

DHANALAKSHMI SRINIVASAN INSTITUTE OF RESEARCH AND TECHNOLOGY

(Deemed to be University under section 3 of UGC Act, 1956.)
PERAMBALUR – 621 212, TAMIL NADU, INDIA.

SCHOOL OF ARTS AND SCIENCE

CURRICULUM AND SYLLABUS

M.C.A. COMPUTER APPLICATIONS

REGULATION 2026

PROGRAMME:

Vision:

- To emerge as a distinguished leader in advanced computing education, nurturing expert software professionals, visionary innovators, and responsible technocrats who leverage cutting-edge technologies to solve complex problems and foster digital empowerment across society.

Mission:

- To deliver inclusive, flexible, and interdisciplinary postgraduate programs in computer applications that integrate advanced computing concepts, emerging technologies, and domain knowledge, equipping graduates with superior analytical, programming, and project management skills for multifaceted careers and lifelong learning.
- To promote high-quality research and innovation in software engineering, data science, artificial intelligence, cybersecurity, and cloud computing, addressing real-world challenges in industry, governance, healthcare, and education sectors.
- To expand access to advanced computing education for rural and marginalized students by blending modern IT expertise with local requirements, preserving cultural knowledge through digital platforms, and developing entrepreneurial competencies for self-sustaining professional growth.
- To instill strong ethical standards, social commitment, and global perspective through practical projects, industry collaborations, community engagements, and experiential learning that effectively bridge advanced theory with impactful real-world computing solutions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO	PROGRAM EDUCATIONAL OBJECTIVES
PEO1	To provide graduates with an in-depth understanding of advanced computer applications, software architecture, database systems, networking, and modern development frameworks, preparing them for leadership roles in IT industry, research organizations, and academia.
PEO2	To enhance problem-solving, critical analysis, and research capabilities so that graduates can independently design, develop, implement, and evaluate sophisticated software systems and applications for complex real-life scenarios.
PEO3	To cultivate professional ethics, effective communication, teamwork, and leadership skills that enable graduates to excel in multidisciplinary teams and contribute responsibly to technological and societal development.
PEO4	To foster a culture of continuous learning and adaptability, empowering graduates to stay abreast of rapid technological advancements and pursue research, higher studies, innovation, or entrepreneurial initiatives in computer applications.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	PROGRAM SPECIFIC OUTCOMES
PSO1	Graduates will be proficient in applying advanced algorithms, software engineering principles, full-stack development, and emerging technologies to build scalable, secure, and efficient software solutions and applications.
PSO2	Graduates will demonstrate expertise in data analytics, artificial intelligence techniques, project management, and ethical computing practices, enabling them to contribute meaningfully to the IT industry, research projects, and technology-driven community initiatives.

PROGRAM OUTCOMES (Pos)

PO	PROGRAM OUTCOMES
PO1	Computational Knowledge Apply knowledge of computing fundamentals, mathematical foundations, and domain-specific concepts to develop computing solutions for complex problems.
PO2	Problem Analysis Identify, formulate, analyze, and solve complex computing problems using principles of mathematics, computer science, and relevant disciplines.
PO3	Design and Development of Solutions Design, develop, and evaluate computing systems, software, and processes that meet specified requirements while considering societal, environmental, and safety aspects.
PO4	Investigation of Complex Problems Conduct investigations using research methodologies, experimentation, data analysis, and interpretation to derive valid conclusions for computing problems.
PO5	Modern Tool Usage Select, adapt, and apply appropriate modern computing tools, technologies, and techniques for designing and implementing effective solutions.
PO6	Professional Ethics Demonstrate professional ethics, integrity, cyber responsibility, and adherence to legal and ethical standards in computing practice.
PO7	Individual and Team Work Function effectively as an individual and as a member or leader in multidisciplinary teams to accomplish shared goals.
PO8	Communication Skills Communicate effectively through technical reports, documentation, presentations, and interpersonal interactions with professional and societal stakeholders.
PO9	Project Management and Leadership Apply project management principles, financial considerations, and leadership skills to manage computing projects in multidisciplinary environments.
PO10	Societal and Environmental Responsibility Assess and address societal, environmental, health, safety, legal, and cultural issues associated with computing solutions and professional practice.
PO11	Life-long Learning Recognize the need for continuous learning and engage in independent professional development to adapt to emerging technologies and evolving industry demands.

SEMESTER-I

Semester	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
								CAT	ESE	Total
I	Core	Advanced Java Programming	PCA26101	4	0	0	4	40	60	100
	Core	Advanced Java Programming Lab	PCA26102	0	0	4	2	40	60	100
	SEC	Data Structures and Algorithms -I	PCA26S01	3	1	0	4	40	60	100
		Data Structures and Algorithms lab -II	PCA26S02	0	0	4	2	40	60	100
	MDC	Multi-Disciplinary Course -I	-	3	1	0	4	40	60	100
	DEC - I	Data Communication and Computer Networks -1	PCA26001	4	0	0	4	40	60	100
		Advanced Database Management Systems -2	PCA26002							
		Open Source Technology -3	PCA26003							
	DEC - II	Hardware and Networking Essentials - 4	PCA26004	4	0	0	4	40	60	100
		Mobile Application Development - 5	PCA26005							
		Image Processing -6	PCA26006							
							24			700

SEMESTER-II

SEMESTER II										
Semester	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
								CAT	ESE	Total
II	Core	Web Technologies	PCA26203	4	0	0	4	40	60	100
	Core	Web Technologies Lab	PCA26204	0	0	4	2	40	60	100
	SEC	Python Programming -III	PCA26S03	4	0	0	4	40	60	100
		Python Programming Lab -IV	PCA26S04	0	0	4	2	40	60	100
	MDC	Multi-disciplinary Course -II	-	3	0	0	3	40	60	100
	DEC - III	Advanced Operating System-7	PCA26007	4	0	0	4	40	60	100
		Cyber Security -8	PCA26008							
		Compiler Design - 9I	PCA26009							
	DEC - IV	Web Development - 10	PCA26010	4	0	0	4	40	60	100
		Agile Technology-11	PCA26011							
		Data Mining and Warehousing-12	PCA26012							
							23			700

SEMESTER-III

Semester	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
								CAT	ESE	Total
III	Core	Big Data Analytics	P CA26305	4	0	0	4	40	60	100
	Core	Big Data Analytics Lab	PCA26306	0	0	4	2	40	60	100
	Core	Artificial Intelligence and Machine Learning	PCA26307	3	1	0	4	40	60	100
	Core	Artificial Intelligence and Machine Learning Lab	PCA26308	0	0	4	2	40	60	100
	Core	Cloud Computing Tools & Techniques	PCA26309	4	0	0	4	40	60	100
	DEC- V	Prompt Engineering -13	PCA26013	4	0	0	4	40	60	100
		Mongo DB -14	PCA26014							
		Natural Language Processing -15	PCA26015							
	EE	Experiential Elective (Internship)	-	0	0	4	2	*	*	100
	SEC	Communication and Soft Skill	SEC2601	1	0	0	1	40	60	100
							23			800

SEMESTER-IV

Semester	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
								CAT	ESE	Total
IV	Core	Data Visualization	PCA26410	4	0	0	4	40	60	100
	Core	Robotics and Intelligent Systems	PCA26411	4	0	0	4	40	60	100
	Core	Project	PCA26EE2	0	0	24	12	40	60	100
							20			400

Semester-wise Categorization of Courses

COURSE CATEGORY	Semester				No of Courses	Total Credits
	I	II	III	IV		
Core Courses (Theory & Practical)	2	2	5	4	13	48
SEC–Skill Enhancement Course	2	2	1	-	5	12
MDC–Multi Disciplinary Course	1	1	-	-	2	8
DEC–Disciplinary Elective Course	2	2	1	-	5	20
EE–Experiential Elective	-	-	1	-	1	2
Total Courses Per Semester	7	7	8	4	26(Courses)	
Total Credits	24	23	23	20	90(Credits)	

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26101	Advanced Java Programming	Core	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand the fundamentals of Java programming, including data types, control structures, object-oriented concepts, exception handling, and multithreading.							
2. To develop database-driven applications using JDBC and gain proficiency in database connectivity, querying, and data management through Java.							
3. To design and implement graphical user interfaces using Java Foundation Classes (JFC), Swing components, event handling, and layout managers.							
4. To build dynamic and secure web applications using Servlets and JavaServer Pages (JSP), incorporating session management and database integration.							
5. To understand Enterprise JavaBeans (EJB) architecture and develop distributed enterprise applications using EJB components, deployment techniques, and modern enterprise computing practices.							
Course Outcomes:							
CO1: Explain the core concepts of Java, including object-oriented programming principles, classes, inheritance, packages, exception handling, and multithreading to develop Java applications.(K1)							
CO2: Develop Java applications that interact with relational databases using JDBC for data retrieval, manipulation, and web-based database connectivity.(K2)							
CO3: Design and implement graphical user interface (GUI) applications using Java Swing components, event handling, and layout managers.(K3)							
CO4: Build dynamic web applications using Servlets and JSP by implementing session management, database connectivity, and web security concepts.(K4)							
CO5: Analyze and develop enterprise applications using Enterprise JavaBeans (EJB) architecture, including session beans, entity beans, deployment strategies, and distributed application development. (K5)							

Unit-I		12 Hrs.
An overview of Java –Types of Java applications –Data types, variables and arrays–Operators - Control statements –Classes and Methods– Inheritance –Packages and Interfaces Exception Handling- Multithreaded Programming.		
Unit-II		12 Hrs.
Java in Databases - JDBC principles – data base access – Interacting - data base search–Creating multimedia databases – Database support in web applications.		
Unit-III		12 Hrs.
Java Foundation classes(JFC) /Swings –JButtons, JLabels, JCheck boxes, JRadio Buttons, JChoices, Lists, JText Fields and JText areas – JScrollbars – Canvases – Event Delegation model – Exceptions – Event classes – Listener Interfaces – Containers and Layout Managers– Adding tool tips and icons – Popup menus – Tabbed panes – sliders –progress bars – Tables.		
Unit-IV		12 Hrs.
Servlet basics-the servlet life cycle- retrieving information- sending HTML information- the session tracking- database connectivity. JSP: Introducing Java server pages – basics- beneath JSP -JSP session - JSP architecture – security.		
Unit-V		10 Hrs.
EJB architecture- EJB requirements – design and implementation – EJB session beans- EJB entity beans-EJB Clients – deployment tips, tricks and traps for building distributed and other systems – implementation and future directions of EJB.		
Unit-VI		2 Hrs.
CURRENT CONTOURS (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned.		

Text Book(s):

1. **Herbert Schildt**, *Java: The Complete Reference*, 12th Edition, McGraw-Hill Education, 2022.
Covers Java fundamentals, OOP concepts, exception handling, multithreading, JDBC, Swing, Servlets, and advanced Java topics.
2. **Cay S. Horstmann**, *Core Java Volume I – Fundamentals*, 13th Edition, Pearson, 2024.
Comprehensive coverage of Java programming concepts, classes, interfaces, collections, exceptions, and GUI programming.
3. **Cay S. Horstmann**, *Core Java Volume II – Advanced Features*, 13th Edition, Pearson, 2024.
Includes JDBC, networking, enterprise computing, web technologies, and advanced Java features.

4. **Marty Hall and Larry Brown**, *Core Servlets and JavaServer Pages (JSP)*, 2nd Edition, Pearson Education. Detailed coverage of Servlets, JSP, session tracking, security, and database connectivity.
5. **Richard Monson-Haefel**, *Enterprise JavaBeans (EJB)*, 5th Edition, O'Reilly Media. Comprehensive guide to EJB architecture, session beans, entity beans, deployment, and distributed systems.

Reference Book(s):

1. **Kathy Sierra and Bert Bates**, *Head First Java*, 3rd Edition, O'Reilly Media, 2022. Beginner-friendly introduction to Java programming and object-oriented concepts.
2. **Deitel & Deitel**, *Java: How to Program*, 12th Edition, Pearson Education, 2023. Covers Java fundamentals, GUI development, database connectivity, web programming, and enterprise applications.
3. **Harold W. Perry**, *Java Servlet and JSP Cookbook*, O'Reilly Media. Practical examples for developing web applications using Servlets and JSP.
4. **Jim Keogh**, *J2EE: The Complete Reference*, McGraw-Hill Education. Covers Java enterprise technologies including Servlets, JSP, JDBC, and EJB.
5. **Bruce Eckel**, *Thinking in Java*, 4th Edition, Prentice Hall. Strong focus on object-oriented programming principles and Java application development.

e Resources:

1. <https://www.edureka.co/blog/advanced-java-tutorial>
2. <https://www.khanacademy.org/computing/computer-programming>
3. <https://docs.oracle.com/javase/tutorial/uiswing/start/about.html>.
4. <http://www.codejava.net/java-se/jdbc/connect-to-oracle-database-via-jdbc>

Relationship Matrix for COs, POs and PSOs

Sem ester	Course code			Title of the course								Hours		Cred it
I	PCA26101			Advanced Java Programming								4		4
Cou rse Out comes (CO s)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mea n Scor e of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	3	2	2	2	2	2	2	3	2	2.38
CO2	3	3	3	3	3	2	2	2	2	2	2	3	3	2.54
CO3	3	3	3	2	3	2	2	2	2	2	2	3	2	2.38
CO4	3	3	3	3	3	2	2	2	2	2	2	3	3	2.54
CO5	3	3	3	3	3	2	2	2	3	2	3	3	3	2.69
Mean	3.00	3.00	3.00	2.60	3.00	2.00	2.00	2.00	2.20	2.00	2.20	3.00	2.60	2.51

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26102	Advanced Java Programming Lab	Core			4	2
Pre-Requisite: Not Required			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand and apply object-oriented programming concepts such as inheritance, method overriding, packages, and access control mechanisms in Java applications.							
2. To develop multithreaded Java applications using thread synchronization and inter-thread communication techniques.							
3. To utilize Java utility classes and libraries, including Calendar, Random, and Vector classes, for efficient application development.							
4. To design graphical user interfaces using AWT components and implement event-driven programming through mouse and keyboard event handling.							
5. To develop database-connected and network-based Java applications using JDBC, applets, and socket programming techniques.							
Course Outcomes:							
CO1: Implement Java programs using inheritance, method overriding, packages, and access specifiers to achieve modular and reusable software design.(K1)							
CO2: Develop multithreaded applications that demonstrate effective thread creation, synchronization, and inter-thread communication.(K2)							
CO3: Apply Java utility classes such as Calendar, Random, and Vector to solve programming problems and manage data efficiently.(K3)							
CO4: Design and implement interactive GUI applications using AWT components, menus, fonts, images, and event-handling mechanisms.(K4)							
CO5: Create database-driven and network-enabled Java applications using JDBC and socket programming for data management and communication.(K5)							

List of Programs

1. Programs implementing Inheritance, method overriding **(5 Periods)**
2. Programs implementing Access specification among the package. **(5 Periods)**
3. Programs implementing Inter Thread communication. **(5 Periods)**
4. Programs implementing Calendar, random, vector classes. **(5 Periods)**
5. Programs implementing the event handling both mouse and Keyboard. **(5 Periods)**
6. Programs implementing AWT menus, font, images, images. **(5 Periods)**
7. Programs implementing JDBC to a applet window to get and displaying Student details.
(5 Periods)
8. Programs using socket programming **(5 Periods)**
9. Demonstrate the use of ArrayList, LinkedList, HashSet, HashMap, and Iterator. **(5 Periods)**
10. Create GUI applications using JFrame, JButton, JLabel, JTextField, GridLayout, and
BorderLayout. **(5 Periods)**
11. Develop applications to insert, update, delete, and retrieve records from a database.
(5 Periods)
12. Programs implementing Serialization and Deserialization
13. Programs implementing Servlets to process client requests and generate dynamic web pages
(5 Periods)
14. Programs implementing Session Management using Cookies and HttpSession **(5 Periods)**
15. Programs implementing Mini Web Applications such as Student Information System,
Employee Management System, or Online Feedback System using JSP, Servlets, and JDBC
(5 Periods)

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	PCA26102			Advanced Java Programming Lab								4		2
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	2	1	1	1	-	-		3	2	2.09
CO2	3	3	2	2	3	1	1	1	-	-		3	2	2.09
CO3	3	2	2	2	3	1	-	-	-	-		3	2	2.25
CO4	2	2	3	2	3	1	1	2	-	-		3	2	2.10
CO5	3	3	3	2	3	1	1	1	1	1		3	3	2.25
Mean	2.80	2.60	2.60	2.00	2.80	1.00	1.00	1.20	0.20	0.20	0.00	3.00	2.20	2.08

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA261S01	Data Structures and Algorithms	SEC	3	1		4
Pre-Requisite: <ul style="list-style-type: none"> Proficiency in fundamental data structures such as arrays, linked lists, stacks, queues, trees. 			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand the fundamental concepts of linear and non-linear data structures and their representations in computer memory.							
2. To develop skills in implementing and manipulating data structures such as stacks, queues, linked lists, trees, and AVL trees for efficient data processing.							
3. To analyze algorithm design principles, recursive techniques, and divide-and-conquer strategies for solving computational problems.							
4. To apply greedy algorithms, heuristic methods, backtracking, and branch-and-bound techniques for designing efficient solutions to optimization problems.							
5. To understand and implement dynamic programming approaches for solving complex optimization and shortest-path problems.							
Course Outcomes:							
CO1: Apply linear data structures such as arrays, stacks, queues, and priority queues to solve computational problems efficiently.(K2)							
CO2: Implement linked lists, binary trees, AVL trees, and tree traversal algorithms for effective data organization and manipulation.(K3)							
CO3: Analyze and implement recursive, searching, sorting, and divide-and-conquer algorithms to improve computational efficiency.(K4)							
CO4: Design solutions using greedy, heuristic, backtracking, and branch-and-bound techniques for optimization and decision-making problems.(K5)							
CO5: Develop dynamic programming solutions for shortest-path, knapsack, optimal search tree, and travelling salesperson problems, and evaluate their performance.(K5)							
Unit-I							12 Hrs.

Linear Data Structures: Concepts Of Non-Primitive Data Structures - Storage Structure For Arrays - Stacks -Operations On Stacks - Queues - Priority Queues.		
Unit-II		12 Hrs.
Linked Linear Lists: Operations On Linked Linear Lists - Circularly Linked Lists - Doubly Linked Linear Lists. Non-Linear Data Structure: Trees - Binary Trees –Tree Traversal - Operations On Binary Trees - AVL Trees - Storage Representation And Manipulations Of Binary Trees.		
Unit-III		12 Hrs.
Algorithms: Algorithm Specification - Pseudo Code Conventions, Recursive Algorithms. Divide And Conquer: General Method - Sequential Search - Binary Search - Finding The Maximum And Minimum - Merge Sort Quick Sort- Insertion Sort - Selection Sort.		
Unit-IV		12 Hrs.
(a)Greedy Method: General Method – Knapsack problem – Job Sequencing with Deadlines -Optimal Merge Patterns–Spanning Tree -Minimum Cost Spanning Trees. (b) Algorithm Design Methods: Sub goals - Hill Climbing and Working Backward - Heuristics - Backtrack Programming - Branch and Bound.		
Unit-V		12 Hrs.
Dynamic Programming: General Method- Multistage Graphs–Single-Source Shortest Paths: General Weights - All Pair Shortest Path - Optimal Binary Search Trees - 0/1 Knapsack - Travelling Salesperson Problem.		

Text Book(s):

1. Jean-Paul Tremblay and Paul G. Sorenson, “An introduction to data structures with applications”, 2nd Ed, Tata McGraw Hill Publishing Company Limited, New Delhi, 1995. Units I and II.
2. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Computer Algorithms”, Galgotia Publications, New Delhi, 2007. Units III, IV(a) and V.
3. S.E. Goodman and S.T. Hedetniemi, “Introduction to the Design and Analysis of Algorithms”, Tata McGraw Hill, International Edition, 1987. Unit: IV(b).

Reference Book(s):

1. ReemaThareja, (2018). Data Structures using C, 2ndEdition, Oxford University Press, New Delhi.
2. Jean Paul Tremblay and Paul G. Sorensen, (2017). An Introduction to Data Structures with Applications, 2nd Edition, Tata McGraw Hill, New Delhi.

e Resources:

1. <https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/>
2. <https://techdevguide.withgoogle.com/paths/data-structures-and-algorithms/>
3. <https://www.programiz.com/dsa>

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course										Hours		Credit
I	PCA26S01	Data Structures and Algorithms										4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2	
CO1	3	3	2	2	2	1	-	-	-	-		3	2	2.25
CO2	3	3	3	2	2	1	-	-	-	-		3	2	2.38
CO3	3	3	3	3	3	1	-	-	-	-		3	2	2.50
CO4	3	3	3	3	3	1	1	-	-	-		3	2	2.42
CO5	3	3	3	3	3	1	1	1	-	-		3	3	2.52
Mean	3.00	3.00	2.80	2.60	2.60	1.00	0.40	0.20	0.00	0.00	0.00	3.00	2.20	2.41

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26S02	Data Structures and Algorithms Lab	SEC			4	2
Pre-Requisite: Not Required			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To develop problem-solving skills using Python programming constructs and built-in libraries for generating combinations and handling data collections.							
2. To understand and implement searching algorithms for efficient retrieval of data from linear and ordered collections.							
3. To design and analyze sorting algorithms for organizing data efficiently and evaluating their performance.							
4. To implement linear data structures such as stacks, queues, and linked lists for effective data storage and manipulation.							
5. To develop tree-based data structures and apply binary search tree operations for efficient data management and retrieval.							
Course Outcomes:							
CO1: Develop Python programs that utilize combinatorial techniques and fundamental programming constructs to solve computational problems.(K2)							
CO2: Implement and compare linear search and binary search algorithms for efficient data searching.(K3)							
CO3: Apply sorting techniques such as Bubble Sort, Selection Sort, Merge Sort, and Quick Sort to organize and process data effectively.(K3)							
CO4: Design and implement stacks, queues, singly linked lists, and doubly linked lists using Python for efficient data handling.(K4)							
CO5: Construct and manipulate Binary Search Trees to perform insertion, deletion, traversal, and search operations efficiently.(K5)							

List of Programs

1. Write a Python program to generate the combinations of n distinct objects taken from the elements of a given list. Example: Original list: [1,2,3,4,5,6,7,8,9] Combinations of 2 distinct objects:[1,2][1,3] [1, 4] [1,5][7,8] [7, 9] [8,9]. (4 Periods)
2. Write a program for Linear Search and Binary search (4 Periods)
3. Write a program to implement Bubble Sort and Selection Sort. (4 Periods)
4. Write a program to implement Merge sort and Quicksort. (4 Periods)
5. Write a program to implement Stacks and Queues (4 Periods)
6. Write a program to implement Singly Linked List. (4 Periods)
7. Write a program to implement Doubly Linked list (4 Periods)
8. Write a program to implement Binary Search Tree. (4 Periods)
9. Write a program to implement Circular Linked List and perform insertion, deletion, and Traversal operations. (4 Periods)
10. Write a program to implement Deque (Double-Ended Queue) using arrays or linked lists. (4 Periods)
11. Write a program to implement Heap Sort and Priority Queue using a Binary Heap. (4 Periods)
12. Write a program to implement AVL Tree and perform insertion and deletion operations with Rotations. (4 Periods)
13. Write a program to implement Graph Traversal Algorithms (BFS and DFS). (4 Periods)
14. Write a program to implement Shortest Path Algorithms (Dijkstra's Algorithm) for weighted graphs. (4 Periods)
15. Write a program to implement Hash Tables and perform insertion, searching, and deletion using collision handling techniques. (4 Periods)

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course											Hours	Credit
I	PCA26S02	Data Structures and Algorithms Lab											4	2
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	3	1	-	-	-	-		3	2	2.38
CO2	3	3	3	2	3	1	-	-	-	-		3	2	2.50
CO3	3	3	3	2	3	1	-	-	-	-		3	2	2.50
CO4	3	3	3	2	3	1	1	-	-	-		3	2	2.50
CO5	3	3	3	3	3	1	1	1	-	-		3	3	2.67
Mean	3.00	3.00	3.00	2.20	3.00	1.00	0.40	0.20	0.00	0.00	0.00	3.00	2.20	2.51

Unit-I		12 Hrs.
Networks Fundamentals : Components -Data Representation –Data Flow - Networks- Distributed Processing- Network Criteria - Physical Structures - Network Models - Categories of Networks, Interconnection of Networks: The OSI Model- TCP/IP Protocol Suite- Addressing.		
Unit-II		12 Hrs.
Network Layer : Logical addressing, Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Tunneling, address mapping, ICMP, IGMP, forwarding, Uni-cast routing protocols, multicast routing protocols.		
Unit-III		12 Hrs.
Transport Layer: Process to process delivery, UDP and TCP protocols, SCTP, data traffic, congestion, congestion control, QoS, integrated services, differentiated services, QoS in switched networks.		
Unit-IV		12 Hrs.
Application Layer : Domain name space, DNS in Internet, Remote Logging, Telnet, electronic mail, FTP, WWW, HTTP, SNMP, Multi-media, Network security.		
Unit-V		12 Hrs.
Fundamentals Of Data Communication : Communication Model – Data communications – Data Transmission: Concepts and Terminology, Analog and Digital Transmission, Transmission Impairments – Signal Encoding Techniques: Digital Data and Digital Signals – Multiplexing: FDM, TDM, Multiple Channel Access.		

Text Book(s):

- 1.Behrouz A. Forouzan , “Data Communications and Networking “, 6th Edition, Aug’ 2022
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks A Systems Approach, Elsevier Educate, 6th Edition, 2021.
- 3.Larry L. Peterson, Bruce S. Davie, “Computer Networks A Systems Approach, Elsevier Educate, 6th Edition, 2020.
- 4.James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, 8th Edition, Pearson Education, 2020.

Reference Book(s):

1. Larry L. Peterson and Bruce S. Davie, “Computer Networks: A Systems Approach”, 6th Edition, Morgan Kaufmann Publishers, June 2021.
2. Kurose, Ross: Computer Networking - A Top-Down Approach 8th Global edition, Pearson 2022
3. Jacek Rak, “Resilient Routing in Communication Networks, A Systems Perspective”, Springer, 2024

e Resources:

1. [GeeksforGeeks – Computer Networks Tutorials](#)
2. [TutorialsPoint – Data Communication and Computer Networks](#)
3. [Wireshark Documentation](#)
4. [MDN Web Docs – HTTP Overview](#)
5. [IBM Networking Concepts](#)
6. [Internet Society Resources](#)
7. [OWASP Network Security Resources](#)

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	26PCA1DEC1			Data Communication and Computer Networks								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	2	2	1	2	-	-	1	-	-		3	3	2.11
CO2	3	3	3	2	3	-	-	1	-	-		3	3	2.42
CO3	2	3	3	2	3	-	-	1	-	-		3	3	2.50
CO4	2	2	3	2	3	2	1	2	1	1		3	3	2.08
CO5	3	2	2	2	3	-	-	1	-	-		3	3	2.17
Mean	2.60	2.40	2.60	1.80	2.80	0.40	0.20	1.20	0.20	0.20	0.00	3.00	3.00	2.26

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26001	Advanced Database Management Systems	DEC - I	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand the fundamental concepts of database systems, data models, and Entity Relationship (ER) modeling.							
2. To learn relational database concepts, integrity constraints, keys, and normalization techniques for efficient database design.							
3. To develop skills in SQL programming for creating, manipulating, and querying databases using various SQL commands and functions.							
4. To understand transaction processing, concurrency control mechanisms, and database transaction management techniques.							
5. To acquire knowledge of database security, backup, recovery methods, and failure handling mechanisms.							
Course Outcomes:							
CO1: Explain the fundamentals of database systems, data models, and construct Entity Relationship diagrams for real-world applications.(K1)							
CO2: Design relational databases using keys, relationships, and normalization techniques to eliminate redundancy and maintain data integrity.(K2)							
CO3: Apply SQL commands and functions to create, manipulate, and retrieve data efficiently from relational databases.(K3)							
CO4: Analyze transaction processing concepts, concurrency control protocols, and deadlock handling techniques in database systems.(K4)							
CO5: Demonstrate knowledge of database security, backup strategies, and recovery techniques to ensure database reliability and availability.(K5)							
Unit-I							12 Hrs.
Introduction to Database Management System (DBMS): Database Concepts, characteristics of data in database, Overview of Database Models: Hierarchical Model, Network Model, Relational Model and Object-Oriented Model. Entity Relationship Model: Entity, Attributes, Relationships.							
Unit-II							12 Hrs.

Relational DBMS: RDBMS Terminology, Relational Data Structure, Data Integrity, Codd's Rule, Overview of Relational Algebra and Relational Calculus, Relational Database Design: Primary Keys, Foreign Keys, Candidate Keys, Relationships, Normalization, Purpose of Normalization, First Normal Form, Second Normal Form, Third Normal Form.

Unit-III	12 Hrs.
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SQL: SQL Data Types and Literals, DDL, DML, DQL, DCL, DAS, TCS, SQL operators, Creating Database, Creating, Modifying and Deleting Tables, Creating View, Indexes, Queries: Insert, Select, Update, Where Clause, Having Clause, Sub-Queries, Order By, Grouping, Creating Variables, Functions: Aggregate and Scalar, Joins, Unions, Triggers, Procedures.

Unit-IV	12 Hrs.
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Transactions: Transaction concept, Transaction Properties, Transaction States, Concurrency Control: Concurrency Control Schemes - Lock Based Protocols, Timestamp Based Protocols, Deadlock handling, User Defined Transaction.

Unit-V	12 Hrs.
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Database Security: Data Security Risks, Data security requirements, Database Users, Database Backup, Database Recovery: Types of database Failures, Recovery Techniques - Deferred Update, Immediate Update and Shadow paging.

Text Book(s):

1. Database System Concepts, 7th Edition, McGraw-Hill Education, 2019.
2. Database Management Systems, 3rd Edition, McGraw-Hill Education, 2003.
3. Database Management Systems, Dreamtech Press, Latest Edition.
4. Fundamentals of Database Systems, 7th Edition, Pearson Education, 2016.
5. A, Leon and M.Leon, "Database Management Systems"
6. R,Elrnasri,S.Navathe, "Fundamentals of Database Systems"

Reference Book(s):

1. An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.
2. Fundamentals of Database Systems, 7th Edition, Pearson Education, 2016.

3. Database Management Systems, 3rd Edition, McGraw-Hill Education, 2003.
4. SQL, PL/SQL: The Programming Language of Oracle, BPB Publications, Latest Edition.
5. Database Processing: Fundamentals, Design and Implementation, 15th Edition, Pearson Education, 2015.
6. Database Systems Using Oracle: A Simplified Guide to SQL and PL/SQL, PHI Learning, Latest Edition.

e Resources:

- [MySQL Official Documentation](#)
- [PostgreSQL Documentation](#)
- [W3Schools – SQL Tutorial](#)
- [GeeksforGeeks – DBMS Tutorial](#)

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	PCA26002			Advanced Database Management Systems								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)	Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11			PSO1
CO1	3	3	2	2	3	2	2	2	2	2		3	3	2.42
CO2	3	3	3	2	3	2	2	2	2	2		3	3	2.50
CO3	3	3	3	2	3	2	2	3	2	2		3	3	2.58
CO4	3	3	3	3	3	2	2	2	2	2		3	3	2.58
CO5	3	3	3	3	3	3	2	2	2	3		3	3	2.75
Mean	3.00	3.00	2.80	2.40	3.00	2.20	2.00	2.20	2.00	2.20	0.00	3.00	3.00	2.57

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26003	Open Source Technology	DEC - I	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand the philosophy and ecosystem of Open Source Software (OSS).							
2. To explore open-source operating systems, programming languages, databases, and web technologies.							
3. To gain hands-on experience with open-source development tools and version control systems.							
4. To develop applications using popular open-source technologies.							
5. To understand open-source licensing, security, and cloud technologies.							
Course Outcomes:							
CO1: Explain the concepts, principles, and licensing models of Open Source Software.(K1)							
CO2: Install and configure Linux operating systems and use shell scripting.(K2)							
CO3: Develop web applications using open-source frameworks and databases.(K3)							
CO4: Apply Git, Docker, and cloud-based open-source tools in software development.(K4)							
CO5: Build and deploy open-source applications following industry best practices.(K5)							

Unit-I	Introduction to Open Source Technology	12 Hrs.
Introduction to Open Source Software (OSS) – History and Evolution of Open Source – Free Software vs Open Source Software – Advantages and Challenges of Open Source Software – Open Source Development Model – Open Source Communities – Open Source Licenses – GNU General Public License (GPL) – MIT License – Apache License – BSD License – Open Source Business Models – Open Source Software Ecosystem.		
Unit-II	Linux Operating System and Shell Programming	12 Hrs.
Introduction to Linux – Linux Architecture – Linux File System – Linux Installation – Linux Commands – File and Directory Management – File Permissions – Process Management – User Management – Package Management – Shell Programming – Bash Scripting – Scheduling Jobs using Cron – Linux Administration Basics.		
Unit-III	Open Source Web Technologies	12 Hrs.

Open Source Web Technologies Overview – Apache HTTP Server – Nginx Web Server – PHP Programming Basics – Python Web Frameworks (Flask and Django) – Node.js Fundamentals – MySQL Database – PostgreSQL Database – SQLite – RESTful Web Services – Open Source Content Management Systems (WordPress and Drupal).

Unit-IV	Open Source Development Tools	12 Hrs.
Version Control Systems – Git Fundamentals – GitHub Workflow – GitLab – Continuous Integration and Continuous Deployment (CI/CD) – Docker Fundamentals – Docker Containers – Docker Images – Docker Compose – Kubernetes Basics – Jenkins Overview – Open Source Integrated Development Environments (Visual Studio Code and Eclipse).		
Unit-V	Emerging Open Source Technologies	12 Hrs.
Open Source Cloud Platforms – OpenStack Overview – Cloud Native Applications – Container Orchestration – DevOps Tools – Infrastructure as Code – Ansible Basics – Terraform Overview – Open Source Artificial Intelligence and Machine Learning Frameworks – TensorFlow – PyTorch – Ethical Issues in Open Source Software – Future Trends in Open Source Technology.		

Text Book(s):

1. Christopher Negus, *Linux Bible*, 10th Edition, Wiley.Chafic Kazoun, Programming Flex 2, O'Reilly Publications, 2007
2. Ellen Siever, Stephen Figgins, Robert Love & Arnold Robbins, *Linux in a Nutshell*, O'Reilly.
3. Karl Fogel, *Producing Open Source Software*, O'Reilly.
4. W. Richard Stevens & Stephen A. Rago, *Advanced Programming in the UNIX Environment*, Addison-Wesley.

Reference Book(s):

1. Andrew M. St. Laurent, *Understanding Open Source and Free Software Licensing*, O'Reilly.
2. Mark G. Sobell, *A Practical Guide to Linux Commands, Editors, and Shell Programming*, Pearson.
3. Nigel Poulton, *Docker Deep Dive*, Leanpub.
4. Kelsey Hightower, Brendan Burns & Joe Beda, *Kubernetes: Up and Running*, O'Reilly.
5. Sam Newman, *Building Microservices*, O'Reilly.

e Resources:

1. https://help.ubuntu.com?utm_source=chatgpt.com
2. https://nptel.ac.in?utm_source=chatgpt.com
3. https://nptel.ac.in?utm_source=chatgpt.com

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	PCA26003			Open Source Technology								4		4
Course Outcomes (Cos)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	2	2	3	-	-	2	-	-		3	3	2.62
CO2	3	3	3	2	3	-	2	2	-	-		3	3	2.66
CO3	3	3	3	3	3	2	2	2	-	-		3	3	2.75
CO4	3	3	3	3	3	2	3	2	2	-		3	3	2.75
CO5	3	3	3	3	3	2	3	2	2	2		3	3	2.92
Mean	3.00	3.00	2.80	2.60	3.00	1.20	2.00	2.00	0.80	0.40	0.00	3.00	3.00	2.74

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26004	Hardware and Networking Essentials	DEC-II	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand the fundamentals of computer systems, peripheral devices, and their roles in modern computing environments.							
2. To acquire knowledge of PC architecture, motherboard components, power supplies, and computer assembly procedures.							
3. To understand processor technologies, adapter cards, display devices, ports, cables, and the processes involved in assembling and disassembling personal computers..							
4. To study memory organization, storage devices, BIOS, POST operations, and techniques for installing, upgrading, and maintaining storage systems.							
5. To understand computer networking concepts, network architectures, communication protocols, reference models, and IP addressing mechanisms.							
Course Outcomes:							
CO1: Identify and explain the functions of computer peripherals, input/output devices, and portable computing systems.							
CO2: Analyze PC architecture and demonstrate knowledge of motherboard components, power supplies, and computer hardware installation procedures.							
CO3: Evaluate processor technologies, adapter cards, ports, cables, and perform basic computer assembly and disassembly operations.							
CO4: Differentiate memory types, storage technologies, and system initialization processes, and perform storage device installation and maintenance tasks.							
CO5: Describe computer networking fundamentals, network types, OSI and TCP/IP reference models, protocols, and IP addressing schemes.							
Unit-I							12 Hrs.

Basic computer system–Main system UNIT–Peripherals–Keyboard–keyboard types –keyboard organization–keyboard ergonomic–interfacing–Mouse–mouse types– mouse interface - Printer – printer types - Monitor – monitor types - Scanner – Digital camera- Laptop,PDA-Notebook computer.		
Unit-II		12 Hrs.
PC Architecture: The Case – Case types - The Power Supply - power supply types- Motherboard – motherboard chipset - motherboard types - Motherboard architecture – motherboard installation.		
Unit-III		12 Hrs.
Processor/CPU–Processortypes–Latestprocesortypes-processorinstallation- Adapter Cards- Display Devices-Ports and Cables–Assemble the PC–Disassemble the PC.		
Unit-IV		12 Hrs.
Memory–Primary memory-RAM,ROM,ECC,DIP,SIPP,SIMM,DIMM,RIMM DDR, XMS memory, Cache memory, shadow memory – POST – BIOS – Secondary memory – HDD – types of hard disk drives - tracks – sectors – installing and upgrading – partitioning-magneticrecording–CHKDSK-SCANDISK–FDISK–Opticaldisks– DVD – Blu-Ray.		
Unit-V		12 Hrs.
Network: Introduction–Uses of Computer Networks–Network Hardware: Personal Area Networks –Local Area Networks – Metropolitan Area Networks – Wide Area Networks–Internetworks–Protocols – Reference Models: The OSI Reference Model– The TCP/IP Reference Model -IP address.		

Text Book(s):

1. S. Scott Mueller, *Upgrading and Repairing PCs*, 23rd Edition, Pearson Education, 2022. Comprehensive coverage of PC hardware, processors, motherboards, memory, storage devices, peripherals, and networking fundamentals.
2. V. Rajaraman, *Fundamentals of Computers*, 6th Edition, PHI Learning, 2019. Provides a strong foundation in computer organization, hardware components, memory systems, and networking concepts. Peter Norton,
3. *Introduction to Computers*, 8th Edition, McGraw-Hill Education. Covers computer architecture, peripheral devices, storage systems, and communication technologies.
4. Charles J. Brookshear and Dennis Brylow, *Computer Science: An Overview*, 13th Edition, Pearson Education, 2021. Discusses computer hardware, system architecture, memory, storage, and networking fundamentals.

Reference Book(s):

1. K.L.James, Computer Hardware, Installation, Interfacing, Trouble shooting and Maintenance, 2013.
2. Jean Andrews, Joy Dark and Jill West, *CompTIA A+ Guide to IT Technical Support*, 11th Edition, Cengage Learning, 2022.
3. William Stallings, *Computer Organization and Architecture: Designing for Performance*, 11th Edition, Pearson Education, 2022.
4. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, 6th Edition, Pearson Education, 2021.

e Resources:

1. [Cisco Networking Academy](#)
2. [Intel Developer Zone](#)
3. [CompTIA IT Fundamentals Resources](#)
4. [Microsoft Learn](#)
5. [IBM Training and Skills.](#)

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	PCA26004			Hardware and Networking Essentials								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)	Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11			PSO1
CO1	3	2	2	1	2	1	-	-	-	-		3	2	2.00
CO2	3	3	2	2	2	1	-	-	-	-		3	2	2.17
CO3	3	3	3	2	2	1	-	-	-	-		3	2	2.33
CO4	3	2	2	2	2	1	-	-	-	-		3	2	2.08
CO5	3	3	2	2	3	1	1	1	-	-		3	2	2.33
Mean	3.00	2.60	2.20	1.80	2.20	1.00	0.20	0.20	0.00	0.00	0.00	3.00	2.00	2.54

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26005	MOBILE APPLICATION DEVELOPMENT	DEC-II	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. Understand the Android OS and application architecture and its installation.							
2. Build user interfaces with Layout, Form widgets and enhance the application with fragments.							
3. Understand the principles of graphics, messaging, sound and video and give an exposure to generating signed APK and Publishing it.							
4. Implement data management in Android applications using SQLite databases, content providers, menus, notifications, and action bars.							
5. Develop, optimize, test, sign, and deploy Android applications that support different screen sizes and multimedia features, including audio, video, camera, and messaging services.							
Course Outcomes:							
CO1: Understand Android Applications(K1)							
CO2: Understand Android Applications Development(K2)							
CO3:Understand Building User Interfaces(K3)							
CO4: Understand Databases and content Providers(K4)							
CO5: Supporting And Optimizing For Different Screen Sizes(K5)							
Unit-I	ANDROID INTRODUCTION						12 Hrs.
An Open Platform for Mobile Development – Native Android applications –Android SDK features – Evolution- development of android for mobile –Development framework.							
Unit-II	ANDROID APPLICATION DEVELOPMENT						12 Hrs.
Installation – Creating application – Types of Applications – Android development tools. Creating Applications and activities: Application Manifest file – Manifest editor – Externalizing the resources – Android application life cycle – Android application class- android activities.							
Unit-III	BUILDING USER INTERFACES						12 Hrs.

Fundamental UI Design – Layouts – Fragments – Widget Tool box – Creating new views – introducing adapters.

Unit-IV	DATABASES AND CONTENT PROVIDERS	12 Hrs.
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Android databases – working with SQLite databases – Creating content providers – Native android content providers-Introducing the Action Bar–Creating and Using Menus and Action bar action items – Introducing Dialogs – Introducing notifications.

Unit-V	SUPPORTING AND OPTIMIZING FOR DIFFERENT SCREEN SIZES	12 Hrs.
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Creating scalable graphic assets–Working with animations-Audio, Video and using the Camera-introducing SMS and MMS – signing and publishing application.

Text Book(s):

1. Reto Meier, “Professional Android 4 Application Development”, WROX Publication – Wiley–India, 2012
2. Pradeep Kothari & Kogent Learning Solutions Inc, “Android Application Development
3. Black Book ”, Dream tech Press, Edition 2014, ISBN:978–93–5119–409–5.

Reference Book(s):

1. W.Frank Ableson, Robi Sen, Chris King, C.Enrique Ortiz, “Android in Action”, Manning Publications Co, Third Edition, ISBN 9781617290508

e Resources:

1. [Intel Developer Zone](http://intel.com/developer-zone)
2. <https://software.intel.com>
3. <https://www.comptia.org/certifications/it-fundamentals>
4. <https://www.ibm.com/training/>

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	PCA26005			MOBILE APPLICATION DEVELOPMENT								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	
CO1	3	2	2	1	2	1	-	-	-	-	-	3	2	2.00
CO2	3	3	2	2	2	1	-	-	-	-	-	3	2	2.17
CO3	3	3	3	2	2	1	-	-	-	-	-	3	2	2.33
CO4	3	2	2	2	2	1	-	-	-	-	-	3	2	2.08
CO5	3	3	2	2	3	1	1	1	-	-	-	3	2	2.33
Mean Attainment of POs / PSOs	3.00	2.60	2.20	1.80	2.20	1.00	0.20	0.20	0.00	0.00	0.00	3.00	2.00	2.54

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	PCA26006	IMAGE PROCESSING	DEC-II	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. Understand the fundamentals of digital image processing systems, image representation, and human visual perception.							
2. Analyze image transforms in both spatial and frequency domains for efficient image processing.							
3. Apply image enhancement techniques to improve image quality using spatial and frequency domain methods.							
4. Evaluate image restoration techniques for removing degradations and reconstructing images.							
5. Analyze image compression and reconstruction techniques used in medical imaging, remote sensing, multimedia, and computer vision applications.							
Course Outcomes:							
CO1: Review the fundamental concepts of a digital image processing system(K1)							
CO2: Analyze images in the frequency domain using various transforms.(K2)							
CO3:Understand the fundamentals of digital image processing systems, image representation, and human visual perception.(K3)							
CO4: Evaluate the techniques for image enhancement and image restoration. Categorize various compression techniques.(K4)							
CO5: Gain idea to process various image used in various fields such as weather forecasting, Diagnosis of various disease using image Such as tumour, cancer etc.(K5)							
Unit-I	CONTINUOUS AND DISCRETE IMAGES AND SYSTEMS						12 Hrs.
Light, Luminance, Brightness and Contrast, Eye, The Monochrome Vision Model, Image Processing Problems and Applications, Vision Camera, Digital processing System, 2-D Sampling Theory, Aliasing, Image Quantization, Lloyd Max Quantizer, Dither, Color Images, Linear Systems And Shift Invariance, Fourier Transform, Z Transform, Matrix Theory Results, Block Matrices and Kronecker Products.							
Unit-II	IMAGE TRANSFORMS						12 Hrs.

2-D orthogonal and Unitary transforms, 1-D and 2-DDFT, Cosine, Sine, Walsh, Hadamard, Haar, Slant, Karhunen-loeve, Singular value Decomposition transforms.

Unit-III	IMAGE ENHANCEMENT	12 Hrs.
Point operations-contrast stretching, clipping and thresholding density slicing, Histogram equalization, modification and specification, spatial operations – spatial averaging, low pass, high pass, bandpass filtering, direction smoothing, median filtering, generalized cepstrum and homomorphic filtering, edge enhancement using 2-D IIR and FIR filters, color image enhancement.		
Unit-IV	IMAGE RESTORATION	12 Hrs.
Image observation models, sources of degradation, inverse and Wiener filtering, geometric mean filter, non linear filters, smoothing splines and interpolation, constrained least squares restoration.		
Unit-V	IMAGE DATA COMPRESSION AND IMAGE RECONSTRUCTION FROM PROJECTIONS	12 Hrs.
Image data rates, pixel coding, predictive techniques transform coding and vector DPCM, Block truncation coding, wavelet transform coding of images, color image coding. Random transform, back projection operator, inverse random transform, back projection algorithm, fan beam and algebraic restoration techniques.		

Text Book(s):

1. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI, 1995.
2. Sid Ahmed M.A., “Image Processing”, McGraw Hill Inc, 1995.
3. Gonzalez R. and Wintz P., “Digital Image Processing”, Addison Wesley, 2nd Ed, 1987
4. W. Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz, “Android in Action”, Manning Publications Co, Third Edition, ISBN 9781617290508

Reference Book(s):

1. Digital Image Processing, Pearson Education, 2018.
2. Fundamentals of Digital Image Processing, Prentice Hall of India, 1995.
3. Digital Image Processing Using MATLAB, Pearson Education, 3rd Edition.
4. Image Processing: Principles and Applications, Wiley, 2005.

5. Digital Image Processing, McGraw-Hill Education.

e Resources:

1. <https://www.tutorialspoint.com/dip/index.htm>
2. https://en.wikipedia.org/wiki/Digital_image_processing
3. <https://www.javatpoint.com/digital-image-processing-tutorial>

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	PCA26006			MOBILE APPLICATION DEVELOPMENT								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	
CO1	3	2	2	1	2	1	-	-	-	-	-	3	2	2.00
CO2	3	3	2	2	2	1	-	-	-	-	-	3	2	2.17
CO3	3	3	3	3	2	1	-	-	-	-	-	3	2	2.33
CO4	3	3	3	3	3	1	-	-	-	-	-	3	2	2.50
CO5	3	3	3	3	3	2	2	1	-	-	-	3	3	2.67
Mean	3.00	2.80	2.60	2.40	2.40	1.20	0.40	0.20	0.00	0.00	0.00	3.00	2.20	2.33

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	PCA26203	Web Technologies	Core	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand the fundamentals of PHP programming, including variables, operators, control structures, cookies, sessions, and server-side scripting concepts..							
2. To develop dynamic web applications using PHP file handling techniques and MySQL database operations for data storage and retrieval.							
3. To understand the architecture and technologies of web services, including XML, XML Schema, SAX, and DOM for data representation and exchange.							
4. To analyze SOAP and WSDL technologies for designing, publishing, and consuming interoperable web services.							
5. To understand UDDI, web service conversations, workflow management, and business process execution techniques used in enterprise web service applications.							
Course Outcomes:							
CO1: Develop server-side web applications using PHP constructs, cookies, sessions, and server variables to manage dynamic web content.(K2)							
CO2: Design and implement database-driven web applications using PHP and MySQL with file handling and data manipulation operations.(K3)							
CO3: Apply XML technologies, including XML Schema, SAX, and DOM, to create, validate, parse, and process structured data for web services.(K3)							
CO4: Design and evaluate SOAP-based web services using WSDL specifications and related standards for service communication and integra(K4)							
CO5: Analyze and implement service-oriented solutions using UDDI, WSCL, workflow management systems, and business process execution languages for enterprise applications.(K5)							

Unit-I		12 Hrs.
PHP introduction: variables – operators – control structures – Advanced concepts in PHP : Cookies – sessions – server variables .		
Unit-II		12 Hrs.
Accessing files–reading –writing- MySQL database: insert –update –delete –join– group by – aggregate functions – formats – case studies.		
Unit-III		12 Hrs.
Introduction – What are web services? SOAP WSDL UDDI– Web services and enterprises. XML: XML Fundamentals XML: The Lingua Franca of web services-XML Documents XML namespaces Explicit and Default namespaces, Inheriting namespaces, And not inheriting namespaces, Attributes and namespaces –XML Schema XML schema and namespaces, A first schema, Implementing XML schema types. SAX: Simple API for XML, DOM: Document object Model.		
Unit-IV		12 Hrs.
SOAP and WSDL5 The SOAP Model- SOAP- SOAP Messages SOAP Envelope, SOAP Header, SOAP Body, SOAP Faults SOAP encoding – SOAP RPC- Using alternative SOAP Encodings, Document, RPC, Literal, Encoded SOAPRPC and SOAP Document Literal, SOAP web services and the REST Architecture - Syntactic differences between SOAP 1.2-WSDL structure, The stock quote WSDL interface, definitions, The type element, bindings, services, managing WSDL descriptions, Extending WSDL – Using SOAP and WSDL		
Unit-V		12 Hrs.
UDDI: UDDI at a glance- The UDDI Business registry-UDDI under the covers – Accessing UDDI- How UDDI is playing out Conversations Overview – Web Services – Web services Conversation Language – WSCL Interface components –Relationship between WSCL and WSDL Workflow Business Process Management – Workflow and Workflow management systems – Business process execution language for web services		

Text Book(s):

1. K. Meena , R. Sivakumar , A.B. Karthick Anand Babu “Web programming using PHP and MySQL” Himalaya Publishing House – 2011. (for UNIT 1 and UNIT 2)
2. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services An Architect’s Guide” Pearson Education–Second Indian Reprint 2005. (for UNIT 3, UNIT 4 and UNIT 5)
3. Ron Schmelzer, Travis Vandersypen, Jason Bloomberg, Ashutosh Banerjee and Graham

Cummins, *XML and Web Services Unleashed*, Sams Publishing, 2002.

- Introduces web services, SOA principles, SOAP, WSDL, UDDI, and enterprise integration.

Reference Book(s):

- Ben Forta, *SQL in 10 Minutes, Sams Teach Yourself*, 5th Edition, Sams Publishing, 2020.
- Deitel and Deitel, *Internet and World Wide Web: How to Program*, 5th Edition, Pearson Education, 2012.
- David Hunter, Jeff Rafter, Joe Fawcett, Eric van der Vlist and Danny Ayers, *Beginning XML*, 5th Edition, Wrox Publications, 2012.

e Resources:

- [PHP Official Documentation](#)
- [MySQL Documentation](#)
- [W3Schools PHP Tutorial](#)
- [MDN Web Docs – Web Technologies](#) .
- [W3C XML Technology Resources](#)
- [SOAP Specification Resource](#)

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	PCA26203			Web Technologies								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	3	1	1	1	-	-		3	1	2.20
CO2	3	3	3	2	3	1	1	1	-	-		3	1	2.20
CO3	3	3	2	3	3	1	-	-	-	-		3	2	2.50
CO4	3	3	3	3	3	1	1	1	-	-		3	2	2.42
CO5	3	3	3	3	3	1	1	1	1	-		3	2	2.50
Mean	3.00	3.00	2.80	2.60	3.00	1.00	0.80	0.80	0.20	0.00	0.00	3.00	1.60	2.57

List of Programs

1. Create a simple Web Service that converts the temperature from Fahrenheit to Celsius and vice
(4 Periods)
2. Use the above Web Service on a webpage and execute to fetch the results
(4 Periods)
3. Create a Web Services provider and make it available on the Internet or intranet
(4 Periods)
4. Create a web-based Consumer of an existing webservice. (4 Periods)
5. Create a Windows application-based consumer of an existing webservice
(4 Periods)
6. Write an application that simulates sending a SOAP message as a request and receiving
another as a response. (4 Periods)
7. Develop a WebService that provides images as responses. (4 Periods)
8. Develop a webservice that access table contents of a database. (4 Periods)
9. Develop a console-based WebService Client. (4 Periods)
10. Develop a Web intranet/internet-based Web Service Client. (4 Periods)
11. Develop a RESTful Web Service to perform CRUD (Create, Read, Update, Delete)
operations on student records. (4 Periods)
12. Create a JSON-based Web Service and develop a client application to consume the JSON
response. (4 Periods)
13. Develop a File Upload and Download Web Service using HTTP protocols. (4 Periods)
14. Create a Web Service Authentication System using login credentials and session
management. (4 Periods)
15. Develop a Weather Information Web Service Client that consumes a public API and displays
weather details on a web page. (4 Periods)

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	PCA26204			Web Technologies Lab								4		2
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	3	1	1	1	-	-		3	2	2.20
CO2	3	3	3	2	3	1	1	1	1	-		3	2	2.30
CO3	3	3	3	2	3	1	1	1	-	-		3	2	2.20
CO4	3	3	3	3	3	1	1	1	-	-		3	2	2.40
CO5	3	3	3	3	3	1	1	1	1	-		3	2	2.50
Mean Attainment of POs / PSOs	3.00	3.00	3.00	2.40	3.00	1.00	1.00	1.00	0.40	0.00	0.00	3.00	2.00	2.57

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	PCA26S03	Python Programming	SEC	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To introduce the fundamentals of Python programming, including syntax, data types, input/output operations, and object-oriented programming concepts.							
2. To develop problem-solving skills using control structures, loops, and exception handling mechanisms in Python.							
3. To understand and apply functions, modules, and packages for developing modular and reusable Python applications.							
4. To utilize Python data structures such as lists, tuples, dictionaries, and sets for efficient data storage and manipulation.							
5. To implement file handling techniques and advanced Python features, including lambda functions, comprehensions, iterators, decorators, and context managers.							
Course Outcomes:							
CO1: Apply Python programming fundamentals, object-oriented concepts, and basic input/output operations to develop simple applications.(K3)							
CO2: Design Python programs using conditional statements, loops, and exception handling techniques to solve computational problems effectively.(K4)							
CO3: Develop modular Python applications using functions, modules, packages, and variable scope management.(K3)							
CO4: Utilize lists, tuples, dictionaries, and sets to organize, process, and manipulate data efficiently in Python programs.(K3)							
CO5: Implement file operations and advanced Python programming constructs such as lambda functions, comprehensions, decorators, iterators, and context managers to develop robust applications.(K5)							
Unit-I							12 Hrs.

Introduction to Python- Overview of Python- Installation of Python and IDEs (Anaconda, PyCharm, Jupyter Notebook) - Python Syntax, Variables, and Data Types- Basic Input and Output- Comments in Python Object-Oriented Programming in Python- Introduction to OOP concepts- Classes and Objects- Attributes and Methods-Inheritance: Single, Multiple, and Multilevel- Polymorphism and Encapsulation		
Unit-II		12 Hrs.
Control Structures- Conditional Statements (if, elif, else)- Looping Constructs (for, while)- Break and Continue Statements - Introduction to Exceptions and Error Handling.		
Unit-III		12 Hrs.
Functions and Modules- Defining Functions- Function Arguments (default, keyword, variable-length)- Return Values and Scope of Variables - Introduction to Modules and Packages.		
Unit-IV		12 Hrs.
Data Structures- Lists: Creating, accessing, and manipulating- Tuples: Immutability and tuple packing/unpacking- Dictionaries: Key-value pairs, methods- Sets: Properties and operations.		
Unit-V		12 Hrs.
File Handling- Reading files - Writing to files - Working with different file formats (text, CSV)- Exception Handling in File Operations Advanced Features- Lambda Functions- List Comprehensions and Generator Expressions - Decorators and Iterators - Context Managers.		

Text Book(s):

1. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 3rd Edition, O'Reilly Media, 2024.
2. John V. Guttag, *Introduction to Computation and Programming Using Python*, 3rd Edition, MIT Press, 2021.
3. Reema Thareja, *Python Programming: Using Problem Solving Approach*, Oxford University Press, 2019.
4. Paul Deitel and Harvey Deitel, *Python for Programmers*, Pearson Education, 2020.
5. Van Horne, James, C: *Financial Management and Policy*, Pearson, 2009.

Reference Book(s):

1. **Mark Lutz**, *Learning Python*, 5th Edition, O'Reilly Media, 2013.
2. **Eric Matthes**, *Python Crash Course*, 3rd Edition, No Starch Press, 2023.

3. **Kenneth A. Lambert**, *Fundamentals of Python: First Programs*, 3rd Edition, Cengage Learning, 2018.
4. **Wesley J. Chun**, *Core Python Programming*, 3rd Edition, Pearson Education.
5. **Charles R. Severance**, *Python for Everybody: Exploring Data Using Python*, 2023 Edition.

e Resources:

1. [Python Official Documentation](#)
2. [Python Software Foundation](#)
3. [W3Schools Python Tutorial](#)
4. [Real Python](#)
5. [TutorialsPoint Python Tutorial](#)

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	PCA26S03			Python Programming								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	3	1	1	1	-	-		3	2	2.20
CO2	3	3	3	2	3	1	1	1	-	-		3	2	2.20
CO3	3	3	3	2	3	1	1	1	-	-		3	2	2.20
CO4	3	3	3	2	3	1	1	1	-	-		3	2	2.20
CO5	3	3	3	3	3	1	1	1	1	-		3	2	2.40
Mean	3.00	3.00	3.00	2.20	3.00	1.00	1.00	1.00	0.20	0.00	0.00	3.00	2.00	2.24

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	PCA26S04	Python Programming Lab	SEC			4	2
Pre-Requisite: Not Required			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To develop fundamental programming skills using Python for solving basic computational problems.							
2. To understand and implement searching, sorting, and stack operations using appropriate programming techniques.							
3. To explore string manipulation and regular expression techniques for text processing and data validation.							
4. To apply file handling operations for storing, retrieving, and managing data efficiently.							
5. To utilize Python data structures such as lists and dictionaries for organizing and processing information effectively.							
Course Outcomes:							
CO1: Develop Python programs to solve computational problems using fundamental programming constructs and arithmetic operations.(K3)							
CO2: Implement searching, sorting, and stack-based algorithms to perform efficient data processing tasks.(K3)							
CO3: Apply string functions and regular expressions to perform text manipulation and data validation operations.(K4)							
CO4: Perform file input/output operations for reading, writing, and managing data in Python applications. (K3)							
CO5: Utilize lists and dictionaries to store, organize, and manipulate data effectively in Python programs. (K4)							

List of Programs

1. Implement a sequential search. (4 Periods)
2. Create a calculator program. (4 Periods)
3. Explore string functions. (4 Periods)
4. Implement Selection Sort. (4 Periods)
5. Implement Stack. (4 Periods)
6. Read and write into a file. (4 Periods)
7. Demonstrate usage of basic regular expression. (4 Periods)
8. Demonstrate use of advanced regular expressions for data validation. (4 Periods)
9. Demonstrate use of List (4 Periods)
10. Demonstrate use of Dictionaries (4 Periods)
11. Implement Functions and Recursive Functions (Factorial, Fibonacci, GCD, etc.). (4 Periods)
12. Demonstrate the use of Tuples and Sets and perform various operations on them. (4 Periods)
13. Implement Exception Handling using try, except, else, finally, and user-defined exceptions. (4 Periods)
13. Develop programs using Object-Oriented Programming Concepts (Classes, Objects, Inheritance, and Polymorphism). (4 Periods)
15. Develop a Mini Project such as Student Management System, Library Management System, or Employee Payroll System using Python. (4 Periods)

Relationship Matrix for COs, POs and PSOs

Semester	Course code		Title of the course									Hours		Credit
II	PCA26S04		Python Programming Lab									4		2
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	3	1	-	-	-	-		3	2	2.29
CO2	3	3	3	2	3	1	-	-	-	-		3	2	2.29
CO3	3	3	2	2	3	1	1	1	-	-		3	2	2.17
CO4	3	2	2	2	3	1	-	-	-	-		3	2	2.08
CO5	3	3	3	2	3	1	1	1	-	-		3	2	2.33
Mean Overall Score	3.00	2.80	2.60	2.00	3.00	1.00	0.40	0.40	0.00	0.00	0.00	3.00	2.00	2.59

[illegible]

Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms.

Unit-III	DISTRIBUTED RESOURCE MANAGEMENT	12 Hrs.
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Distributed File Systems – Design Issues – Distributed Shared Memory – Algorithms for Implementing Distributed Shared Memory – Distributed Scheduling – Issues in Load Distributing – Load Distributing Algorithms.

Unit-IV	REAL TIME AND MOBILE OPERATING SYSTEMS	12 Hrs.
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Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Microkernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

Unit-V	CASE STUDIES	12 Hrs.
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Linux System: Design Principles - Kernel Modules - Process Management - Scheduling - Memory Management – Input Output Management - File System – Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Text Book(s):

1. Mukesh Singhal, Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, First Edition, 1994.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts - Essentials”, Ninth Edition, John Wiley & Sons, 2013.

Reference Book(s):

1. Love Robert,” Linux Kernel Development”, Pearson Education India, Third Edition, 2018.
2. Jean Paul NeilSmyth, “iOS 12 App Development Essentials”, Payload media, 2018.

e Resources:

1. https://www.wiley.com/en-us/Operating+System+Concepts%2C+9th+Edition-p-9781118063330?utm_source
2. https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/?utm_source
3. https://www.gnu.org/software/software.html?utm_source

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	PCA26007			Advances in Operating Systems								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	2	2	1	-	-	-	-	-	-	3	2	2.29
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	2.57
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	2.71
CO4	3	2	2	2	2	-	-	-	-	-	-	3	3	2.43
CO5	3	3	3	3	3	-	-	-	2	2	1	3	3	2.69
Mean Overall Score	3.00	2.80	2.60	2.20	2.00	0.00	0.00	0.00	0.40	0.40	0.20	3.00	2.60	2.54

[illegible]

CO5: Perform digital forensic investigations by applying evidence collection, preservation, forensic analysis techniques, and adhering to legal and ethical standards.(K5)		
Unit-I		12 Hrs.
Introduction to Cyber Security- Overview of Cyber Security- Importance of Cyber Security- Types of Cyber Threats- Cyber Security Terminology . Cyber Security Policy and Governance- Information Security Policies- Risk Management and Compliance- Incident Response and Management- Cyber Security Standards and Frameworks (e.g., NIST, ISO 27001)		
Unit-II		12 Hrs.
Networking and Security- Computer Networks Basics- Network Protocols and Security- Firewalls, VPNs, and IDS/IPS - Wireless Security . Cryptography and Its Applications- Introduction to Cryptography- Symmetric. Asymmetric Encryption- Hash Functions and Digital Signatures- Applications of Cryptography in Cyber Security.		
Unit-III		12 Hrs.
Operating Systems Security- OS Security Fundamentals- Secure OS Configurations- Malware Analysis and Prevention - Virtualization Security.		
Unit-IV		12 Hrs.
Ethical Hacking and Penetration Testing- Overview of Ethical Hacking- Penetration Testing Methodologies- Vulnerability Assessment Tools- Reporting and Remediation.		
Unit-V		12 Hrs.
Digital Forensics- Digital Forensics Fundamentals-Evidence Collection and Preservation- Forensic Analysis Techniques - Legal and Ethical Issues in Digital Forensics.		

Text Book(s):

1. William Stallings and Lawrie Brown, *Computer Security: Principles and Practice*, 5th Edition, Pearson Education, 2024.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger, and Jonathan Margulies, *Security in Computing*, 6th Edition, Pearson Education, 2022.
3. Michael E. Whitman and Herbert J. Mattord, *Principles of Information Security*, 7th Edition, Cengage Learning, 2021.
4. James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach*, 8th Edition, Pearson Education, 2021.
5. William Stallings, *Cryptography and Network Security : Principles and Practice*, 8th Edition,

Reference Book(s):

1. Bruce Schneier, *Applied Cryptography: Protocols, Algorithms, and Source Code in C*, 20th Anniversary Edition, Wiley India, 2015.
2. Matt Bishop, *Computer Security: Art and Science*, 2nd Edition, Addison-Wesley, 2018.
3. Eric Cole, *Network Security Bible*, 3rd Edition, Wiley Publishing, 2011.
4. Bill Nelson, Amelia Phillips, and Christopher Steuart, *Guide to Computer Forensics and Investigations*, 6th Edition, Cengage Learning, 2018.
5. Nelson Phillips and Enfinger Steuart, *Computer Forensics and Investigations*, Cengage Learning.

e Resources:

1. [National Institute of Standards and Technology \(NIST\) Cybersecurity Framework](#)
2. [Cybersecurity and Infrastructure Security Agency \(CISA\) Resources](#)
3. [Wireshark Documentation and Tutorials](#)
4. [Metasploit Framework Documentation](#)
5. [edX Cybersecurity Programs](#)
6. [Cisco Networking Academy – Cybersecurity Courses](#).

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	PCA26008			Cyber Security								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	3	2	3	2	-	2	-	2		3	3	2.60
CO2	3	3	3	2	3	2	-	2	-	2		3	3	2.60
CO3	3	3	3	2	3	2	-	2	-	1		3	3	2.50
CO4	3	3	3	3	3	2	2	2	1	2		3	3	2.73
CO5	3	3	3	3	3	3	2	2	2	2		3	3	2.91
Mean Overall Score	3.00	3.00	3.00	2.40	3.00	2.20	0.80	2.00	0.60	1.80	0.00	3.00	3.00	2.67

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	PCA26009	Compiler Design	DEC - III	4			4
Pre-Requisite: <ul style="list-style-type: none"> C Programming and Data Structures. 			Co- Requisite: <ul style="list-style-type: none"> Theory of Computation. 	Progressive Course: <ul style="list-style-type: none"> Advanced Compiler Design / Programming Language Processing. 			
Course Objectives:							
1. Understand the basic concepts of compiler design, phases of compilation, and error handling mechanisms.							
2. Analyze and implement lexical analyzers using regular expressions, finite automata, and token recognition techniques.							
3. Apply parsing techniques for syntax analysis using top-down and bottom-up parsing methods.							
4. Design intermediate code representations and generate intermediate code for expressions, control structures, and statements.							
5. Evaluate code optimization strategies and understand code generation techniques for target machine architectures.							
Course Outcomes:							
CO1: Explain the structure of a compiler, its phases, compiler construction tools, and error handling techniques.(K2)							
CO2: Construct lexical analyzers using regular expressions, finite automata, and token recognition methods.(K3)							
CO3: Develop parsers for context-free grammars using predictive, recursive descent, shift-reduce, and LR parsing techniques.(K3)							
CO4: Generate intermediate code representations such as three-address code for expressions and control flow statements.(K3)							

CO5: Apply code optimization methods and design code generation schemes for efficient execution on target machines.(K5)

Unit-I		12 Hrs.
Introduction to Compilers : Compilers -Analysis - Synthesis model of compilation - Analysis of the source program - The phases of a compiler - Cousins of the compiler - Compiler construction tools - Error handling.		
Unit-II		12 Hrs.
Lexical Analyzer : Lexical analysis - Role of lexical analyzer - Tokens, Patterns and lexemes - Input buffering - Specification of tokens - Regular expressions - Recognition of tokens - Transition diagrams - Implementing a transition diagram - Finite Automata-Regular expression to NFA-Conversion of NFA to DFA.		
Unit-III		12 Hrs.
Syntax Analyzer : Syntax analysis - Role of parser - Context-free grammars - Derivations - Writing a grammar - Top Down parsing - Recursive descent parsing - Predictive parsers - Non-recursive predictive parsers - Construction of predictive parsing tables - Bottom up parsing - Handles - Shift reduce parser - Operator precedence parsing - LR parsers - Canonical collection of LR(0) items - Constructing SLR parsing tables.		
Unit-IV		12 Hrs.
Intermediate Code Generation : Intermediate code generation - Intermediate languages - Graphical Representation - Three Address Code - Assignment statements - Boolean expressions - Flow of Control Statements - Case Statements.		
Unit-V		12 Hrs.
Code Optimization and Code Generation : An Organization for an Optimizing Compiler - the principle sources of optimization - Optimization of basic blocks -The use of Algebraic identities - Loops in flow graphs - Code generation-issues in the design of a code generator-The Target machine.		

Text Book(s):

1. Compilers: Principles, Techniques, and Tools, Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, Second Edition, Pearson Addison Wesley, 2007.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, *Compilers: Principles, Techniques and Tools*, 2nd Edition, Pearson Education, 2007.
3. Dhamdhere D. M., *Compiler Construction: Principles and Practice*, 2nd Edition, Macmillan India Ltd., 2011.

4. Tremblay J. P. and Sorenson P. G., *The Theory and Practice of Compiler Writing*, McGraw-Hill, 2005.
5. Holub Allen I., *Compiler Design in C*, Prentice Hall of India, 2003.

Reference Book(s):

1. Steven S. Muchnick, *Advanced Compiler Design and Implementation*, Morgan Kaufmann Publishers, 2008.
2. Andrew W. Appel, *Modern Compiler Implementation in Java*, 2nd Edition, Cambridge University Press, 2004.
3. Randy Allen and Ken Kennedy, *Optimizing Compilers for Modern Architectures*, Morgan Kaufmann Publishers, 2002.
4. Cooper Keith D. and Torczon Linda, *Engineering a Compiler*, 2nd Edition, Morgan Kaufmann Publishers, 2012.
5. Dick Grune, Henri E. Bal, Criel J.H. Jacobs, and Koen Langendoen, *Modern Compiler Design*, 2nd Edition, Springer, 2012.

e Resources:

1. <https://nptel.ac.in/courses/106105190>
2. <https://www.geeksforgeeks.org/compiler-design-tutorials/>
3. https://www.tutorialspoint.com/compiler_design/index.htm

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
II	PCA26009			Compiler Design								4		4
Course Outcomes (COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)	Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11			PSO1
CO1	3	3	2	2	2	1	-	1	-	-		3	3	2.50
CO2	3	3	3	2	3	-	-	-	-	-		3	3	2.88
CO3	3	3	3	3	3	-	1	1	-	-		3	3	3.25
CO4	3	3	3	2	3	-	-	-	-	-		3	3	2.88
CO5	3	3	3	3	3	1	-	1	1	1		3	3	3.13
Mean Overall Score	3.00	3.00	2.80	2.40	2.80	0.40	0.20	0.60	0.20	0.20	0.00	3.00	3.00	2.60

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	PCA26010	Web Development	DEC - IV	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. Understand the fundamentals of Internet technologies, networking concepts, protocols, and Internet architecture.							
2. Learn the structure and elements of HTML for designing and formatting web pages.							
3. Develop web pages using advanced HTML features such as tables, forms, frames, and hyperlinks.							
4. Apply JavaScript programming concepts including operators, control structures, functions, and dialog boxes to create interactive web pages.							
5. Design dynamic and event-driven web applications using JavaScript DOM, browser objects, forms, cookies, and user-defined objects.							
Course Outcomes:							
CO1: Explain Internet concepts, networking protocols, Internet architecture, addressing schemes, and communication models.(K2)							
CO2: Create and format web pages using HTML elements such as headings, paragraphs, lists, special characters, and document layout features.(K3)							
CO3: Develop structured web pages using HTML tables, hyperlinks, frames, forms, and form controls.(K3)							
CO4: Implement JavaScript programs using operators, expressions, conditional statements, loops, functions, and dialog boxes.(K3)							
CO5: Design interactive web applications using JavaScript DOM, event handling, browser objects, forms, cookies, and user-defined objects.(K5)							
Unit-I							12 Hrs.

Networking Concepts: INTERNET - History - Applications-Users – Protocols -Host Machines and Host Names - Internet Architecture and Packet Switching,Client Server Model - Band width and Asynchronous Communication. Connection: Dial-up Access-Direct and Dedicated Connections - shell or TCP/ IP accounts - Domains and Addresses – IP addresses		
Unit-II		12 Hrs.
HTML: Introduction to HTML Tags - Document Layout - Comments – Headings-Paragraphs - Breaks - Texts - Lists - Special Characters.		
Unit-III		12 Hrs.
HTML: Tables - Linking documents - Frames - Form and its elements.		
Unit-IV		12 Hrs.
JavaScript: Introduction to JavaScript - JavaScript in web pages-writing JavaScript with HTML - Basic programming techniques - operators and expressions - conditional checking - loops - functions - user defined functions -dialog boxes.		
Unit-V		12 Hrs.
JavaScript: JavaScript DOM: JSS DOM - understanding objects in HTML -browser objects - web page object hierarchy - Handling events - The form object -built-in objects-user defined objects - cookies - setting a cookie.		

Text Book(s):

1. Achyut S. Godbole and Atul Kahate, *Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing*, 3rd Edition, McGraw-Hill Education, 2020.
2. Deitel P. J. and Deitel H. M., *Internet and World Wide Web: How to Program*, 5th Edition, Pearson Education, 2012.
3. Laura Lemay, Rafe Colburn, and Jennifer Kyrnin, *Mastering HTML, CSS & JavaScript Web Publishing*, BPB Publications, 2016.
4. Thomas A. Powell, *HTML & CSS: The Complete Reference*, 5th Edition, McGraw-Hill Education, 2017.

Reference Book(s):

1. David Flanagan, *JavaScript: The Definitive Guide*, 7th Edition, O'Reilly Media, 2020.
2. Robin Nixon, *Learning PHP, MySQL & JavaScript*, 6th Edition, O'Reilly Media, 2021.
3. Ivan N. Bayross, “Web enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP”, 4th Revised Edition, BPB Publications, New Delhi, 2010.(Units-II, III, IV, V)
4. Chuck Musciano & Bill Kennedy, “HTML - The Definitive Guide”, Shroff Publishers & Distributors Pvt. Ltd., Calcutta - 1999.

e Resources:

1. [MDN Web Docs \(HTML, CSS, JavaScript\)](#)
2. [W3Schools Online Web Tutorials](#)
3. [WHATWG HTML Living Standard](#)
4. [JavaScript Info](#)
5. [TutorialsPoint – Web Technologies Tutorials](#)

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course										Hours	Credit
II	PCA26010	Web Development										4	4
Course Outcomes (COs)	Programme Outcomes(POs)										Programme Specific Outcomes (PSOs)	Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2

Unit-III	Agility and Knowledge Management	12 Hrs.
Agile Information Systems – Agile Decision Making — Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing.		
Unit-IV	Agility and Requirements Engineering	12 Hrs.
Impact of Agile Processes in RE, Current Agile Practices, Variance, Overview of RE Using Agile Managing Unstable Requirements, Requirements Elicitation, Agile Requirements . Abstraction Model: Requirements Management & Prioritization in Agile Environment, Agile Requirements Modeling and Generation, Concurrency in Agile Requirements Generation.		
Unit-V	Agility and Quality Assurance	12 Hrs.
Developing Incremental Requirements, Agile Approach to Quality Assurance, Customer Tests, Test-Driven Development, Incremental Design and Architecture, Spike Solutions, Performance Optimization.		

Text Book(s):

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. James Shore and Shane Warden, “The Art of Agile Development”, O’REILLY, 2007.
3. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.

Reference Book(s):

1. Robert C. Martin, “Agile Software Development, Principles, Patterns, and Practices” , PHI, 2002.
2. Bhuvan Unhelkar, “The Art of Agile Practice: A Composite Approach for Projects and Organizations”, CRC Press.
3. Craig Larman, —Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004

e Resources:

1. [W3Schools Online Web Tutorials](#)
2. [JavaScript Info](#)
3. <https://www.scaledagileframework.com/>

4. <https://www.atlassian.com/agile>

Relationship Matrix for COs, POs and PSOs

[illegible]

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	PCA26012	DATA MINING AND DATA WAREHOUSING	DEC - IV	4			4
Pre-Requisite:			Co- Requisite:	Progressive Course:			
Course Objectives:							
1. To understand the principles of Data warehousing and Data Mining.							
2. To be familiar with the Data warehouse architecture and its Implementation.							
3. To know the Architecture of a Data Mining system.							
4. To understand the various Data preprocessing Methods.							
5. To perform classification and prediction of data.							
Course Outcomes:							
CO1: Identify the scope and necessity of Data Mining & Warehousing for the society(K1)							
CO2:Describe the designing of Data Warehousing so that it can be able to solve the root problems.(K2)							
CO3: To understand various tools of Data Mining and their techniques to solve the real time problems.(K4)							
CO4: To develop ability to design various algorithms based on datamining tools.(K2)							
CO5: To develop further interest in research and design of new Data Mining techniques.(K3)							
Unit-I	Data Warehousing and Business Analysis						12 Hrs.
Data warehousing Components –Building a Datawarehouse–Data Warehouse Architecture–DBMS Schemas for Decision Support–Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.							

Unit-II	Data Mining	12 Hrs.
Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation–Data Reduction–Data Discretization and Concept Hierarchy Generation- Architecture of A Typical Data Mining Systems- Classification of Data Mining Systems.		
Unit-III	Association Rule Mining	12 Hrs.
Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint- Based Association Mining.		
Unit-IV	Classification and Prediction	12 Hrs.
Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification– Classification by Back propagation– Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor –Ensemble Methods – Model Section.		
Unit-V	Cluster Analysis	12 Hrs.
Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid- Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint- Based Cluster Analysis – Outlier Analysis.		

Text Book(s):

- 1.Jiawei Han, Micheline Kamber and Jian Pei“Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.
- 2.Alex Berson, Stephen J.Smith, “Data warehousing Data mining and OLAP”, Tata McGraw-Hill, 2nd Edition, 2007
- 4.

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- 2.Alex Berson, Stephen J.Smith, “Data warehousing Data mining and OLAP”, Tata McGraw-Hill, 2nd Edition, 2007

e Resources:

1. [Oracle Database Data Warehousing Guide](#)
2. Microsoft Learn – Data Fundamentals
3. [IBM – Data Mining and Analytics Resources](#)
4. [KDnuggets – Data Mining and Data Science Articles](#)
5. [GeeksforGeeks – Data Mining Tutorial](#)

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 3. [IBM – Data Mining and Analytics Resources](#)
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 5. [GeeksforGeeks – Data Mining Tutorial](#)

Relationship Matrix for COs, POs and PSOs

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