MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI – 12

M.C.A

SYLLABUS

FROM THE ACADEMIC YEAR 2026 – 2027

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM

VISION AND MISSION OF THE UNIVERSITY

Vision

"To provide quality education to reach the un-reached"

Mission

- To conduct research, teaching and outreach programmes to improve conditions of human living.
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development.
- To provide quality/inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled.

PREAMBLE

MCA is a Professional PG degree Programme which provides students with an opportunity to develop technical computing skills and core competence in the field of software development. The Learning Outcome based Curriculum Framework (LOCF) for the program has been formulated with the Programme Educational Outcomes, Programme Specific Outcomes, Course outcomes, Regulations, Curriculum structure, the detailed Syllabus for the Core, Allied, Practical, Supportive, and Skill-based courses; and the guidelines for the Project works/ Internship activities. The Curriculum focuses on imparting conceptual knowledge, coding skills, software development and debugging, software testing and maintenance, and problem-solving using computers.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

In alignment with the Vision and Mission of the University, the following have been defined as the PEO for the graduates.

PEO1: Developing strong positive attitude to learn independently the concepts in the field of study.

PEO2: Ensuring confidence among the learners to apply the knowledge and skills gained to solve real life issues.

PEO3: Habituating ethical values among the learners to succeed in personal and professional life.

PROGRAMME OUTCOMES (POs)

PO1: Comprehend the knowledge acquired and share the knowledge with others to convince them in a discussion.

PO2: Analyze and compare the factual data/situation and formulate the problem in to a conceptual model to critically evaluate for finding solution.

PO3: Apply the theories and philosophies learned in formulating theoretical research problem with underlying assumptions and solve the problem scientifically.

PO4: Think reflectively on the earlier attempts for applications of the concepts with a sense of inquiring practices and attempt for self-directed lifelong learning process.

PO5: Understand the existence of multicultural practices and global viewpoint and utilization of knowledge with the ability to prolong moral/ethical values in personal and professional life.

PO6: Expose the learner to the digital literacy and information explosion with latest technology for enabling the learner to learn through multiple sources.

PO7: Prepare the learner to be a responsible player in the varied teams with facilitating capability and formulate teams as a leader for defined purposes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Software **Development Skills**
Ability to design, develop, test, and maintain software applications using modern programming languages and tools.

PSO2: Problem **Solving & Analytical Ability**
Apply computational thinking and analytical skills to solve complex real-world problems.

PSO3: **Database Management**
Design and manage databases efficiently using SQL and modern database technologies.

PSO4: Web **& Mobile Application Development**
Develop dynamic web and mobile applications using current frameworks and technologies.

PSO5: System Design & Architecture
Understand and implement system architecture, operating systems, and networking concepts.

PSO6: Emerging **Technologies Adaptation**
Apply knowledge in emerging areas like Artificial Intelligence, Data Science, Cloud Computing, and Cyber Security.

PSO7: Professional & Ethical Responsibility
Demonstrate ethical practices, teamwork, communication skills, and professionalism in the IT industry.

COURSE OUTCOMES (COs)

Four Course Outcomes (COs) for each course that can be achieved by the learners on completion of that particular course are as follows:

Considering outcomes related to

i. K1 and K2 level of evaluation in all the Units as CO1

ii. K3 level of evaluation in all the Units as CO2

iii. K4 level of evaluation in all the Units as CO3

iv. K5 and K6 level of evaluation in all the Units as CO4.

Level of Correlation between COs, POs and PSOs

0 – No Correlation 1 – Low 2 – Medium 3 – High

ELIGIBILITY FOR ADMISSION TO THE PROGRAMME

Candidates who have passed any Bachelor's Degree (e.g., BCA, B.Sc., B.Com., BA, B.E., B.Tech., etc.) preferably with Mathematics at the Higher Secondary (+2) level or at the Graduation level, with a minimum aggregate of 50% marks (45% for reserved category candidates) in the qualifying examination, are eligible for admission.

Candidates who have not studied Computer Science or Mathematics either at the Undergraduate level or at the Higher Secondary (+2) level are required to undergo a two-week Bridge Course.

Bridge Course Modules

Module1: Fundamentals of Computers

Introduction, characteristics of computers, computer generations, block diagram of computer, hardware and software.

Module2: Mathematical Foundations of Computer Science

Basic concept of set, set types, set operations, types of matrix, basic logic operations.

Module3: Problem Solving Techniques

Algorithm design, logical thinking, flowchart development, pseudocode, debugging techniques.

Module4: Programming in C

Introduction to Programming languages, data types in C, keywords, identifiers, variables, operators, I/O statements, decision making and looping statements, simple programs.

Module5: Data Structures

Arrays, stacks, queues, linked lists, searching and sorting techniques.

MEDIUM OF INSTRUCTION AND EXAMINATION

The medium of instruction as well as examination will be in English.

DURATION OF THE PROGRAMME

The students shall undergo the prescribed course of study for a period of not less than two academic years (Four semesters). Each semester contains 90 working days.

MEASUREMENT OF ATTAINMENT OF COURSE OUTCOME

The Course Outcomes (COs) are measured through the performance of learners by direct and indirect assessment methods for that particular course.

i. Internal Assessment (25 Marks)

Each paper carries an internal component and each test will be of one hour duration.

Tests – 15 Marks (Average of best Two out of Three Tests)
Seminar: 5 Marks
Assignment: 5 Marks
No Internal Minimum

ii. Semester End Examinations (75 Marks)

Written exams, Practical, Internship, Project report, and comprehensive Viva Voce.

Note: In both Internal and Semester End Examinations

Lower Order Thinking (K1, K2, & K3) – 40 % in each part
Higher Order Thinking (K4, K5, & K6) – 60 % in each part

QUESTION PAPER PATTERN

The question paper pattern for all theory papers shall be as follows.
Part-A Internal Choice questions(Three questions from each unit compulsory)15×1=15 Marks

Part-B Internal Choice questions (One question from each unit: either/or) 5×4=20 Marks

Part-C Internal Choice questions (One question from each unit: either/or) 5×8=40 Marks

There is a pass minimum of 50% for external and overall components.

MODEL QUESTION PAPER

ADVANED JAVA PROGRAMMING

(For those who joined in July 2026 onwards)

Time: Three hours **Maximum: 75 marks**

Part-A (15×1=15 Marks)
Answer All questions

1. Which package is used for JDBC connectivity in Java? (K1)

a) java.io
b) java.sql
c) java.net
d) java.awt

2. Which method is used to start a thread in Java? (K1)

a) execute()
b) run()
c) start()
d) init()

3. What is the main purpose of Object Serialization? (K2)

a) To compile Java code
b) To convert objects into byte streams
c) To execute SQL queries
d) To design GUI applications

4. Which protocol is mainly used by Servlets for client communication? (K2)

a) FTP
b) SMTP
c) HTTP
d) TCP

5. Which JDBC method is used to execute SQL SELECT queries? (K3)

a) executeUpdate()
b) executeQuery()
c) execute()
d) executeSQL()

6. Which command is used to create a JAR file? (K3)

a) javac
b) java
c) jar
d) javadoc

7. Which feature best supports distributed applications in Java? (K4)

a) Swing
b) JDBC
c) RMI
d) AWT

8. Which technique is most suitable for maintaining user sessions in Servlets? (K4)

a) Threads
b) Cookies
c) Serialization
d) JDBC

9. Which technology is more suitable for dynamic web page generation? (K4)

a) JSP
b) JAR
c) JDBC
d) RMI

10. Why is Prepared Statement preferred over Statement in JDBC? (K5)

a) Faster compilation
b) Better security and performance
c) Easier GUI creation
d) Supports threading

11. Which Java feature improves platform independence in GUI applications? (K5)

a) Swing
b) RMI
c) JDBC
d) Servlet

12. Why are cookies important in web applications? (K5)

a) They increase thread speed
b) They maintain client state information
c) They create database tables
d) They compile JSP pages

13. Which component would you choose to design a distributed banking application? (K6)
a) JDBC
b) Swing
c) RMI
d) Applet

14. Which technology combination is best for creating a database-driven web application? (K6)

a) Swing + AWT
b) JSP + JDBC
c) Thread + JAR
d) RMI + Serialization

15. Which approach is most appropriate for designing an interactive Java desktop application? (K6)

a) Servlet programming
b) Swing programming
c) JDBC connectivity
d) Object serialization

Part-B (5×4=20 Marks)

Answer all questions

16.a) Explain Java threading concepts.

OR K2

b) Describe ServerSocket class in Java.

17.a) Demonstrate the creation of Remote objects in RMI.

OR K3

b) Write the steps involved in Object Serialization.

18.a) Analyze JDBC architecture and principles.

OR K4

b) Compare multimedia databases and traditional databases.

19.a) Evaluate the working of cookies in Servlets.

OR K5

b) Assess the advantages of JSP components in web applications.

20.a) Design a Swing-based GUI application.

OR K6

b) Develop a JAR file creation process for deployment.

Part-C (5×8= 40 Marks)

Answer all questions

21.a) Explain Java event handling mechanism with suitable examples.

OR K2

b) Discuss media techniques and networking features in Java.

22a) Demonstrate the working of RMI architecture with diagram.

OR K3

b) Explain Remote Object Activation and Java Spaces.

23a) Analyze database interaction using JDBC with suitable examples.

OR K4

b) Compare database support techniques in web applications.

24a) Evaluate Servlet life cycle and HTTP request handling.

OR K5

b) Assess JSP directives, declarations and scriptlets with examples

25a) Design an internationalized Java application using Swing.

OR K6

b) Create an advanced Java application integrating GUI and database connectivity.

TEMPLATE FOR CURRICULUM DESIGN FOR M.C.A

First Year

Semester – I

List of Courses	Credits	Hours per week (L/T/P)
Core – I	4	5
Core – II	4	5
Core – III	4	4
Lab –I	3	4
Lab –II	3	4
Elective – I	3	4
Elective – II	3	4
Total	**24**	**30**

Semester-II

List of Courses	Credits	Hours per week(L/T/P)
Core – IV	4	5
Core – V	4	5
Lab –III	3	4
Lab –IV	3	4
Elective – III	3	4
Elective – IV	3	4
Skill Enhancement Course [SEC]-I	2	4
Total	**22**	**30**

Second Year

Semester – III

List of Courses	Credits	Hours per week(L/T/P)
Core –VI	4	5
Core –VII	4	4
Core –VIII	4	4
Lab –V	3	4
Mini Project	6	6
Elective – V	3	4
Skill Enhancement Course-II	2	3
Internship / Industrial Activity/Field Visit/Knowledge Updation Activity	2	-
Total	**28**	**30**

Semester-IV

List of Courses	Credits	Hours per week (L/T/P)
Major Project with Viva Voce	16	-
Extension Activity	1	-
Total	**17**	**-**

CONSOLIDATED SEMESTER WISE AND COMPONENT WISE CREDIT DISTRIBUTION

Credits	SemI	Sem II	Sem III	SemIV	Total
Core/Core Lab	18	14	21		53
Electives (i)Discipline– Centric	6	6	3		15
(ii Skill Enhancement		2	2		4
(iii)Summer Internship / Industrial Training/ Project			2	16	18
Ability Enhancement / Extension				1	1
Total Credits	24	22	28	17	91

First Year
Semester I

Type of the Course	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	EXT	Total
Core – I	Discrete Mathematics	4	5		25	75	100
Core – II	Advanced Python Programming	4	5		25	75	100
Core – III	Linux and Shell Programming	4	4		25	75	100
Core Lab I	Advanced Python Programming Lab	3		4	50	50	100
Core Lab II	Linux and Shell Programming Lab	3		4	50	50	100
Elective I	Advanced Operating Systems /Architecture and Frameworks / Data Engineering and Management	3	4		25	75	100
Elective II	Advanced Computer Networks / Network Protocols / Cryptography and Network Security	3	4		25	75	100
Total		24	22	8			

Semester II

Type of the Course	Title of the Course	Credits	Hours		CIA	EXT	Total
			Theory	Practical			
Core – IV	Advanced Java Programming	4	5		25	75	100
Core – V	Advanced Data Structures	4	5		25	75	100
Core Lab III	Advanced Java Programming Lab	3		4	50	50	100
Core Lab IV	Advanced Data Structures Lab	3		4	50	50	100
Elective – III	Artificial Intelligence and Machine Learning/ Soft Computing / High Performance Computing	3	4		25	75	100
Elective – IV	Internet of Things / Solution Architecture / Software Development Technologies	3	4		25	75	100
Skill Enhancement Course – I	Web Development using PHP	2	4		25	75	100
Total		22	22	8			

Semester III

Type of the Course	Title of the Course	Credits	Hours		CIA	EXT	Total
			Theory	Practical			
Core – VI	Dot NET Technologies	4	5		25	75	100
Core – VII	Big Data Analytics	4	4		25	75	100
Core - VIII	Mobile Computing	4	4		25	25	100
Core Lab V	Dot NET Technologies Lab	3		4	50	50	100
	Mini Project	6		6	50	50	100
Elective – V	Cyber Security / Research Methodology / Computer Vision	3	4		25	75	100
Skill Enhancement Course – II	Social Networks	2	3		25	75	100
	Internship/ Industrial Visit/Field Visit/Research Knowledge Updation Activity	2	-	-	50	50	100
Total		28	20	10			

Semester IV

Title of the Course	Credits	Hours
Project with Viva Voce	16	
Extension Activity	1	
Total	17	

Total Credits: 91

Internship (minimum of 30 hours)**:** The students should submit certificate of attendance from the industry stating the nature of work done, duration and role played along with report (minimum of 20 pages) at the end of III semester for external evaluation.

Industrial Visit/Field Visit: A report based on the observation and learning outcome to be submitted (minimum of 10 pages) along with suitable evidences at the end of III semester for external evaluation.

Research Knowledge Updation Activity: A report to be submitted (minimum of 10 pages) based on the study made along with the completion certificate stating the work done (MOOC/NPTEL) at the end of III semester for external evaluation.

Internship/Industrial Visit/Field Visit/Research Knowledge Updation Activity:
Internal –50 Marks, External – 50 Marks

Mini Project & Project: Individual Project report should be submitted at the end of the respective semester for external evaluation.
Internal – 50 Marks, External – 50 Marks

Extension Activity (Minimum of 10 hours)**:** Extension activity should be able to reflect, realize and apply his / her knowledge acquired during the course of study to the community in terms of but not limited to:

- Awareness Campaign
- Conduct of literacy programme
- Developing an application
- Formulation of a framework
- Conduct of certificate programme

A report should be submitted along with suitable evidences at the end of IV semester for external evaluation (Minimum of 10 Pages).
Internal – 50 Marks, External – 50 Marks

COURSE - PSO MAPPING

Type of the Course	Title of the Course	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Core – I	Discrete Mathematics	3	3	2	2	3	2	2
Core – II	Advanced Python Programming	3	3	2	3	3	3	2
Core – III	Linux and Shell Programming	3	3	2	2	3	2	3
Core Lab I	Advanced Python Programming Lab	3	3	2	2	3	3	2
Core Lab II	Linux and Shell Programming Lab	3	3	2	2	3	2	2
Elective I	Advanced Operating Systems	3	3	2	2	3	2	3
Elective I	Architecture and Frameworks	3	3	2	2	3	2	2
Elective I	Data Engineering and Management	3	3	3	2	3	3	2
Elective II	Advanced Computer Networks	3	3	2	2	3	3	2
Elective II	Network Protocols	3	3	2	2	3	3	2
Elective II	Cryptography and Network Security	3	3	2	2	3	3	2
Core – IV	Advanced Java Programming	3	3	2	2	3	3	2
Core – V	Advanced Data Structures	3	3	2	2	3	2	2
Core Lab III	Advanced Java Programming Lab	3	3	2	3	3	3	3
Core Lab IV	Advanced Data Structures Lab	3	3	2	2	3	2	2
Elective III	Artificial Intelligence and Machine Learning	3	3	2	2	2	3	2
Elective III	Soft Computing	3	3	2	2	3	3	3
Elective III	High Performance Computing	3	3	2	3	3	3	2
Elective IV	Internet of Things	3	3	2	3	3	3	2
Elective IV	Solution Architecture	3	3	2	3	3	3	2
Elective IV	Software Development Technologies	3	3	2	3	2	2	3
SEC - I	Web Development using PHP	3	3	2	3	2	2	3

DETAILED SYLLABUS

SEMESTER I

Core I - Discrete Mathematics

Course Outcomes (COs)

L	P	T
4	-	1

CO1	Explain the fundamental concepts of relations, functions, logic, matrices, and graph theory.	K1 and K2
CO2	Apply logical rules, recurrence relations, permutations and combinations, matrix operations, and graph techniques to solve mathematical problems.	K3
CO3	Analyze logical expressions, recurrence relations, matrices, and graph structures for problem solving.	K4
CO4	Evaluate and construct mathematical models using discrete mathematical concepts in computing applications.	K5 and K6

Unit-I

Relations- Binary relations -Operations on relations- properties of binary relations in a set – Equivalence relations— Representation of a relation by a matrix -Representation of a relation by a digraph – Functions-Definition and examples-Classification of functions-Composition of functions-Inverse function.

Unit-II

Mathematical Logic-Logical connectives -Well-formed formulas – Truth table of well-formed formula –Algebra of proposition –Quine's method- Normal forms of well-formed formulas- Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-Rules of Inference for propositional calculus – Quantifiers- Universal Quantifiers- Existential Quantifiers.

Unit-III

Recurrence Relations- Formulation -solving Recurrence Relation by Iteration- solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two-Solving Linear Non-Homogeneous Recurrence Relations. Permutations-Cyclic permutation-Permutations with repetitions- permutations of sets with indistinguishable objects-Combinations- Combinations with repetition.

Unit-IV

Matrices- special types of matrices-Determinants- Inverse of a square matrix-Cramer's rule for solving linear equations-Elementary operations -Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems.

Unit-V

Graphs -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix representation of graphs.

Text book

1. N. Chandrasekaran and M. Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

Reference Books

1. Kimmo Eriksson &Hillevi Gavel, Discrete Mathematics & Discrete Models, Studentlitteratur AB, 2015.
2. Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill, 2012.

CO - PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	2	3	1	1	2	1	1
CO2	3	3	3	2	1	2	2	3	3	2	2	2	2	2
CO3	3	3	3	3	1	2	2	3	3	2	2	3	2	2
CO4	3	3	3	3	2	3	3	3	3	2	2	3	3	3
Weightage of course contribution to each PSO								11	12	7	7	10	8	8

Core II - Advanced Python Programming

L	P	T
4	-	1

Course Outcomes (COs)

CO1	Demonstrate knowledge and understanding of Python programming fundamentals, control structures, strings, functions, object-oriented concepts, Python packages (NumPy, Pandas, Matplotlib), and Django framework components used for application development.	K1 and K2
CO2	Apply Python programming concepts, data structures, functions, classes, libraries, and Django tools to develop programs for problem solving, data analysis, visualization, and basic web application development.	K3
CO3	Analyze computational problems and evaluate suitable Python programming techniques, object-oriented designs, data manipulation methods, visualization approaches, and Django-based solutions for efficient software development.	K4
CO4	Design, develop, and evaluate advanced Python applications using object-oriented programming, GUI programming, scientific computing libraries, data visualization tools, and Django framework to create efficient real-world software solutions.	K5 and K6

Unit I

Introduction: Fundamental ideas of Computer Science - Strings, Assignment and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop.

Unit II

Strings and Text Files: Accessing Characters and substrings in strings - Data encryption - Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-down Design - Design with recursive Functions - Managing a Program's namespace - Higher-Order Functions.

Unit III

Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism – Graphical User Interfaces - The Behavior of terminal-Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events.

Unit IV

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The Data Frame - The Index Objects – Data Visualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts.

Unit V

Django: Installing Django – Building an application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with Query Sets and Managers – Retrieving Objects – Building List and Detail Views.

Text Books

1. K.A. Lambert, "Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 **(**Unit - I, II and III**).**
2. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018 **(**Unit - IV).
3. Antonio Mele, "Django 3 By Example", Third Edition, 2020 **(**Unit - V**).**

Reference Books

1. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media, 2013.
2. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, 3rd Edition, O'Reilly Media, 2022.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	2	1	1	1	2	1
CO2	3	3	3	2	1	3	2	3	3	2	3	2	3	2
CO3	2	3	3	3	2	2	2	2	3	2	2	3	2	2
CO4	3	3	3	3	2	3	3	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	11	7	9	9	10	8

Core III - Linux and Shell Programming

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamentals of Linux operating system concepts, bash shell commands, file handling utilities, shell scripting basics, and structured programming constructs.	K1 and K2
CO2	Apply shell programming concepts, loops, control structures, functions, pipes, regular expressions, sed, and gawk commands to develop shell scripts for problem solving and automation.	K3
CO3	Analyze Linux shell scripts, process communication methods, file processing techniques, and scripting utilities to identify efficient solutions for system-level tasks.	K4
CO4	Design, develop, and evaluate advanced shell-based applications and automation utilities using alternative shells, database/web/email scripting, and Python integration for real-world environments.	K5 and K6

Unit-I

Basic bash Shell Commands: Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. Basic Script Building: Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. Using Structured Commands: Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

(Book-1, Chapters: 3, 11, and 12)

Unit-II

More Structured Commands: Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. Handling User Input: Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. Script Control: Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

(Book-1, Chapters: 13, 14, and 16)

Unit-III

Creating Functions: Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. Writing Scripts for Graphical Desktops: Creating text menus-Building text window widgets-Adding X Window graphics. Introducing sed and gawk: Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

(Book-1, Chapters: 17, 18, and 19)

Unit-IV

Regular Expressions: Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. Advanced sed: Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. Advanced gawk: Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

(Book-1, Chapters: 20, 21, and 22)

Unit-V

Working with Alternative Shells: Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh. Writing Simple Script Utilities: Automating backups-Managing user accounts-Watching disk space. Producing Scripts for Database, Web, and E-Mail: Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. Using Python as a Bash Scripting Alternative: Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

(Book-1, Chapters: 23, 24, 25, and Book-2, Chapter: 14)

Text Books

1.Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley Publishing, 3rd Edition, 2015.**Chapters:** 3, 11 to 14, 16 to 25.

2.Mokhtar Ebrahim, Andrew Mallett, "Mastering Linux Shell Scripting", Packt Publishing, 2nd Edition, 2018. **Chapter:** 14.

Reference Books

1. Clif Flynt, Sarath Lakshman, Shantanu Tushar, "Linux Shell Scripting Cookbook ", Packt Publishing, 3rd Edition, 2017.

2.Stephen G. Kochan, Patrick Wood, "Shell Programming in Unix, Linux, and OS X", Addison Wesley Professional, 4th Edition, 2016.

3.Robert Love, "Linux System Programming", O'Reilly Media, Inc, 2013.

4.W.R. Stevens, "Advanced Programming in the UNIX environment", 2nd Edition, Pearson Education, 2013.

5.Graham Glass, King Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	1	1	1	2	1	3	2	1	1	1	1	1
CO2	3	3	3	2	1	3	2	3	3	2	2	3	2	3
CO3	2	3	3	3	2	2	2	2	3	2	2	3	2	2
CO4	3	3	3	3	2	3	3	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	11	7	8	10	8	9

Core Lab I - Advanced Python Programming Lab

Course Outcomes (COs)

L	P	T
-	4	-

CO1	Explain Python fundamentals including data types, control structures, functions, classes, and basic programming concepts used across all units.	K1 and k2
CO2	Apply Python programming concepts to solve problems using functions, object-oriented programming, and modular design techniques across all units.	K3
CO3	Analyze and interpret data using Python libraries such as NumPy, Pandas, and Matplotlib to solve computational and data-related problems.	k4
CO4	Evaluate and create web-based applications using Django framework and integrate advanced Python concepts to develop real-world solutions across all units.	K5 and K6

Implement the following in Python:

1. Program using elementary data items, lists, dictionaries and tuples.
2. Program using conditional branches, loops.
3. Program using functions.
4. Program using classes and objects.
5. Program using inheritance.
6. Program using polymorphism.
7. Program using Numpy.
8. Program using Pandas.
9. Program using Matplotlib.
10. Program for creating dynamic and interactive web pages using forms.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	1	1	1
CO2	3	3	3	2	1	2	2	3	3	2	1	2	2	2
CO3	3	3	3	2	1	3	1	3	3	2	1	3	3	1
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	2
Weightage of course contribution to each PSO								12	12	7	6	9	9	6

Core Lab II - Linux and Shell Programming Lab

Course Outcomes (COs)

L	P	T
-	4	-

CO1	Explain Linux shell scripting concepts, basic commands, control structures, and file handling operations used in shell programming.	K1 and K2
CO2	Apply shell scripting concepts to solve problems using control structures, functions, regular expressions, and scripting utilities for system tasks.	K3
CO3	Apply shell scripting concepts to solve problems using control structures, functions, regular expressions, and scripting utilities for system tasks.	K4
CO4	Evaluate and create advanced shell scripts for GUI tools, file backup systems, IPC/networking tasks, and database connectivity using PostgreSQL.	K5 and K6

List of Programs

1. Write a Shell Script program to calculate the number of days between two dates.
2. Write a Shell Script program to check systems on local network using control structures with user input.
3. Write a Shell Script program to check systems on local network using control structures with file input.
4. Write a Shell Script program to demonstrate the script control commands.
5. Write a Shell Script program to demonstrate the Shell script function.
6. Write a Shell Script program to demonstrate the Regular Expressions.
7. Write a Shell Script program to demonstrate the sed and awk Commands.
8. Write a Shell Script program to demonstrate the File Backup process through creating a daily archive location.
9. Write a Shell Script program to create a following GUI tools.
    a. Creating text menus
    b. Building text window widgets
10. Write a Shell Script program to demonstrate to connect a PostgreSQL database and performing CRUD operations.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	1	1	1	2	1	3	2	1	1	1	1	1
CO2	3	3	3	2	1	3	2	3	3	2	2	3	2	2
CO3	2	3	3	3	2	2	2	2	3	2	2	3	2	2
CO4	3	3	3	3	2	3	3	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	11	7	8	10	8	8

Elective I - Advanced Operating Systems

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamental concepts of operating systems, including types of OS, process management, scheduling, and inter-process communication.	K1 and K2
CO2	Apply CPU scheduling algorithms, synchronization techniques, and deadlock handling methods to solve operating system problems.	K3
CO3	Analyze memory management techniques, file systems, and I/O management strategies to evaluate system performance.	K4
CO4	Evaluate and design solutions based on case studies of Linux, Windows, and mobile operating systems like Android and iOS.	K5 and K6

Unit:1 Basics of Operating Systems

Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

Unit:2 Distributed Operating Systems

Distributed Operating Systems: Issues – Communication Primitives – Lamports Logical Clocks –Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues.

Unit:3 Real Time Operating System

Real-time Operating Systems :Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling.

Unit:4 Handheld System

Operating Systems for Handheld Systems: Requirements–Technology Overview– Handheld Operating Systems–Palm OS-Symbian Operating System-Android– Architecture of android– Securing handheld systems.

Unit: 5 Case Studies

Case Studies: Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Text Books

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.
2. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

Reference Books

1. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education, India,2006.
2. Pramod Chandra P. Bhatt, An introduction to operating systems, concept and practice, PHI,Third edition, 2010.
3. Daniel.P.Bovet & MarcoCesati, "UnderstandingtheLinuxkernel",3rd edition, O" Reilly,2005.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	3	2	1	1	2	1	3	3	1	1	2	1	2
CO2	3	3	2	1	1	2	1	3	3	1	1	2	1	2
CO3	2	3	3	3	2	2	2	2	3	2	2	3	3	2
CO4	3	3	3	3	2	3	3	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	6	7	10	8	9

Elective I - Architecture and Frameworks

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamentals of software architecture, including roles of architects, development methodologies, risk management, and configuration management.	K1 and K2
CO2	Apply domain knowledge, requirement engineering techniques, and quality attributes to develop structured software system designs.	K3
CO3	Analyze software architecture design approaches, patterns, and documentation techniques to evaluate system design effectiveness.	K4
CO4	Evaluate and design modern software architectures by applying performance optimization techniques and security principles.	K5 and K6

Unit – I

Software architecture introduction – Importance of Software architecture – Software architecture consumers – Architect role - software architecture in an organization – Types of software architects – Software development methodologies – Project management – Office politics – Software risk management – Configuration management – Software product lines.

Unit – II

Domain Knowledge – Developing business acumen – Domain-driven design – requirement engineering – requirement elicitation –Software Quality attributes: Maintainability – Usability –Availability – Portability – Interoperability – Testability.

Unit – III

Software Architectures design – Importance - Top-down Versus bottom-up design approaches – Architectural drivers – Documenting the Software architecture design – Systematic approach - Attribute-driven design – Microsoft's technique for architecture and design –Architecture-centric design method – Architecture development method – Tracking the progress of the software architecture's design.

Unit – IV

Designing orthogonal software systems – Minimizing complexity – SOLID design principles – Software architecture patterns – layered – Event-driven architecture – Model-View patterns – Service-oriented architecture.

Unit – V

Architecting Modern Applications - Importance of Performance – Performance improvement - Server side caching – Web application performance – Database performance -Securing software systems – Threat modelling – Secure by design.

Text Book

1. Joseph Ingeno, “Software Architect’s Handbook” Packt Publishing 2018.

Reference books

1. Oliver Vogel, Indo Arnold, ArifChughtai and TImoKehrer, “Software Architecture” Springer-Verlag, 2011.
2. Ian Gorton, “Essential Software architecture”, Second Edition, Springer, 2011.
3. Len Bass, Paul Clements and Rick Kazman, “Software architecture in practice”, Third edition, Addison-Wesley, 2013.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	2	1	1	2	1	1
CO2	3	3	3	2	1	2	1	3	3	2	2	3	2	2
CO3	2	3	3	3	2	2	2	2	3	2	2	3	2	2
CO4	2	3	3	3	2	2	2	2	3	2	2	3	2	2
Weightage of course contribution to each PSO								10	11	7	7	11	7	7

Elective I - Data Engineering and Management

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain database architecture, data management concepts, data modelling, and physical database design principles.	K1 and K2
CO2	Apply corporate data modelling techniques, data quality methods, naming conventions, and data accessibility concepts in database systems.	K3
CO3	Analyze distributed databases, data warehousing, OLAP systems, and business intelligence techniques for data-driven decision making.	K4
CO4	Evaluate CRM systems, AI/ML integration, cloud deployment models, and modern data engineering platforms for enterprise solutions	K5 and K6

Unit-I

Database Development: Database architecture of an information system-Overview of the database development process-Conceptual data modeling-Relational data analysis-Roles of a data model-Physical database design. Data Management: Problems encountered without data management-Data management responsibilities-Data management activities-Roles within data management-Benefits of data management-Relationship between data management and enterprise.

Unit-II

Corporate Data Modelling: Need for a corporate data model-Nature of a corporate data model- Develop a corporate data model - Corporate data model principles. Data Definition and Naming: Elements of a data definition-Data naming conventions. Data Quality: Issues associated with poor data quality-Causes of poor data quality-Dimensions of data quality-Data model quality-Improving data quality. Data Accessibility: Data security-Data integrity-Data recovery.

Unit-III:

Use Of Packaged Application Software: Application software packages-Impact on data management. Distributed Data and Databases: Rationale for distributing data-Perfect distributed database system-Top-down fragmentation and partitioning. Bottom-up integration-The management of replication. Business Intelligence: Data ware housing-Multidimensional model of data-Standard reporting tools-Online analytical processing OLAP-Relational schema for a data warehouse.

Unit-IV:

CRM: Three main pillars of CRM. Getting To Know Your Customer: 360-degree client view. Utilizing Artificial Intelligence and Machine Learning in Your CRM Strategy: Evolution of AI-Current state of AI-Teaming up AI with people-Applying AI to your CRM solution-ethical aspects of AI-An example of AI in CRM processes.

Unit-V:

Cloud Versus on Premise Versus Hybrid: Factors influencing vendor selection-Hybrid deployment-what are your options. CRM Differentiators: It's not about the feature list; it's about the ecosystem-Fourth industrial revolution and CRM-AI and smart cloud-To cloud or not to cloud-Leveraging smart cloud into CRM-Big Data-Social selling and advertising-Implementation Tools-Sustainable CRM platform.

Text Books

1. Keith Gordon, "Principles of Data Management Facilitating Information Sharing", BCS Learning, 2013. (Chapters:1-5, 7,8,12,13,14)
2. Max Fatouretchi, "The Art of CRM", Packt Publishing, 2019. (Chapters: 1,2,5,8,9)

Reference Books

1. Peter Ghavami, "Big Data Management_ Data Governance Principles for Big Data Analytics", De Gruyter, 2020.
2. Francis Buttle, Stan Maklan, Customer Relationship Management Concepts and Technologies, Routledge, 2019.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	2	3	1	2	1	1
CO2	3	3	3	2	1	2	1	3	3	3	2	3	2	2
CO3	2	3	3	3	2	3	2	2	3	3	2	3	3	2
CO4	3	3	3	3	2	3	3	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	11	11	8	11	9	8

Elective II - Advanced Computer Networks

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamentals of computer networks including OSI model, TCP/IP protocol suite, transmission media, and network architecture.	K1 and K2
CO2	Apply data link layer concepts such as framing, error control, flow control, and LAN technologies in network communication.	K3
CO3	Analyze network layer and transport layer protocols including IP addressing, routing, TCP/UDP, congestion control, and QoS mechanisms.	K4
CO4	Evaluate application layer services and Internet protocols such as DNS, email, file transfer, and network management systems.	K5 and K6

Unit:1 INTRODUCTION

Introduction- data communications – networks – The internet – Protocols and standards OSI model - layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media.

Unit:2 DATA LINK LAYER

Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing –Flow and error control Multiple access – random access – wired LAN – wireless LAN – Cellular telephony – satellite networks.

Unit:3 NETWOR K LAYER

Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP– Network layer delivery –forwarding – unicast and multicast routing protocols.

Unit:4 TRANSPORT LAYER

Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion control – QoS– Techniques to improve QoS.

Unit:5 APPLICATION LAYER

Domain name system – name space – domain name space – distribution of name space – DNS in the internet – remote logging - email – file transfer - Network management system – SNMP Protocol.

Text Book

1.Data communications and networking – Behrouz A Forouzan McGraw Hill 4thReprint

Reference Books

1.Computer Networks – Tenenbaum -Pearson -2022

2.Computer networking –Kurose James F, Ross Keith W -Pearson – 2017

3.Data and computer communications – William Stallings – Pearson 2017

4.Computer networks and Internet – Douglas E Comer – Pearson – 2018

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	2	1	1
CO2	3	3	3	2	1	2	1	3	3	2	1	3	2	1
CO3	2	3	3	3	2	2	2	2	3	2	2	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	7	7	11	9	7

Elective II - Network Protocols

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the TCP/IP architecture, transport protocols (TCP, UDP, SCTP), and basic Internet protocol concepts.	K1 and K2
CO2	Apply routing protocols and Internet architecture concepts such as RIP, OSPF, BGP, and MPLS in network communication.	K3
CO3	Analyze QoS mechanisms, multicast/anycast routing, tunnelling, and VPN technologies for efficient data transmission.	K4
CO4	Evaluate IP traffic engineering, network security, and mobility support techniques in modern Internet systems.	K5 and K6

Unit I

Transmission Control Protocol/Internet Protocol: Fundamental Architecture - Internet Protocol Basics - Routing - Transport-Layer Protocols : Transmission Control Protocol - User Datagram Protocol - Stream Control Transmission Protocol - Real-Time Transport Protocol.

Unit II

Internet Architecture: Internet Exchange Point - History of Internet Exchange Points - Internet Service Provider Interconnection Relationships - Peering and Transit - IP Routing Protocols: Overview of Routing Protocols - Routing Information Protocol - Open Shortest Path First - Border Gateway Protocol - Multiprotocol Label Switching.

Unit III

IP Quality of Service: Introduction - Quality of Service in IP Version 4 - Integrated Services - Differentiated Services - Quality of Service with Nested Differentiated Services Levels - IP Multicast and Any cast: Addressing - Multicast Routing - Routing Protocols –Any casting- IPv6 Any cast Routing Protocol: Protocol Independent Any cast—Sparse Mode - Transport over Packet: Draft-Martini Signaling and Encapsulation - Layer-2 Tunneling Protocol.

Unit V

Virtual Private Wired Service - Types of Private Wire Services - Generic Routing Encapsulation - Layer-2 Tunneling Protocol - Layer-3 Virtual Private Network 2547bis, Virtual Router - IP and Optical Networking: IP/Optical Network Evolution - Challenges in Legacy Traditional IP/Optical Networks - Automated Provisioning in IP/Optical Networks - Control Plane Models for IP/Optical Networking - Next-Generation Multilayer Network Design Requirements - Benefits and Challenges in IP/Optical Networking - IP Version 6: Addresses in IP Version 6 - IP Packet Headers - IP Address Resolution - IP Version 6 Deployment: Drivers and Impediments.

Unit V

IP Traffic Engineering: Models of Traffic Demands - Optimal Routing with Multiprotocol Label Switching - Link-Weight Optimization with Open Shortest Path First - Extended Shortest-Path-Based Routing Schemes - IP Network Security: Introduction - Detection of Denial-of-Service Attack - IP Trace back- Edge Sampling Scheme - Advanced Marking

Scheme - Mobility Support for IP: Mobility Management Approaches - Security Threats Related to IP Mobility - Mobility Support in IPv6 - Reactive Versus Proactive Mobility Support - Relation to Multihoming - Protocols Supplementing.

Text Book

1. "Advanced Internet Protocols, Services and Applications", Eiji Oki, Roberto Rojas-Cessa, Mallikarjun Tatipamula, Christian Vogt, Copyright © 2012 by John Wiley & Sons, Inc.

Reference Books

1. "TCP/IP Protocol Suite", Behrouz A.Forouzan, Fourth Edition, Tata Mcgraw-Hill Edition 2010.
2. "Computer Communications and Networking Technologies" - Michael A. Gallo & William M. Hancock- BROOKS&COLE.
3. "Computer Networks and Internets" -Douglas E. Comer- PEARSON.
4. Data and Computer Communications- Eighth Edition- William Stallings- Pearson Education.
5. Network Security Bible, 2nd edition, Eric Cole, Wiley Publishers.
6. Data communication and networks –James Irvine and David Harley- Publishers: Wiley India.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	2	1	1
CO2	3	3	3	2	1	2	1	3	3	2	1	3	2	1
CO3	2	3	3	3	2	3	2	2	3	2	2	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	7	7	11	9	7

Elective II - Cryptography and Network Security

L	P	T
3	-	1

Course Outcomes (COs)

CO1	Explain the fundamental concepts of cryptography, security services, classical encryption techniques, and security models.	K1 and K2
CO2	Apply symmetric key cryptographic algorithms, block ciphers, and number theory concepts for secure data encryption and decryption.	K3
CO3	Analyze public key cryptography, hash functions, MACs, and authentication techniques for secure communication.	K4
CO4	Evaluate and design secure systems using digital signatures, key management techniques, and Public Key Infrastructure (PKI).	K5 and K6

Unit-I

Overview: Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms –A Model for Network Security – Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines – Steganography.

Unit-II

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure –The Data Encryption Standard – The DES Example – The Strength of DES – Block Cipher Design Principles – Basic Concepts in Number Theory and Finite Fields: Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic – Groups, Rings, and Fields – Finite Fields of the Form GF(p) – Polynomial Arithmetic.

Unit-III

Advanced Encryption Standard: Finite Field Arithmetic– AES Structure – AES Transformation Functions – AES Key Expansion –Block Cipher Operation: Multiple Encryption and Triple DES – Stream Ciphers – RC4 – Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems – The RSA Algorithm –Diffie-Hellman Key Exchange – Elgamal Cryptographic System – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Pseudorandom Number Generation Based on an Asymmetric Cipher.

Unit-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions - Two Simple Hash Functions – Requirements and Security – Hash Functions Based on Cipher Block Chaining – Secure Hash Algorithm (SHA) – SHA-3 – Message Authentication Codes: Requirements – Functions – Security of MACs – MACs Based on Hash Functions: HMAC – MACs based on Block Ciphers: DAA and CMAC – Authenticated Encryption: CCM and GCM – Key Wrapping.

Unit-V

Digital Signatures – Elgamal Digital Signature Scheme – Schnorr Digital Signature Scheme – NIST Digital Signature Algorithm – Elliptic Curve Digital Signature Algorithm – RSA-PSS Digital Signature Algorithm – Key Management and Distribution: Symmetric Key

Distribution Using Symmetric Encryption – Symmetric Key Distribution Using Asymmetric Encryption – Distribution of Public Keys – X.509 Certificates – Public-Key Infrastructure.

Text Books

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education PHI, 7th Edition.
2. Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography And Network Security", McGraw Hill Education, 3rd Edition.

Reference Books

1. Bernard Menezes, "Network Security and Cryptography", Cengage,1st Edition, 2010.
2. William Stallings, "Cryptography and Network Security", Pearson Education India, Sixth Edition, 2016.
3. V.K. Jain, "Cryptography and Network Security", Khanna Book Publishing, New Delhi, 2016.
4. C.K. Shyamala, N. Harini, Dr. T. R. Padmanabhan, "Cryptography and Security", Wiley India Pvt. Ltd.,2011

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	2	1	1
CO2	3	3	3	2	1	2	1	3	3	2	1	3	2	1
CO3	2	3	3	3	2	3	2	2	3	2	2	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	7	7	11	9	7

SEMESTER II

Core IV - Advanced Java Programming

L	P	T
4	-	1

Course Outcomes (COs)

CO1	Explain the fundamentals of Java programming including threading, networking, event handling, and basic Java components.	K1 and K2
CO2	Apply distributed application concepts using RMI, remote objects, stubs/skeletons, and object serialization.	K3
CO3	Analyze database connectivity using JDBC and web-based database applications for dynamic data handling.	K4
CO4	Evaluate and design web-based applications using Servlets, JSP, and advanced Java techniques including Swing and JAR deployment.	K5 and K6

Unit1 Basics of Java

Java Basics Review: Components and event handling–Threading concepts–Networking features –Media techniques.

Unit2 Remote Method Invocation

Remote Method Invocation-Distributed Application Architecture Creating stubs and skeletons-Defining Remote objects- Remote Object Activation- Object Serialization-Java Spaces.

Unit3 Database

Java in Databases-JDBC principles–database access-Interacting-database search–Creating multimedia databases – Database support in web applications.

Unit4 Servlets

Java Servlets: Java Servlet and CGI programming- A simple java Servlet-Anatomy of a java Servlet-Reading data from a client-Reading http request header-sending data to a client and writing the http response header-working with cookies Java Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions- Scriptlets-Directives-Declarations-A complete example.

Unit5 Advanced Techniques

JAR file format creation–Internationalization–Swing Programming–Advanced Java techniques.

Text Books

1.Herbert Schildt, "Java the Complete Reference", 9th edition, McGraw Hill Publication, 2017

2.Tony Goddis, "Starting out with Java from Control Structures Through Objects", 6th Edition Pearson Education Limited, 2016.

3.Jamie Jaworski, "Java Unleashed", SAMS Tech media Publications,1999.

Reference Books

1. Jim Keogh, "The Complete ReferenceJ2EE",Tata McGraw Hill Publishing Company Ltd,2010.
2. Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley,1999.
3. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi, 2012.
4. David Sawyer McFarland, "Java Script and JQuery -The Missing Manual" Oreilly Publications,3rd Edition,2011.
5. Deitel and Deitel, "Java How to Program", Third Edition, PHI/Pearson Education Asia.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	1	1	2
CO2	3	3	3	2	1	2	1	3	3	2	2	3	2	3
CO3	2	3	3	3	2	3	2	2	3	2	2	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	7	8	10	9	10

Core V - Advanced Data Structures

L	P	T
4	-	1

Course Outcomes (COs)

CO1	Describe abstract data types, arrays, sets, maps, and fundamental data structures.	K1 and K2
CO2	Apply algorithm analysis and recursion techniques to evaluate time and space complexity of problems.	K3
CO3	Analyze linear and non-linear data structures such as stacks, queues, linked lists, trees, heaps, and hash structures.	K4
CO4	Evaluate and design advanced algorithms including search trees, sorting techniques, and graph algorithms for complex problem solving.	K5 and K6

Unit-I

Abstract Data Types: Introduction-Date Abstract Data Type-Bags-Iterators. Arrays: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. Sets, Maps: Sets-Maps- Multi-Dimensional Arrays.

Unit-II

Algorithm Analysis: Experimental Studies-Seven Functions-Asymptotic Analysis. Recursion: Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

Unit-III

Stacks, Queues, and Deques: Stacks- Queues- Double-Ended Queues Linked. Lists: Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. Trees: General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

Unit-IV

Priority Queues: Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. Maps, Hash Tables, and Skip Lists: Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

Unit-V

Search Trees: Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. Sorting and Selection: Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. Graph Algorithms: Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.

Text books

1. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011. (Unit – 1) **Chapters:** 1, 2, 3.

2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5) **Chapters:** 3 to 12, and 14.

Reference books

1. Dr. Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.
2. Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	1	1	1
CO2	3	3	3	2	1	2	1	3	3	2	1	2	2	1
CO3	2	3	3	3	2	2	2	2	3	2	2	3	2	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	7	7	9	8	7

Core Lab III - Advanced Java Programming Lab

L	P	T
-	4	-

Course Outcomes (COs)

CO1	Explain the concepts and working principles of Servlets, JSP, JDBC, RMI, Applets, and Socket Programming used in Java-based web and distributed applications.	K1 and K2
CO2	Develop Java programs using Servlets, JSP, JDBC, and Applets to perform form handling, database operations, and web-based processing.	K3
CO3	Analyze web application behaviour using sessions, request handling, and servlet/JSP advanced features.	K4
CO4	Design distributed applications using RMI and socket programming for client-server communication.	K5 and K6

LIST OF PROGRAMS

1. Display a welcome message using Servlet.
2. Design a Purchase Order form using Html form and Servlet.
3. Develop a program for calculating the percentage of marks of a student using JSP.
4. Design a Purchase Order form using Html form and JSP.
5. Prepare a Employee pay slip using JSP.
6. Write a program using JDBC for creating a table, inserting, deleting records and list out the records.
7. Write a program using Java servlet to handle form data.
8. Write a simple Servlet program to create a table of all the headers it receives along with their associated values.
9. Write a program in JSP by using session object.
10. Write a program to build a simple Client Server application using RMI.
11. Create an apple for a calculator application.
12. Program to send a text message to another system and receive the text message from the system (use socket programming).

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	3	1	1	2	1	3	2	1	3	2	1	1
CO2	3	3	3	2	1	2	1	3	3	2	2	3	2	1
CO3	2	3	3	3	2	3	2	2	3	2	3	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	11	7	11	11	9	7

Core Lab IV - Advanced Data Structures Lab

L	P	T
-	4	-

Course Outcomes (COs)

CO1	Implement recursion techniques including linear and binary recursion using Python	K3
CO2	Implement Stack, Queue, and Doubly Linked List ADTs for real-world problem solving.	K3
CO3	Apply priority queues, heaps, sorting techniques, and binary search trees for structured data processing.	K4
CO4	Design and evaluate graph-based algorithms including MST and DFS traversal for complex problems.	K5 and K6

Implement the following problems using Python 3.4 and above

1. Recursion concepts.
    i) Linear recursion
    ii) Binary recursion.
2. Stack ADT.
3. Queue ADT.
4. Doubly Linked List ADT.
5. Heaps using Priority Queues.
6. Merge sort.
7. Quick sort.
8. Binary Search Tree.
9. Minimum Spanning Tree.
10. Depth First Search Tree traversal.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	3	3	1	1	2	1	3	3	2	1	1	1	1
CO2	3	3	3	2	1	2	1	3	3	2	2	2	2	1
CO3	2	3	3	3	2	2	2	2	3	2	2	3	2	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	8	8	9	8	7

Elective III - Artificial Intelligence and Machine Learning

L	P	T
3	-	1

Course Outcomes (COs)

CO1	Explain the fundamental concepts of Artificial Intelligence, search techniques, heuristic methods, and knowledge representation approaches.	K1 and K2
CO2	Apply machine learning algorithms, supervised learning models, and neural network techniques to solve real-world problems.	K3
CO3	Analyze deep learning architectures, unsupervised learning methods, and reinforcement learning models for intelligent decision-making.	K4
CO4	Evaluate and design AI and ML solutions using advanced algorithms, neural networks, clustering, and reinforcement learning techniques.	K5 and K6

Unit1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Introduction: AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

Unit2 HEURISTIC SEARCH AND KNOWLEDGE REPRESENTATION

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.

Unit3 FUNDAMENTALS OF MACHINE LEARNING AND SUPERVISED ALGORITHMS

Basics of Machine Learning: Types of Machine Learning-Regression Analysis- Classification Algorithm- Clustering Techniques-Association Rule Learning-Model Evaluation and Performance Metrics- Supervised Algorithms: Steps involved in Supervised Learning- Linear Regression - Logistics Regression - Random Forest Algorithms - Support Vector Machines - K-Nearest Neighbours - Gradient Boosting Machines - Ensemble Method.

Unit4 DEEP LEARNING AND NEURAL NETWORKS

Deep Learning and Neural Networks: Basic Structure-Types of Neural Network models - Feed Forward Neural Network - Multilayer Perceptron - Double Nature – Convolutional Neural Network-Radial Base Functional Neural Networks-Intermittent Neural Networks.

Unit5 UNSUPERVISED AND REINFORCEMENT LEARNING TECHNIQUES

Unsupervised Learning Algorithm: One Class SVM- Algorithms for Learning Association Rules-Hierarchical Clustering-Cluster Conformation-PCA Stands for Star Element Analysis-The AIS Algorithm – Machine Learning- Different Generative Model Types. Reinforcement Learning: Real-Life Exemplifications of Underpinning Learning - Markov Decision Processes - Key Components of Markov Decision Processes - Deep Q-Networks.

Text Books

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence." Tata McGraw Hill, 3rd Edition,2009.

2.Dr.M.Punithavalli, Anju Pavithran, " A Journey Through AI & ML- Your Essential Handbook".

3.Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", PHI learning Pvt. Ltd,2015.

Reference Books

1.Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach," Third edition, Pearson, 2010.

2.Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	1	2	1	2	1	2	3	1	1	1	2	1
CO2	2	3	3	2	1	3	2	3	3	2	2	2	3	2
CO3	2	3	2	3	2	3	2	2	3	2	2	2	3	2
CO4	2	3	3	3	2	3	3	3	3	2	2	3	3	3
Weightage of course contribution to each PSO								10	12	7	7	8	11	8

Elective III - Soft Computing

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamentals of soft computing including neural networks, learning processes, and activation functions.	K1 and K2
CO2	Apply supervised learning techniques such as perceptron, ADALINE, and backpropagation networks for problem solving.	K3
CO3	Analyze unsupervised learning methods, associative memory networks, and self-organizing maps.	K4
CO4	Evaluate fuzzy logic systems and genetic algorithms for optimization and intelligent decision-making systems.	K5 and K6

UNIT-I

INTRODUCTION TO SOFT COMPUTING: Artificial Neural Networks- Biological Neurons- Basic Models of Artificial Neural Networks-Connections-Learning-Activation Functions- Important Terminologies of ANNs- Muculloch and Pitts Neuron-Linear Separability- Hebb Network-Flowchart of Training Process-Training Algorithm.

UNIT - II

SUPERVISED LEARNING NETWORK : Perceptron Networks–Perceptron Learning Rule-Architecture-Flowchart for Training Process-Perceptron Training Algorithms for Single Output Classes-Perceptron Training Algorithm for Multiple Output Classes-Perceptron Network Testing Algorithm - Adaptive Linear Neuron-Delta Rule for Single Output Unit-Flowchart for training algorithm-Training Algorithm – Testing Algorithm - Multiple Adaptive Linear Neurons-Architecture-Flowchart of Training Process-Training Algorithm-Back Propagation Network-Architecture-Flowchart for Training Process-Training Algorithm-Learning Factors of Back-Propagation Network-Radial Basis Function Network-Architecture-Flowchart for Training Process-Training Algorithm.

UNIT-III

UNSUPERVISED LEARNING NETWORK**:** Associative Memory Networks - Auto Associative Memory Network-Architecture-Flowchart for Training Process-Training Algorithm-Testing Algorithm- Bidirectional Associative Memory- Architecture-Discrete Bidirectional Associative Memory-Iterative Auto Associative Memory Networks - Linear Auto Associative Memory-Kohonen Self-Organizing Feature Map- Architecture-Flowchart for Training Process-Training Algorithm.

UNIT-IV

INTRODUCTION TO FUZZY LOGIC**:** Classical Sets –Operations on Classical Sets- Fuzzy sets - Fuzzy Sets- Properties of Fuzzy Sets- Fuzzy Relations –Membership Functions: Fuzzification- Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods–Max-Membership Principle-Centroid Method-Weighted Average Method-Mean Max Membership-Center of Sums-

Center of Largest Area-First of Maxima - Fuzzy Set Theory - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Measures – Belief and Plausibility Measures-Probability Measures-Possibility and Necessity Measures- Formation of Rules –Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT-V

GENETIC ALGORITHM: Introduction - Biological Background - Traditional Optimization and Search Techniques -Gradient Based Local Optimization Method-Random Search-Stochastic Hill Climbing-Simulated Annealing-Symbolic Artificial Intelligence-Operators in Genetic Algorithm -Encoding-Selection-Crossover-Mutation - Stopping Conditions for Genetic Algorithm Flow-Genetic Programming-Working of Genetic Programming-Characteristics of Genetic Programming-Data Representation.

Text Books

1. Principles of Soft Computing, S.N. Sivanandam, S.N.Deepa, Wiley, Third Edition, 2019.
   UNIT I: Chapter 1: 2.1,2.3,2.4,2.5,2.6,2.7
   UNIT II: Chapter 2: 3.2,3.3,3.4,3.5,3.6
   UNIT III: Chapter 3: 4.3,4.4,4.7,5.3
   UNIT IV: Chapter 4: 7.2,7.3,8.4,9.3,9.4,10,10.2,10.3,10.4,11.4,12.8,14
   UNIT V: Chapter 5: 15,15.2,15.3,15.4,15.9,15.10

Reference Books

1. Das, A. (2018). Artificial Intelligence and Soft Computing for Beginners.
2. Amit, K. (2018). Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain. CRC press.
3. Rajasekaran, S., & Pai, G. V. (2011). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd.
4. Jang, J. S. R., Sun, C. T., &Mizutani, E. (2004). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.
5. Gupta, M. M. (2004). Soft computing and intelligent systems: theory and applications. Elsevier.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	2	2	1
CO2	3	3	3	2	1	2	1	3	3	2	2	3	2	3
CO3	2	3	3	3	2	2	2	2	3	2	2	3	2	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	7	8	11	9	9

Elective III - High Performance Computing

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Describe the architecture of modern processors, memory hierarchy, and basic optimization techniques in serial computing.	K1 and K2
CO2	Apply data access optimization techniques and analyze parallel computing paradigms in shared and distributed memory systems.	K3
CO3	Analyze shared memory parallel programming using OpenMP and evaluate performance issues in parallel applications.	K4
CO4	Evaluate and design distributed memory parallel programs using MPI for efficient high-performance computing solutions.	K5 and K6

Unit-I

Modern processors: Stored-program computer architecture-General purpose cache based microprocessor architecture-Memory hierarchies-Multi core processors-Multithreaded processors-Vector processors. Basic optimization techniques for serial code: Scalar profiling-Common sense optimizations-Simple measures, large impact-The role of compilers-C++ optimizations.

Unit-II

Data access optimization: Balance analysis and light speed estimates-Storage order-Algorithm classification and access optimizations-The Jacobi algorithm-Algorithm classification and access optimizations-Sparse matrix-vector multiply. Parallel computers: Taxonomy of parallel computing paradigms-Shared-memory computers-Distributed memory computers-Hierarchical systems-Networks.

Unit-III

Basics of parallelization: Introduction to Parallelism -Parallel scalability. Shared memory parallel programming with OpenMP: Short introduction to OpenMP-OpenMP-parallel Jacobi algorithm.

Unit-IV

Efficient OpenMP programming: Profiling OpenMP programs-Performance pitfalls-Parallel sparse matrix-vector multiply. Locality optimizations on ccNUMA architectures: Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls-ccNUMA issues with C++.

Unit-V

Distributed-memory parallel programming with MPI: Message passing-A short introduction to MPI-MPI parallelization of a Jacobi solver. Efficient MPI programming: MPI performance tools-Communication parameters-Synchronization, serialization, contention-Reducing communication overhead-Understanding intranode point-to-point communication.

Text Book

1. Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011. Chapters: 1 to 10.

Reference Books

1. Michael W. Berry, Kyle A. Gallivan, Efstratios Gallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
2. Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	2	2	1
CO2	3	3	3	2	1	3	1	3	3	2	2	3	3	2
CO3	2	3	3	3	2	3	2	3	3	2	3	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								12	12	7	9	11	11	8

Elective IV - Internet of Things

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamentals of IoT including architecture, design principles, and communication technologies.	K1 and K2
CO2	Apply IoT communication protocols and web technologies such as HTTP, REST, SOAP, and WebSockets for device connectivity.	K3
CO3	Analyze IoT systems involving sensors, actuators, embedded devices, and cloud-based data processing.	K4
CO4	Evaluate IoT security mechanisms, APIs, and real-world applications including business models and case studies.	K5 and K6

Unit1 Introduction

Internet of Things: An Overview : IoT Conceptual Framework - IoT Architectural View - Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT - Design Principles for Connected Devices : IoT/M2M Systems Layers and Designs Standardization - Communication Technologies - Data Enrichment, Data Consolidation and Device Management at Gateway.

Unit2 Design Principles for Web Connectivity

Communication Protocols forConnected Devices– Message Communication Protocols for Connected Devices – Web Connectivity for Connected Devices – Network using Gateway , SOAP, REST, HTTP, RESTful and Web Sockets -Internet Connectivity Principles Internet Connectivity - Internet Based Communication – IP Addressing in the IoT – Media Access Control – Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and Others.

Unit3 Data Acquiring, Organizing, Processing and Analytics

Data Acquiring and Storage – Organizing the Data – Transactions, Business Processes, Integration and Enterprise Systems – Analytics – Knowledge Acquiring, Managing and Storing Processes – Data Collection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing – Everything as a Service and Cloud Service Models.

Unit4 Sensors and Actuators

Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks : Sensor Technology –Wireless Sensor Networks Technology - Prototyping the Embedded Devices for IoT and M2M :Embedded Computing Basics – Embedded Platforms for Prototyping.

Unit5 Prototyping and Designing the Software for IoT Applications

Prototyping Embedded Device Software - Devices, Gateways, Internet and Web/ Cloud Services Software Development – Prototyping online Component APIs and Web APIs – Security for IoT :Vulnerabilities, Security Requirements and Threat

Analysis – IoT Security Tomography and Layered Attacker Model – Security Models, Profiles and Protocols for IoT – IoT Application Case Study : Design Layers, Design Complexity and Designing using Cloud PaaS – IoT / IoT Applications in the premises, Supply – Chain and Customer Monitoring – Connected Car and its Applications and Services.

Text Book

1. Raj Kamal , " Internet of Things Architecture and Design Principles", McGraw Hill, 2017.

Reference Books

1. Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Mark Deployement" , River Publishers, 2014.
2. Peter Waher, "Learning Internet of Things" , Packt Publishing, 2015.
3. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", Mc Graw Hill, 2015.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	3	1	1	2	2	1
CO2	3	3	3	2	1	3	1	3	3	2	2	3	3	2
CO3	2	3	3	3	2	3	2	2	3	2	3	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	12	7	9	11	11	8

Elective IV - Solution Architecture

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the evolution of solution architecture, roles of solution architects, and key attributes such as scalability, security, and cost optimization.	K1 and K2
CO2	Apply solution architecture design principles including scaling workloads, resilient systems, and cloud/hybrid migration strategies.	K3
CO3	Analyze architectural design patterns and performance considerations for optimizing cloud-based solutions.	K4
CO4	Evaluate architectural reliability, operational excellence, and cost optimization techniques for modern and legacy system transformation.	K5 and K6

UNIT I

Evolution of solution architecture - The benefits of solution architecture - Solution architecture in the public cloud - Solution Architects in an Organization - Types of solution architect role - Understanding a solution architect's responsibilities - Attributes of the Solution Architecture - Scalability and elasticity - Security and compliance - Cost optimization and budget.

UNIT II

Principles of Solution Architecture Design - Scaling workload - Building resilient architecture - Design for performance - Using replaceable resources - Cloud Migration and Hybrid Cloud Architecture Design - Benefits of cloud-native architecture - Creating a cloud migration strategy - Steps for cloud migration - Creating a hybrid cloud architecture - Designing a cloud-native architecture.

UNIT III

Solution Architecture Design Patterns - Building an n-tier layered architecture - Creating multi-tenant SaaS-based architecture - Building stateless and stateful architecture designs - Understanding SOA - Performance Considerations - Design principles for architecture performance - Technology selection for performance optimization - Managing performance monitoring.

UNIT IV

Architectural Reliability Considerations - Design principles for architectural reliability - Technology selection for architecture reliability - Improving reliability with the cloud -

Operational Excellence Considerations - Designing principles for operational excellence - Selecting technologies for operational excellence - Achieving operational excellence in the public cloud.

UNIT V

Cost Considerations - Design principles for cost optimization - Techniques for cost optimization - Cost optimization in the public cloud - Architecting Legacy Systems - Learning the challenges of legacy systems - Defining a strategy for system modernization - Looking at legacy system modernization techniques - Defining a cloud migration strategy for legacy systems.

Text Book

1. Saurabh Shrivastava and Neelanjali Srivastav, " Solutions Architect's Handbook", Packt Publishing, 2020.

Reference Books

1. Alan McSweeney , "Introduction to Solution Architecture", Kindle Edition, 2019.
2. Bernard, Scott A. An introduction to holistic enterprise architecture. Author House, 2020.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	2	1	1	2	1	3	2	1	1	2	2	1
CO2	3	3	3	2	1	3	2	3	3	2	2	3	3	2
CO3	2	3	3	3	2	3	2	2	3	2	3	3	3	2
CO4	3	3	3	3	2	3	2	3	3	2	3	3	3	3
Weightage of course contribution to each PSO								11	11	7	9	11	11	8

Elective IV - Software Development Technologies

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamental concepts of microservices, Azure services, DevOps, and APIs in all units.	K1 and K2
CO2	Apply software development tools and cloud technologies to implement solutions in all units.	K3
CO3	Analyze DevOps workflows, microservices architecture, database design, and API management techniques in all units.	K4
CO4	Evaluate and design secure, scalable, and cloud-native software applications using modern development technologies in all units.	K5 and K6

Unit -I

Implementing Microservices**:** Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options. Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric. Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service using Application Insights, Cluster monitoring, Infrastructure monitoring.

Unit-II

Azure Kubernetes Service (AKS): Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native Kubernetes dashboard, Prometheus and Grafana. Securing Microservices: Authentication in microservices, Implementing security using API gateway pattern, Creating application using Ocrlot and securing APIs with Azure AD. Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges. Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack.

Unit-III

.NET DevOps for Azure: DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure.

Unit-IV

Building the code: Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection. Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for

release candidates, Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.

Unit-V

Introduction to APIs: Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management. API Development: Considerations, Standards, kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization.

Text Books

1. Harsh Chawla and Hemant Kathuria, Building Microservices Applications on Microsoft Azure- Designing, Developing, Deploying, and Monitoring, Apress, 2019.
2. Jeffrey Palermo , NET DevOps for Azure A Developer's Guide to DevOps Architecture the Right Way, Apress, 2019.
3. Thurupathan and Vijayakumar, Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud, Apress, 2018.

Reference Books

1. Karl Matthias and Sean P. Kane, Docker: Up and Running, O'Reilly Publication, Second Edition 2018.
2. Len Bass,IngoWeber, Liming Zhu,"DevOps, A Software Architects Perspective", AddisonWesley-Pearson Publication, First Ediiton 2015.
3. John Ferguson Smart, "Jenkins, The Definitive Guide", O'Reilly Publication, First Ediiton 2011.

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	1	1	2	1	1	3	2	1	2	1	1	2
CO2	2	3	2	2	3	2	1	3	3	2	2	2	1	2
CO3	3	3	2	2	2	2	1	3	2	2	3	2	1	2
CO4	3	3	3	2	3	2	2	3	3	2	3	2	2	3
Weightage of course contribution to each PSO								12	10	7	10	7	5	9

SEC I - Web Development using PHP

Course Outcomes (COs)

L	P	T
3	-	1

CO1	Explain the fundamentals of PHP programming, control structures, functions, files, forms, cookies, sessions, and database connectivity.	K1 and K2
CO2	Apply PHP programming concepts to develop scripts, handle forms, manage files, and perform database operations.	K3
CO3	Analyze PHP-based web applications using sessions, error handling, form processing, and database interaction techniques.	K4
CO4	Evaluate and develop dynamic web applications using PHP and database technologies for real-time applications.	K5 and K6

UNIT I

Introduction to PHP as a programming Language: - Advantages of PHP, the server side architecture, overview of PHP, history, object oriented support, benefits in running PHP as a server side script.

The basics of PHP: - data types, variables, constants, operators, Conditional statements (if statement, Executing Multiple Statements, else if clause and switch statement), Iterations (for loop, while loop and do while), Arrays, controlling an array using a while loop, do while statement.

UNIT II

Functions, user defined functions, functions with arguments, built in functions (print(), includer(), header(), phpinfo()), Working with Strings.

Working with files and directories: reading files, writing files, processing directories and performing other file and directory operations.

UNIT III

Working with Cookies and Sessions: setting, reading and removing cookies, creating and removing sessions and session variables, Handling errors: handling script errors and using exceptions.

UNIT IV

Working with forms, form elements (Text Box, Text Area, Password, Radio Button, Checkbox, The Combo Box, Hidden Field and image), adding elements to a form.

UNIT V

Data base connectivity using PHP (MySQL, ODBC, ORACLE, SQL) Performing, executing Commands, different types of Data Base Operations like Insertion, deletion, update and query on data.

Text Books

1. Mastering PHP, WebTech Solutions, Khanna Publishing House
2..The Complete Reference PHP, Steven Holzner, McGraw Hill Professional, 2008.

3.Programming PHP, Kevin Tatroe, Peter Maclntyre & Rasmaus Lerdorf, Orelly

Reference Books

1.Robert W. Sebesta, "Programming the World Wide Web", Seventh Edition, Pearson Education, 2015.
2. Raj Kamal: Internet and Web Technologies, McGraw Hill Education.
3. Learning PHP, Ramesh Bangia, Khanna Publishing House

CO – PO & PSO Mapping

COs	POs							PSOs						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
CO1	3	2	1	1	2	1	1	3	2	1	2	1	1	2
CO2	2	3	2	2	3	1	1	3	3	2	2	2	1	2
CO3	3	3	2	2	2	2	1	3	2	2	3	2	1	2
CO4	3	3	3	2	3	2	2	3	3	2	3	2	2	3
Weightage of course contribution to each PSO								12	10	7	10	7	5	9