course Objectives: The objective of the course is to
1. To apply theoretical knowledge to solve real-world problems through software development 2. To enhance skills in system design, coding, testing, and documentation. 3. To encourage teamwork, project planning, and time management. 4. To develop the ability to present and defend technical solutions effectively.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Identify and describe real-life or societal problems through field visits and observations.	Understanding
CO2	Analyze the root causes and impacts of identified problems using suitable data collection and analytical methods.	Apply
CO3	Propose feasible and innovative solutions to the identified societal or community problems.	Analyze
CO4	Communicate findings and proposed solutions effectively through written reports and oral presentations.	Evaluate

Field Project Guidelines

1. Objective

The Field Project aims to help students understand real-world societal problems through observation, interaction, and analysis. Students should visit a community, organization, or location, identify a problem, and propose possible solutions — implementation is *not compulsory*.

2. Project Stages

a) Topic Selection

- Choose a local or societal issue that can be studied through a field visit.
- The topic should relate to technology, environment, education, health, infrastructure, or community development.
- Get approval from your project guide or faculty before starting.

b) Field Visit and Data Collection

- Visit the selected site or community in small teams.
- Observe, interview, and collect data (photos, surveys, or notes).
- Record key findings about the problem and its causes.

c) Problem Analysis

- Analyze the data collected during the visit.
- Identify root causes and possible impacts of the problem.
- Discuss the issue with team members and mentor for better understanding.

d) Solution Proposal

- Suggest feasible, innovative, and sustainable solutions to address the problem.
- The solution can be technical, social, or managerial in nature.
- Justify how your solution could help the community or organization.

e) Report Preparation

- Prepare a well-structured report containing:
    1. Title and team details
    2. Introduction and background
    3. Description of the field and identified problem
    4. Data and observations
    5. Analysis and discussion
    6. Proposed solution(s)
    7. Conclusion and references

f) Presentation

- Each team must present their findings and proposed solutions to the class or evaluation panel.
- Use PowerPoint slides or posters to support your presentation.

3. General Instructions

- Work in teams of 3–5 students.
- Maintain a record of visits and interactions.
- Give credit to all sources and people you consulted.
- Ensure ethical behavior and respect during field visits.
- Avoid copying or using pre-existing project material.

2501PMCAPCC201: Network Technology

Lectures	: 3 Hrs / Week	**Evaluation Scheme**	
Credit	: 3	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Understand basic concepts and applications of data communication and networking.
2. Explore various LAN technologies and their importance.
3. Learn about the data link layer, including framing and error control.
4. Examine IPv4/IPv6 protocols and congestion control methods.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Explain the fundamental concepts and applications of data communication and networking.	Remember
CO2	Identify and describe various LAN technologies and their roles in networking.	Understand
CO3	Demonstrate data link layer techniques for framing and error control in networking.	Apply
CO4	Differentiate IPv4/IPv6 protocols and congestion control methods for efficient data transfer.	Analyze

Description:

This course covers data communication and networking concepts, focusing on network architecture, protocols, and technologies. Students will analyze LAN technologies, understand data link layer functions, and explore IPv4/IPv6 protocols, culminating in the evaluation of application layer protocols and basic network security practices.

Prerequisites:		
	1	Understanding of Computer Architecture.
	2	Knowledge of Operating Systems.

Unit 1	**Introduction to Data Communication**	
	Overview of data communication, applications and significance, network hardware and software, including protocol hierarchy and design issues, connection-oriented vs. connectionless communication, reference models: OSI and TCP/IP, network standardization, performance metrics: bandwidth and latency, delay and bandwidth product.	**8 Hrs**
Unit 2	**Local Area Network (LAN) Technologies**	
	Introduction to LAN technologies: Ethernet (802.3), Token Ring, Frame Relay, FDDI, wireless LANs: Wi-Fi (802.11), Bluetooth (802.15.1), overview of broadband wireless technologies: Wi-MAX (802.16), RFID.	**6 Hrs**
Unit 3	**Data Link Layer**	
	Functions of the data link layer: framing, error control, flow control, error detection and correction techniques, including error-correcting codes, error- detecting codes, services provided to the network layer.	**6 Hrs**
Unit 4	**Network Layer and Routing**	**8 Hrs**
	Introduction to IPv4 and IPv6 addressing, routing algorithms: distance vector, link state, understanding TCP, UDP, sockets, principles of congestion control, prevention policies, Quality of Service (QoS): packet scheduling, traffic shaping, Integrated services.	

Unit 5	**Application Layer Protocols** Overview of application layer protocols: DNS, SMTP, POP, FTP, HTTP, introduction to network security: authentication methods, public and private key cryptography, digital signatures, firewalls.	**5 Hrs**
Unit 6	**Emerging Trends and Technologies** Overview of current trends in networking: Software-Defined Networking (SDN), Network Function Virtualization (NFV), introduction to Internet of Things (IoT) and its impact on networking, discussion on network management and monitoring tools, future directions in data communication and networking.	**6 Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	-	2	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	2	-

References:

Text Books	
1	A.Tanenbaum, Computer Networks, PHI Publication, 5th Edition, 2011
Reference Books	
1	Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach, Morgan Kufman Publication, 5th Edition, 2012
2	S. Keshav, An Engineering Approach to Computer Networking, Addison-Wesley Professional.

SWAYAM Courses (Operational Timestamp: Mon,28-Oct-2022 on 9:00 PM)	
1	https://onlinecourses.swayam2.ac.in/cec19_cs07/preview
2	https://onlinecourses.nptel.ac.in/noc22_ee61/preview [IIT Kharagpur]
Additional Web-link (Operational Timestamp: Mon,28-Oct-2022 on 9:00 PM) :	
1	https://www.coursera.org/courses?query=computer%20network [Coursera]
2	https://www.udemy.com/topic/computer-network/ [Udemy]

2501PMCAPCC202–Software Project Management

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. To introduce the principles and methodologies of software engineering.
2. To provide knowledge of software development life cycle models and their applications.
3. To develop skills in software requirements analysis and design
4. To understand software testing strategies and quality assurance processes.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Implement software development life cycle models to design software systems.	Apply
CO2	Examine and document software requirements effectively.	Analyze
CO3	Design modular and structured software solutions using standard practices	Understand
CO4	Utilize appropriate software testing techniques for quality assurance.	Remember

Description:		
Software Engineering covers the principles and practices for designing, developing, testing, and managing high-quality software systems using structured engineering methods.		
Prerequisites:	1	Programming fundamentals, Algorithms, DBMS.

Unit 1	**Introduction to Software Engineering**	
	Introduction to Software Engineering, Software Development Life Cycle (SDLC), Software Process Models: Waterfall, Incremental, Spiral, Agile, Characteristics of Good Software, Software Engineering Ethics,	**8 Hrs**
Unit 2	**Requirement Analysis**	
	Types of Requirements: Functional and Non-functional, Requirements Elicitation Techniques, Requirements Analysis, Software Requirements Specification (SRS), Validation and Verification of Requirements	**8 Hrs**
Unit 3	**Software Design**	
	Objectives of Input Design, Input Validations, Design of output:- Objectives of Output, Design Types Of Output, Coupling & Cohesion User Interface design: Elements of good design, design issues, features of modern GUI, error messages	**8 Hrs**
Unit 4	**Software Testing and Quality Assurance**	**8 Hrs**
	Basics of Software Testing, Levels of Testing: Unit, Integration, System, Acceptance, Testing Techniques: Black-box, White-box, Test Planning and Test Case Design, Software Quality Assurance (SQA) Software Metrics and Measurement, Introduction to Automation Testing	
Unit 5	**Software Maintenance and Evolution**	**8 Hrs**
	Introduction to Software Maintenance, Types of Maintenance: Corrective, Adaptive, Perfective, Preventive, Challenges in Software Maintenance, Impact Analysis and Change Management, Software Configuration Management in Maintenance.	
Unit 6	**Advanced Software Engineering Concepts**	**8 Hrs**

	Component-Based Software Engineering (CBSE), Service-Oriented Architecture (SOA), Software Reuse, Software Reliability and Fault Tolerance, Introduction to Cloud-based Software Engineering, DevOps and Continuous Integration/Continuous Deployment (CI/CD)	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-	2	2	-
CO3	-	3	2	2	3	-	-	-	-	-	-	-	-	3	2
CO4	2	1	2	-	-	-	-	2	-	-	-	-	2	-	2

References:

Text Books	
1	Software Engineering by R.S. Pressman, Tata McGraw-Hill
Reference Books	
1	An Integrated Approach to Software Engineering by Pankaj Jalote, Tata McGraw-Hill
2	Fundamentals of Software Engineering by Rajib Mall, PHI Learning
3	Software Engineering by Martin Shooman, McGraw-Hill
4	System Analysis and design and Introduction to Software Engineering by Parthsarathi, B.W. Khalkar, Everest Publishing House

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc19_cs69/preview
2	https://onlinecourses.nptel.ac.in/noc19_cs70/preview
Additional Web-link	
1	https://alison.com/course/introduction-to-software-project-management
2	https://alison.com/tag/software-engineering

2501PMCAPCC203 – Feature Engineering

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Understand basic logic and set theory concepts.
2. Learn relations, functions, and their properties
3. Explore counting techniques and combinatorics.
4. Study graphs and trees and their applications.
5. Understand algebraic structures like groups and rings.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Apply logical reasoning and mathematical proofs.	Remember
CO2	Manipulate sets, relations, and functions efficiently.	Understand
CO3	Solve problems using combinatorial techniques.	Analyze
CO4	Analyze graphs and trees relevant to computing.	Apply

Description:

This course introduces the fundamental concepts of Discrete Mathematics essential for computer science and information technology

Prerequisites:	1	Basic Mathematical statistics and probability

Unit 1	**Introduction to Feature Engineering:**	
	Motivating example – AI-powered communications, importance of feature engineering, introduction of feature engineering, Evaluation of machine learning algorithms and feature engineering procedures, Feature understanding, Feature improvement – cleaning datasets, Feature selection – removing bad attributes, Feature construction, Feature transformation, Feature learning.	**10 Hrs**
Unit 2	**Basics of Feature Representation**	
	Scalars, Vectors, and Spaces, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling), $\ell 2$ Normalization, Interaction Features, Feature Selection	**8 Hrs**
Unit 3	**Features of Text and Categorical Data**	
	Bag-of-X: Turning Natural Text into Flat Vectors, Filtering for Cleaner Features, Atoms of Meaning: From Words to n-Grams to Phrases, Tf-Idf : A Simple Twist on Bag-of-Words, Putting It to the Test, Deep Dive, Encoding Categorical Variables, Dealing with Large Categorical Variables.	**6 Hrs**
Unit 4	**Feature Selection:**	**6 Hrs**
	Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies, Effect of Irrelevant Feature, Over fitting to Predictors and External Validation, Greedy Search	

	Methods- Simple Filters, Recursive Feature Elimination, Stepwise Selection	
Unit 5	**Feature Transformations:** Intuition, Derivation, Linear Projection, Variance and Empirical Variance - Vector Formulation, General Solution of the Principal Components, Transforming Features, Implementing PCA, PCA in Action, Whitening and ZCA, Considerations and Limitations of PCA, Use Cases	**8 Hrs**
Unit 6	**Feature Learning** Parametric assumptions of data, Non-parametric fallacy, feature learning algorithms, Reconstructing the data, The Bernoulli RBM, Extracting PCA components from MNIST, Extracting RBM components from MNIST, Using RBMs in a machine learning pipeline, Learning text features – word vectorizations, Word embeddings, Application of word embeddings – information Retrieval	**10 Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	3	3	2	2	-	-	-	-	-	-	-	-	-	-

References:

Text Books	
1	Sinan Ozdemir, Divya Susarla, "Feature Engineering Made Easy", Packt Publishing, ISBN 978-1-78728-760-0
2	Alice Zheng & Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for data scientist", Oreilly.
Reference Books	
1	Max Kuhn , Kjell Johnson, "Feature Engineering and Selection: A Practical Approach for Predictive Models" 1st Edition, Chapman & Hall/CRC Data Science Series, ISBN 13 978-1-138-07922-9.

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc24_ge35/preview
2	https://onlinecourses.swayam2.ac.in/ini25_cs04/preview
Additional Web-link	
1	https://www.mygreatlearning.com/academy/learn-for-free/courses/feature-engineering
2	https://www.pluralsight.com/paths/feature-engineering

2501PMCAPCC204–Java Programming

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to

1. Understand Java basics, including classes, objects, methods, and data types.
2. Learn control structures, methods, and operators for building efficient programs.
3. Use arrays for managing collections of data in Java applications.
4. Explore inheritance and polymorphism for code reusability and flexibility.
5. Handle errors using exception handling and gain an introduction to JavaScript for client-side scripting.

Course Outcomes:

CO Code	Course Outcomes (Students will be able to...)	Bloom's Taxonomy Level
CO1	**Explain** the fundamental concepts of Java, including classes, objects, methods, and data types.	**Understand**
CO2	**Develop** Java programs using control structures, operators, and methods.	**Analyze**
CO3	**Implement** and manipulate arrays for handling collections of data in Java.	**Apply**
CO4	**Apply** the concepts of inheritance and polymorphism to achieve code reusability and flexibility in programs.	**Evaluate**

Description:

This course introduces Java programming, focusing on object-oriented concepts, control structures, data handling, and basic Java libraries. Students will learn to create applications using classes, inheritance, exception handling, and simple Java Script for web features, preparing them to build reliable Java applications

Prerequisites:	1	Fundamental Mathematics, Basic Programming Skills.

Unit 1	**Introduction to Java and Basic Concepts**	
	Overview of Java, Java Class Libraries, Java Development Environment, memory concepts and arithmetic basics, introduction to classes, objects, methods, and instance variables, declaring classes and methods, using set and get methods, primitive vs. reference types, initializing objects with constructors.	**8 Hrs**
Unit 2	**Control Statements and Methods**	
	Control structures :`if`,` if-else`, `while`,` do-while`, `switch`, `break`, and `Continue`, logical operators, program modules, static methods, and fields, declaring methods with parameters, method overloading, and Java API packages.	**8 Hrs**
Unit 3	**Arrays and Data Handling**	

	Declaring and creating arrays in Java, examples with arrays, passing arrays to methods, multidimensional arrays, variable-length arguments, and using command-line arguments.	**8 Hrs**
Unit 4	**Object-Oriented Concepts: Inheritance and Polymorphism** Inheritance basics: super classes, subclasses, protected members, constructors in subclasses, relationship between classes, polymorphism: abstract classes, methods, and interfaces, final methods and classes.	**8 Hrs**
Unit 5	**Exception Handling and Error Management** Introduction to exception handling, common exceptions (Arithmetic, Input Mismatch), Java exception hierarchy, using the `finally` block, and best practices for reliable error handling.	**10 Hrs**
Unit 6	**Introduction to JavaScript and Basic Applets** Overview of JavaScript for client-side scripting, JavaScript syntax basics: operators, comparisons, statements, loops, and events, objects and user-defined functions in JavaScript, basic validations, regular expressions, document object model, popovers, and windows.	**6Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	1	3	-	2
CO2	3	3	3	2	2	-	-	-	-	-	1	3	-	3	-
CO3	3	2	3	2	2	-	-	-	-	-	1	3	-	3	-
CO4	2	3	2	3	1	-	-	-	-	-	-	2	-	2	-

References:

Text Books	
1	Paul Deiteland Harvey Detail, Java : How to Program, Pearson's Publication, 9thEdition.
Reference Books	
1	Herbert Schildt, Java The Complete Reference, McGraw- Hill Publication, 9th Edition
2	Patrick Niemeyer, Daniel Leuck, Learning Java, O'Reilly Media, 4th Edition, 2013.

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2	https://onlinecourses.swayam2.ac.in/aic20_sp13/preview
Additional Web-link	
1	https://www.geeksforgeeks.org/java/java/
2	https://www.geeksforgeeks.org/java/java/

2501PMCAPCC204P : Java Programming Lab

Lectures	: 4Hrs / Week	**Evaluation Scheme**	
Credit	: 2	**ISA**	: 25 Marks
Tutorials	: -	**POE**	: 50 Marks

Course Objectives: The objective of the course is to
• Understand Java basics, including syntax, variables, and data types.
• Use control structures such as loops, conditionals, and switch-case effectively.
• Design and implement classes, objects, and inheritance in Java.
• Apply polymorphism and exception handling in object-oriented programming.

Course Outcomes:

CO Code	Course Outcomes (Students will be able to…)	Bloom's Taxonomy Level
CO1	**Demonstrate** the use of Java syntax, data types, and operators in simple programs.	**Understand**
CO2	**Develop** programs using control statements, loops, and arrays for data handling.	**Apply**
CO3	**Implement** object-oriented concepts such as classes, objects, inheritance, and polymorphism.	**Analyze**
CO4	**Handle** exceptions and apply basic file or input-output operations in Java programs.	**Evaluate**

Description:

This course is designed to help students understand and implement the fundamentals of Java programming. It focuses on object-oriented concepts, control structures, arrays, inheritance, polymorphism, and exception handling to develop robust and efficient applications.

Prerequisites:	1. Basic knowledge of computer operations and software. 2. Understanding of fundamental programming concepts such as variables, data types, and algorithms.

Sr. No.	Practical Topic / Program	Bloom's Taxonomy Level
1	Create a simple Java program to print a personalized welcome message.	Understand
2	Write a Java program to declare and initialize variables of different data types and display their values.	Understand
3	Create a Java class with `set` and `get` methods to manage the attributes of a "Student" object (name, age, and grade).	Understand
4	Implement a Java program to demonstrate the use of basic control statements (`if`, `if-else`, and `switch`) for checking conditions and displaying appropriate messages.	Apply
5	Write a Java program that uses a `while` loop to display numbers from 1 to 10 and calculate their sum.	Apply
6	Design a program that accepts two numbers and a basic operation (+, −, ×, ÷) from the user, using `switch` to perform the calculation.	Apply
7	Create a Java program to declare an array, populate it with values, and print each element using a `for` loop.	Apply
8	Write a Java program to calculate the average of values in an array and display the result.	Apply
9	Develop a simple Java program that demonstrates inheritance by creating a base class `Vehicle` and a derived class `Car`.	Apply
10	Create a Java program with a base class and subclass that illustrates method overriding, showing the concept of polymorphism.	Analyze

11	Write a Java program that uses exception handling to manage divide-by-zero errors with a `try-catch` block.	Evaluate
12	Develop a Java program that catches input mismatches when a user enters invalid data, demonstrating robust error handling.	Evaluate

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	1	-	-	-	3	-	1
CO2	3	3	2	-	2	-	-	-	-	-	-	-	3	-	2
CO3	3	3	3	-	2	-	2	-	-	-	-	-	3	-	2
CO4	3	3	3	-	2	-	2	-	-	-	-	-	3	2	3

References:

Text Books	
1	Paul Deiteland Harvey Detail, Java: How to Program, Pearson's Publication, 9th Edition.
Reference Books	
1	Herbert Schildt, Java The Complete Reference, McGraw- Hill Publication, 9th Edition.
2	Patrick Niemeyer, Daniel Leuck, Learning Java, O'Reilly Media, 4th Edition, 2013.

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2	https://onlinecourses.swayam2.ac.in/aic20_sp13/preview
Additional Web-link	
1	https://www.geeksforgeeks.org/java/java/
2	https://www.geeksforgeeks.org/java/java/

2501PMCAPE2051– Data Mining and Data Warehousing

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. To understand the principles of Data warehousing and Data Mining.
2. To apply data mining techniques to extract meaningful knowledge from data repositories for analysis
3. To understand the Knowledge Discovery in Databases (KDD) process.
4. To describe data mining tasks and analyze commonly used techniques for each task.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Describe various tools of Data Mining and their techniques to solve the real time problems.	Remember
CO2	Demonstrate knowledge of Data Warehouse architecture and its implementation.	Understand
CO3	Identify and examine patterns discovered by association rule mining, classification, and their application techniques for problem-solving.	Analyze
CO4	Use clustering methods and other data mining methodologies to analyze and interpret datasets.	Apply

Description:		
This Course is designed to understand the concepts of data warehousing and data mining.		
Prerequisites:	1	Database System, Programming Experience

Unit 1	**Data Mining**	
	Introduction of Data Mining, Online Analytical Processing, Techniques used to mine the data, Market Basket Analysis, Limitations and challenges to DM. Foundation of Data mining, the roots of Data Mining, The Approach to Data Exploration and Data Mining.	**8 Hrs**
Unit 2	**Data Warehouse**	
	Basic Concepts, Data warehouse architecture, The modern Data warehouse, Data Warehouse roles and structure, need of Data warehouse, The cost of Warehousing Data, Stores, Warehouses and Marts, Metadata, Metadata Extraction, Implementing Data Warehouse, Data Warehouse technologies.	**8 Hrs**
Unit 3	**Data Analysis and Visualization**	
	Data Analysis: Correlation, Covariance, Rank and Percentile, Histogram and Moving Average. Data Visualization with advance Charts: Stock Chart, Surface Chart, Donut Chart, Bubble Chart and Radar Chart.	**8 Hrs**
Unit 4	**Clustering**	**7 Hrs**
	What is clustering? Types of data, Partitioning Methods (k-Means, k-Medoids) Hierarchical Methods(Agglomerative , Divisive)	

Unit 5	**Association Rule Mining** Association rules: Motivation for Association, Rule mining, Market Basket Analysis, Apriori Algorithm, FP tree Algorithm, Iceberg Queries.	**7 Hrs**
Unit 6	**Web Mining** Introduction, web content mining, web structure mining, web usage mining.	**6 Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	3	2	1	-	-	-	-	-	-	-	-			
CO2	2	1	2	1	-	-	-	-	-	-	-	-			
CO3	2	2	2	2	2	-	-	-	-	-	-	-			
CO4	3	2	3	2	2	-	-	-	-	-	-	-			

References:

Text Books	
1	Data mining - Concepts & Techniques, Jiawei Han, Michelin Kamber, Jian Pei,3rd Ed.2012, MK publications.
Reference Books	
1	Mastering Data Mining- Michael J. A. Berry, Gordon S. Linoff, 2nd Edition Wiley publications.
2	Fundamentals of Database Systems, Nava the and Elmasry, Addison Wesley, 2000

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc20_cs12/preview
2	https://onlinecourses.swayam2.ac.in/cec19_cs01/preview
Additional Web-link	
1	https://www.coursera.org/courses?query=data%20mining
2	https://www.edx.org/learn/data-mining

2501PMCAPE2052–Big Data Analytics

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Understand the concepts Big Data and its technologies.
2. Use Big Data platforms for big data analysis.
3. Learn how to create compelling visualization stode liver business insights.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Demonstrate big data concepts and tools to manage and process large-scale datasets.	Understand
CO2	Describe structured and unstructured data using Hadoop and Spark frameworks.	Analyze
CO3	Implement data analytics techniques for pattern discovery and decision-making.	Apply
CO4	Design big data solutions for performance, scalability, and real-world applications.	Evaluate

Description:		
This Course is designed to understand the concepts of Big Data Analytics.		
Prerequisites:	1	Computer Programming, Data Mining, Data Analytics and Data Visualization

Unit 1	**Introduction to Big Data**	
	Big Data Concepts, Challenges Opportunities from Big Data Enterprise Information Management: New Approach to Enterprise Information Management for BigData.	**6Hrs**
Unit 2	**Big Data in the enterprise**	
	Capabilities needed for big data Big Data Implications for Industries Big Data Analytics Telecom/Banking/Retail/HealthCare/IT.	**7Hrs**
Unit 3	**Data Modelling**	
	Understanding data integration Pattern Big Data Workload Design Approaches Map- Reduce patterns, Algorithms and Use Cases. Introduction of No SQL, Database concepts: ACIDVs. BASE, Advantages, Shardingand Share Nothing, Architecture, No SQL Databases, Brewers CAP Theorem, Features and comparisons of few NOSQL Databases	**8 Hrs**
Unit 4	**Hadoop Framework**	**8Hrs**
	Hadoop Architecture, History of Hadoop – Facebook, Dynamo, Yahoo, Google Components of Hadoop Framework: HDFS, MAP Reduce Introduction to Pig, Hive, Mahout Installation of Single Node cluster-installation of Java, Hadoop Configuration.	
Unit 5	**Big Data Analytics Methodology**	**8 Hrs**
	Big data Analytics Methodology- Analyse& Evaluate Business Cases Develop Business Hypothesis Analyse outcomes, Build & Prepare Data sets, Select & Build Analytical Model, Design for Big data Scale, build production ready	

	System, setting Up the Big Data Analytics System, Gathering data, Measure & Monitor.	
Unit 6	**Extracting Value from Big Data** Real-time Analytics, Apache Spark, In-Memory Data Grid for Real-time Analysis Real Time Processing, UseCase.	**7Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	2	-	2	-	-	-	-	-	-	-	-			
CO2	1	1	3	2	-	-	-	-	-	-	-	-			
CO3	-	2	3	2	-	-	-	-	-	-	-	-			
CO4	3	2	3	2	2	-	-	-	-	-	-	-			

References:

Text Books	
1	MadhuJagadeesh,SoumendraMohanty,HarshaSrivatsa,"BigDataImperatives:EnterpriseBigData Warehouse,BIImplementationsandAnalytics",1stEdition,Apress(2013)
Reference Books	
1	FrankJ.Ohlhorst,"BigDataAnalytics:TurningBigDataintoBigMoney",WileyPublishers(2012)
2	CristianMolaro,SurekhaParekh,TerryPurcell,"DB211:TheDatabaseforBigData&Analytics",MCPress,(2013)

2501PMCAPE2053 –Advanced Operating System

Lectures	: 4 Hrs / Week	**Evaluation Scheme**	
Credit	: 4	**ISE**	: 40 Marks
Tutorials	: -	**ESE**	: 60 Marks

Course Objectives: The objective of the course is to
1. Learn Advanced Operating Systems Concepts using Unix/Linux
2. LearnprogramminginterfacetotheUnix/Linuxsystem-thesystemcallinterface
3. Learnhowtocreatecompellingvisualizationstodeliverbusinessinsights.
4. To analyze algorithms used for scheduling, memory management, and fault tolerance.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Define Advanced Operating System concepts.	Remember
CO2	Demonstrate Unix/Linux kernel system.	Understand
CO3	Implement Process Management and Memory Management in detail.	Apply
CO4	Describe Signal Processing in detail.	Analyze

Description:		
This Course is designed to understand the concepts of Advanced Operating Systems		
Prerequisites:	1	Working knowledge of C programming., Basic Computer Architecture concepts, Basic algorithms and data structure concepts

Unit 1	**Introduction to UNIX/Linux Kernel**	
	SystemStructure,UserPerspective,AssumptionsaboutHardware,Architectureof UNIXOperatingSystem.ConceptsofLinuxProgramming-FilesandtheFilesystem, Processes, Users and Groups, Permissions, Signals, Intercrosses Communication.	**6 Hrs**
Unit 2	**File and Directory I/O**	
	Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek,close, pipes, dup. open, create, file sharing, atomic operations, dup2, sync, fsync, and fdatasync, fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set- Group-ID,fileaccesspermissions,ownershipofnewfilesanddirectories,accessfunction, u mask function, chmod and fchmod ,sticky bit, chown, fchown, and lchown, filesize, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlinkandread link functions, filetimes, utime, mkdir and rmdir ,reading directories, chdir, fchdir, and getcwd, device special files.	**8Hrs**
Unit 3	**Process Environment, Process Control and Process Relationships-I**	
	Process states and transitions, layout of system memory, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaitingprocesstermination,invokingotherprograms,theuseridofaprocess, Changing the size of the process, The Shell, Process Scheduling	**8Hrs**
Unit 4	**Process Environment, Process Control and Process Relationships-II**	**8Hrs**
	Processtermination,environmentlist,memorylayoutofaCprogram,sharedlibraries, environment variables,setjmpandlongjmp,getrlimitandsetrlimit,processidentifiers, fork, vfork, exit, wait and waitpid, waitid, wait3 and wait4, race conditions, exec, changing user IDs and group IDs,system function, user identification, process times.	

Unit 5	**Memory Management** The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, choosing Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation.	**8Hrs**
Unit 6	**Signal Handling** Signal concepts, signal function, unreliable signals, interrupted system calls, reentrant functions, SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause,signalsets,sigprocmask,sigpending,sigsetjmpandsiglongjmp,sigsuspend,abort,systemfunctionrevisited,sleep.	**8Hrs**

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	-	2	-	-	-	-	-	-	-	-			
CO2	1	2	3	3	-	-	-	-	-	-	-	-			
CO3	3	2	1	2	-	-	-	-	-	-	-	-			
CO4	1	-	-	-	-	-	-	-	-	-	-	-			

References:

Text Books	
1	The Design of the UNIX Operating System, MauriceJ.Bach. PHI
Reference Books	
1	Advanced Programming in the UNIX Environment, Richard Stevens, Addison-Wesley
	Linux System Programming, Robert Love, O'Reilly

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc24_cs80/preview
2	https://elearn.nptel.ac.in/shop/nptel/real-time-operating-system
Additional Web-link	
1	https://alison.com/tag/operating-systems
2	https://www.edx.org/learn/operating-systems

2501PMCAPCC208P – Advanced Python Programming- Lab

Lectures : 4 Hrs / Week
Credit : 2

Evaluation Scheme
ISA : 25 Marks
POE : 50 Marks

Course Objectives: The objective of the courses to
1. Understand why Python is a useful scripting language for developers.
2. Understand how to design and program Python applications.
3. Learn how to build and package Python modules for reusability.
4. Learn how to design object-oriented program swath Python classes.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand the Basic Syntax of Python Programming.	Remember
CO2	Understand and implement concepts of object-oriented methodology using Python.	Understand
CO3	Understand and design collections in Python.	Understand
CO4	To develop problem-solving skills and their implementation through Python.	Apply

Description:		
This course is designed to understanding implement the fundamentals of Python programming		
Prerequisites:	1	Basic Computer skills and mathematical skills.

Sr. No.	**Practical Topic**	**Bloom's Taxonomy**
1	Study of Basics of python language	Understand
2	Python variables declaration and data types	Apply
3	Write a program to create as imple calculator	Apply
4	Write a program to check Armstrong's number or not	Apply
5	Write a program to display prime numbers from inputted range.	Apply
6	Write a program to count the number of vowel sand constants in a string.	Apply
7	Write a program to implement a Python list.	Apply
8	Write a program to implement Python Dictionary	Apply
9	Write a program to implement set operations in python.	Apply
10	File handling in python	Understand

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	3	2			
CO2	2	2	3	2	-	-	-	-	-	-	3	2			
CO3	1	2	2	3	-	-	-	-	-	-	3	2			
CO4	2	3	3	2	-	-	-	-	-	-	3	3			

References:

Text Books	
1	Learning Python By MarkLutz, O'Reilly Publication
2	Programming with python, Ausers Book, Michael Dawson, Cengage Learning
Reference Books	
1	Practical Programming: An introduction to Computer Science Using Python, second Edition , Paul Gries, Jennifer Campbell, Jason Montojo, The Pragmatic Bookshelf.
2	Python for Informatics: Exploring information, Charles Severance

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
2	https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_GUVI_01
Additional Web-link	
1	https://www.geeksforgeeks.org/python/python-programming-language-tutorial/
2	https://www.mygreatlearning.com/academy/learn-for-free/courses/python-fundamentals-for-beginners

2501PMCAPCC201T–Network Technology - Tutorial

Lectures : 1Hrs / Week
Credit : 1

Evaluation Scheme
ISA : 25 Marks
POE : -

Term Work & Tutorial
Complete 10-12 assignments covering core topics from each unit. The assignments should be practical and focus on understanding fundamental concepts and their real-world applications.
Studentswillanalyzevariousnetworkingtechnologies,focusingonkeyconceptssuchasdata Transmission, LAN technologies, routing, and security protocols, and implement practical exercises like setting up networks, testing data link layer functions, and exploring modern networking trends.
Students should complete exercises on core topics from each unit: • **Unit1:** Introduction to data communication concepts, terminology, and protocol models. • **Unit2:** Exploration of LAN technologies such as Ethernet, WI-Fi, and Bluetooth. • **Unit3:** Understanding data link layer functions like error detection and correction. • **Unit4:**ImplementingIPv4/IPv6addressingandroutingalgorithmsinnetworks. • **Unit5:** Configuring application layer protocols like HTTP, DNS, and FTP. • **Unit6:** Exploring emerging networking trend slike SDN, IoT, and network virtualization.
Studentsshouldimplementafewpracticalexercisesrelatedtokeydatacommunicationconceptsfromthe Syllabus, such as configuring network devices, implementing LAN technologies, setting up basic routing protocols, or troubleshooting network performance issues.

2501PMCAAEC206– Advanced Python Programming (Theory)

Practicals : 2Hrs / Week
Credit : 2

Evaluation Scheme
ISA : 50 Marks
POE : -

Course Objectives : The objective of the course is to

1. Introduce advanced Python concepts and syntax required for professional programming.
2. Explain object-oriented programming and modular development in Python.
3. Discuss file handling, exception handling, and functional programming techniques.
4. Build conceptual understanding of advanced Python topics used in lab projects.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Explain advanced Python features, including functions, modules, and packages.	Understand
CO2	Describe object-oriented programming concepts such as classes, inheritance, and polymorphism.	Remember
CO3	Explain file handling, exception handling, and data processing techniques in Python.	Apply
CO4	Analyze functional programming tools (decorators, generators, lambda functions) and their use cases.	Analyze

Description:

This theory course provides the conceptual foundation for Advanced Python Programming. It covers modules, object-oriented programming, file and exception handling, functional programming concepts, and data processing techniques. The course emphasizes conceptual understanding to support practical application in the lab, enabling students to implement advanced Python programs effectively.

Prerequisites:	Proficiency in basic Python programming, including syntax, loops, functions, and simple data structures. Fundamental computer skills and logical problem-solving ability.

Unit 1	**Advanced Functions & Modules**	
	Function arguments, recursion, nested functions, variable-length arguments; creating and importing modules, Python standard libraries	5 Hrs
Unit 2	**Object-Oriented Programming**	
	Classes, objects, constructors, instance & class variables; single, multiple, multilevel inheritance; super(); method overriding	4 Hrs
Unit 3	Polymorphism & Encapsulation	
	Operator overloading, method overloading, abstract classes, interfaces, encapsulation and data hiding	5 Hrs
Unit 4	**Exception Handling & File Handling**	5 Hrs
	try, except, else, finally blocks; user-defined exceptions; reading/writing text, CSV, JSON files; context managers	
Unit 5	**Functional Programming & Decorators**	5 Hrs
	Lambda, map, filter, reduce, list comprehensions; function decorators and practical examples	
Unit 6	**Iterators, Generators, Regular Expressions & Advanced Data**	4 Hrs

	Handling Iterator protocol, generator functions, yield keyword; regex syntax and validation; nested lists/dictionaries, advanced operations, introduction to database connectivity (SQLite/MySQL)	

Mapping of COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	3	2			
CO2	2	2	3	2	-	-	-	-	-	-	3	2			
CO3	1	2	2	3	-	-	-	-	-	-	3	2			
CO4	2	3	3	2	-	-	-	-	-	-	3	3			

References:

Text Books	
1	Learning Python By MarkLutz, O'Reilly Publication
2	Programming with python ,Ausers Book, Michael Dawson, Cengage Learning
Reference Books	
1	PracticalProgramming:AnintroductiontoComputerScienceUsingPython,second Edition , Paul Gries, Jennifer Campbell, Jason Montojo, The Pragmatic Bookshelf.
2	Python for Informatics: Exploring Information, Charles Severance

SWAYAM Courses	
1	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
2	https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_GUVI_01
Additional Web-link	
1	https://www.geeksforgeeks.org/python/python-programming-language-tutorial/
2	https://www.mygreatlearning.com/academy/learn-for-free/courses/python-fundamentals-for-beginners

2501PMCAOJT207 –Mini Project

Lectures : 4 Hrs / Week
Credit : 2

Evaluation Scheme
ISA : 25 Marks
POE : 50 Marks

Course Objectives: The objective of the course is to

1. To apply theoretical knowledge to solve real-world problems through software development
2. To enhance skills in system design, coding, testing, and documentation.
3. To encourage teamwork, project planning, and time management.
4. To develop the ability to present and defend technical solutions effectively.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Design and develop a complete software application or system.	Apply
CO2	Apply software engineering principles to real-world project development.	Apply
CO3	Collaborate effectively in teams and manage project workflows.	Apply
CO4	Present technical work clearly through documentation and oral presentation.	Apply

Guide Lines for Projects:

Project Selection
- Choose a relevant and feasible project that aligns with your specialization and current industry trends.
- The project must be original; plagiarism will lead to disqualification.

Project Proposal Submission
- Submit a project proposal including the title, objectives, scope, technology stack, and expected outcomes.
- The proposal must be approved by the assigned faculty guide.

Team Formation
- Projects can be done individually or in teams (preferably 2–3 members).
- Team members must contribute equally and document individual responsibilities.

Regular Progress Reviews
- Attend all scheduled review meetings and present progress updates.
- Maintain a project diary or logbook signed weekly by the faculty guide.

Technical Documentation
- Prepare proper documentation including system requirements, design diagrams, implementation, testing, and user manuals.
- Follow standard formatting and citation styles as instructed.

Final Submission Requirements
- Submit the source code, executable files, project report, and presentation slides.
- Ensure the report includes screenshots, test results, and references.

Viva Voce and Demonstration
- Demonstrate the working of the project and be prepared to answer technical questions during the final viva.
- Each team member must be able to explain the complete project.

Ethical Conduct
- Ensure ethical use of data and technology; avoid using copyrighted material without permission.
- Acknowledge all external tools, APIs, or frameworks used.

Secretory BOS Dept. of MCA	Chairman BOS Dept. of MCA	PG Coordinator TKIET, Warananagar

Dean Academics TKIET, Warananagar	Principal TKIET, Warananagar Chairman Academic Council