ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A^{+}' Grade by NAAC)

Thoothukudi-628001, Tamil Nadu

(**Affiliated to Manonmaniam Sundaranar University**)



Syllabus

M.Sc. Computer Science

School of Computing Sciences

Outcome Based Curriculum

(w.e.f. 2024)

Preamble

M.Sc. Computer Science program helps students to master their computer skills in programming and in managing databases and networks. The students are made globally competent and innovative.

Vision

To empower young women to be technologically adept and encourage them to build their careers in the innovative field of computing

Mission

- To provide learning ambience with professional training to create and apply knowledge of computer science in various fields.
- To impart necessary skills to develop innovative products and moral values to find solution to real life problems.

Programme Outcome

PO No.	**After completion of the Postgraduate programme the students of St. Mary's College will be able to**
PO 1	acquire expertise knowledge in their respective disciplines and become professionals.
PO 2	develop critical/logical thinking skills, managerial skills and become locally, nationally & globally competent and be a lifelong learner
PO 3	pursue research / higher learning programme & apply their experiment and research skills to analyse and solve complex problems.
PO 4	compete in the job market by applying the knowledge acquired in Arts, Science, Economics, Commerce and Management studies
PO 5	be an empowered and economically independent woman with efficient leadership qualities and develop the themselves as a holistic person

Program Specific Outcome:

PSO. No.	Students of M.Sc. Computer Science will be able to	PO addressed
PSO-1	prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions	**PO-4**
PSO-2	create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start up and high potential organizations.	**PO-5,PO-2**
PSO-3	design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.	**PO-3**
PSO-4	produce employable, ethical and innovative professionals to sustain in the dynamic business world.	**PO-1**
PSO-5	contribute to the development of the society by collaborating with stakeholders for mutual benefit.	**PO-5**

ST. MARY'S COLLEGE (AUTONOMOUS), THOOTHUKUDI
PG COMPUTER SCIENCE
Course Structure (w.e.f. 2024)
Semester – I

Components	Course Code	Course Title	Hours / Week	Credits	Max Marks		
					CIA	ESE	Total
Core I	24PCSC11	Analysis and Design of Algorithms	5	4	40	60	100
Core II	24PCSC12	Web Development in Python	5	4	40	60	100
Core III	24PCSC13	Mathematical Foundation for Computer Science	5	4	40	60	100
Core Practical I	24PCSCR1	Analysis and Design of Algorithms Lab	4	2	40	60	100
Core Practical II	24PCSCR2	Web Development in Python Lab	3	2	40	60	100
Elective I	24PCSE11/ 24PCSE12	**A. Soft Computing** B. Multimedia and its Applications	4	3	40	60	100
Skill Enhancement Course I	24PCSSE1	React JS	4	3	40	60	100
MOOC (Compulsory)				+2			
		Total	**30**	**22+2**			

Semester – II

Components	Course Code	Course Title	Hours / Week	Credits	Max Marks		
					CIA	ESE	Total
Core IV	24PCSC21	Compiler Design	5	4	40	60	100
Core V	24PCSC22	Network Programming using Java	5	4	40	60	100
Core VI	24PCSC23	Digital Image Processing	5	4	40	60	100
Core Practical III	24PCSCR3	Digital Image Processing Lab	4	2	40	60	100
Core Practical IV	24PCSCR4	Java Programming Lab	3	2	40	60	100
Elective II	24PCSE21/ 24PCSE22	**A. Blockchain Technology** B. Theory of Computation	4	3	40	60	100
Skill Enhancement Course II	24PCSSE2	Soft Skills	4	3	40	60	100
		Total	**30**	**22**			

Semester – III

Components	Course Code	Course Title	Hours / Week	Credits	Max Marks		
					CIA	ESE	Total
Core VII	24PCSC31	Data Science and Machine Learning	5	5	40	60	100
Core VIII	24PCSC32	Internet of Things	4	4	40	60	100
Core IX	24PCSC33	Cryptography and Network Security	4	4	40	60	100
Core Practical V	24PCSCR5	Data Science and Machine Learning Lab	3	2	40	60	100
Discipline Centric Elective III	24PCSE31/ 24PCSE32	**A. Emerging Trends in Modern Computing** B. Advanced Software Engineering	4	3	40	60	100
Skill Enhancement Course III	24PCSSE3	Dart Programming Lab	4	3	40	60	100
Project	24PCSCR6	Mini Project and Viva Voce	6	4	40	60	100
Internship / Self Study (Optional)	24PCSI31/ 24PCSSS1	Course for Competitive Exams		+2			
		Total	**30**	**25+2**			

Semester – IV

Components	Course Code	Course Title	Hours / Week	Credits	Max Marks		
					CIA	ESE	Total
Core X	24PCSC41	Research Methodology and Thesis Writing	5	5	40	60	100
Project	24PCSP41	Major Project and Viva Voce	25	16	100	100	200
Extension Activities				+1			
		Total	**30**	**21+1**			

Note: 1. It is mandatory for all I PG students to attend the course through Swayam Portal. Students who pass in MOOC through portals will get extra credit. Students who fail in MOOC can appear for supplementary exam and the institution will provide the certificate. No extra credits will be given.

2. Internship can be completed during the II Semester vacation.

Master of Science (Computer Science)

Components	No. of Courses	No. of. Hours	Total Credits	Extra Credits
Core	10	48	42	
Practical	5	17	10	
Elective	3	12	9	
Skill Enhancement	3	12	9	
Project	2	31	20	
MOOC	1			+2
Self-Study Course/MOOC/ Internship	1			+2
Extension Activities				+1
		120	**90**	**+5**

SEMESTER – I			
CORE I - ANALYSIS AND DESIGN OF ALGORITHMS			
Course Code: 24PCSC11	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 4**

Course Objectives:

1. To enable the students to learn the elementary data structures and algorithms.
2. To present an introduction to the algorithms, their analysis and design
3. To discuss various methods like basic traversal and search techniques, divide and conquer method, dynamic programming, backtracking.
4. To understand the various design and analysis of the algorithms.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	estimate the correctness of algorithms using loop invariance.	K1
CO-2	explain important algorithmic design paradigms and apply when algorithm design situation calls for it.	K2
CO-3	demonstrate the major graph algorithms and employ when appropriate.	K3
CO-4	compare between different data structures and pick up appropriate data structures for a design situation.	K4
CO-5	recommend the correct algorithm for problems.	K5

SEMESTER – I			
CORE I - ANALYSIS AND DESIGN OF ALGORITHMS			
Course Code : 24PCSC11	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 4**

UNIT: 1 FUNDAMENTALS

Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heap sort- Graph.

UNIT: 2 TRAVERSAL AND SEARCH TECHNIQUES

Basic Traversal and Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.

UNIT: 3 GREEDY METHOD

The Greedy Method:-General Method–Knapsack Problem–Minimum Cost Spanning Tree–Single Source Shortest Path.

UNIT: 4 DYNAMIC PROGRAMMING

Dynamic Programming-General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.

UNIT: 5 BACKTRACKING

Backtracking:-General Method–8-Queens Problem–Sum Of Subsets–Graph Coloring–Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.

Text Books

1. Ellis Horowitz. *Computer Algorithms* Galgotia Publications.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman. *Data Structures and Algorithms.*

Reference Books

1. Goodrich. *Data Structures & Algorithms in Java.* Wiley, 3rd edition.
2. Skiena. *The Algorithm Design Manual.* Springer, Second Edition, 2008.
3. Anany Levith. *Introduction to the Design and Analysis of algorithm*. Asia: Pearson Education, 2003.

Related Online Contents

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3. https://www.javatpoint.com/daa-tutorial

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	3	2	3	2
CO-2	2	3	3	2	3	3	2	3	2	3
CO-3	3	3	2	3	2	2	3	3	3	3
CO-4	3	2	3	2	3	3	3	2	3	3
CO-5	2	3	2	3	3	2	3	3	2	3
Ave.	2.6	2.6	2.6	2.6	2.6	2.6	2.8	2.6	2.6	2.8

SEMESTER – I			
CORE II - WEB DEVELOPMENT IN PYTHON			
Course Code: 24PCSC12	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 4**

Course Objectives:

1. To learn how to design framework with Django.
2. To work with forms and authentication with Django
3. To implement database interaction using SQLite.
4. To deploy website using Django.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	define database models in Django.	K1
CO-2	solve problems and their need.	K2
CO-3	construct web application more reliable, scalable, adaptable, and simple.	K3
CO-4	simplify work for programmers by using rapid development.	K4
CO-5	prove the skills and understanding necessary to develop web applications using Django.	K5

SEMESTER – I			
CORE II - WEB DEVELOPMENT IN PYTHON			
Course Code: 24PCSC12	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 4**

UNIT: 1 INTRODUCTION TO DJANGO FRAMEWORK

Django overview-Views and URL Confs-Templates-Models

UNIT: 2 JINJA TEMPLATES IN DJANGO

Jinja Advantages and Disadvantages-Transition to Jinja Template from Django Templates-New Concept and features in Jinja Templates-Jinja template Configuration in Django-Jinja Built-In statements/tags and Function-Jinja Built-In Filters and Tests.

UNIT: 3 DJANGO FORMS AND ADMIN SITE

Django Form Structure and Workflow-Django Form Processing-Django Form field Types-Set up the Layout for Django forms-Django Custom From Fields-Making a Contact form-Using the Admin site-Making fields optional-Custom model admin classes.

UNIT: 4 DJANGO MODEL QUERIES AND MANAGERS

CRUD single records in Django models-CURD Multiple Records in Django Models-CRUD Relationship Records across Django models-Model Queries by SQL keyword.

UNIT: 5 TESTING AND DEPLOYING DJANGO

Introduction to automated testing-Testing tools-Choosing the host-Preparing the site for Deployment-Deploy to Python Anywhere.

Reference Books

1. Nigel George. *Mastering Django: Core* **-** *The Complete guide to Django 1.8.* Packet Publishing Ltd., 2016.
2. Daniel Rubio F. Bahia, Ensenada, Baja California. *Beginning Django: Web Application Development and Deployment with Python*. Mexico press publication, 2017.
3. Leonardo Luis Lazzaro. *Ultimate Django for Web App Development Using Python: Build Modern, Reliable and Scalable Production-Grade Web Applications with Django and Python.* published by Orange Education Pvt Ltd. 2024.
4. Nigel George. *Build a website with Django.* GNW Independent Publishing. 1st Edition 2019.
5. Ray Yao," *Django in 8 Hours: For Beginners, Learn Coding Fast. Independently published Edition. 2nd Edition 2020.*
6. Andrew Pinkham. *Django Unleashed.* Pearson Education, Inc. 2016.

Related Online Contents

1. https://www.w3schools.com/django/
2. https://pythonprogramming.net/jinja-templates-django-python-tutorial/
3. https://developer.mozilla.org/en-US/docs/Learn_web_development/Extensions/Server-side/Django/Deployment

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	2	2	2	2	2	3	2
CO-2	2	3	3	2	2	2	3	3	2	2
CO-3	2	3	2	3	3	3	3	2	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	2.6	2.8	2.6	2.6	2.6	2.6	2.8	2.6	2.8	2.6

SEMESTER – I			
CORE III - MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE			
Course Code : 24PCSC13	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 4**

Course Objectives:

1. To develop a strong understanding of mathematical concepts such as moments, skewness, kurtosis, and curve fitting techniques using least squares methods.
2. To apply statistical methods like correlation, regression, and rank correlation to analyze data relationships and trends effectively.
3. To explore the fundamentals of mathematical logic, including propositional and predicate logic, truth tables, equivalence, normal forms, and rules of inference.
4. To understand graph theory and its applications, covering paths, circuits, Euler and Hamiltonian graphs, trees, spanning trees, connectivity, and planar graphs.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall the fundamental concepts of logic, abstract algebra, linear algebra, probability and statistics, graph theory etc.	K1
CO-2	summarize mathematical principles and logic.	K2
CO-3	apply mathematical logic to solve problems.	K3
CO-4	analyze whether given graphs are isomorphic.	K4
CO-5	evaluate real-world problems using graphs and trees.	K5

SEMESTER – I			
CORE III - MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE			
Course Code: 24PCSC13	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 4**

UNIT: 1 STATISTICS

Moments - Skewness and kurtosis-Curve Fitting-Method of least squares-fitting lines-parabolic, exponential & logarithmic curves

UNIT: 2 CORRELATION & REGRESSION

Correlation & regression - Karl Pearson's coefficient of correlation- lines of regression coefficient - rank correlation.

UNIT: 3 MATHEMATICAL LOGIC

Mathematical Logic: Propositions and Predicate logic - Truth table – Propositional-Equivalence- Normal forms - Predicate and Quantifiers-Rules of Inference.

UNIT: 4 GRAPH THEORY

Graph Theory: Introduction – Paths and Circuits: Sub graphs – Walks, Paths, Circuits Connected Graphs, Disconnected Graphs and Components – Euler Graphs – Operations on Graph – Hamiltonian Paths and Circuits - Trees and Fundamental Circuits: Trees – Some properties of Trees – Distance and Centers in a Tree – Rooted and Binary Trees – Spanning Trees – Fundamental Circuits

UNIT: 5 GRAPH THEORY

Cut-Sets and Cut-Vertices: Cut-Sets – Properties of Cut-Sets – All Cut-Sets in a Graph – Fundamental Circuits and Cut-Sets – Connectivity and Separability – Planar Graphs: Combinational vs geometric graphs – Planar graphs – Different representation of a planar graph – Matrix: Incidence matrix, Submatrices, Circuit matrix.

Text Books

1. Dr.M.K.Venkatraman, Dr. N. Sridharan and N.Chandrasekaran. *Discrete Mathematics*. Chennai: The National Publishing Company 2007.
2. S. Arumugam and A. Issac. *Statistics*. Palayamkottai: New Gamma publishing House 2011.
3. NarsinghDeo. *Graph Theory with Application to Engineering and Computer Science*. Prentice-Hall of India Pvt.Ltd 2003.

Reference Books

1. Tremblay and Manohar. *Discrete Mathematical Structures with applications to Computer Science*. Tata McGraw Hill.
2. A.Tamilarasi and A.M.Natarajan. *Discrete Mathematics and its Application.* Khanna Publishers, 2nd Edition 2005.
3. Bondy, J. A. and Murty, U.S.R. *Graph Theory with Applications.* North Holland Publication 2008.

Related Online Contents

1. https://onlinecourses.nptel.ac.in/noc24_ma30/preview
2. https://www.tutorialspoint.com/difference-between-propositional-logic-and-predicate-logic
3. https://www.tpointtech.com/graph-theory

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	2	3	2	3	3
CO-2	2	3	2	3	3	3	2	3	2	3
CO-3	3	3	3	2	2	3	2	3	3	2
CO-4	3	2	2	3	3	2	3	2	3	3
CO-5	2	3	3	3	2	3	3	3	2	3
Ave.	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.8

SEMESTER – I			
CORE PRACTICAL I - ANALYSIS AND DESIGN OF ALGORITHMS LAB			
Course Code : 24PCSCR1	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits :2**

Course Objectives:

1. To understand and implement fundamental data structures, such as stacks and circular queues, using linked lists for efficient data management.
2. To apply tree traversal techniques in binary search trees for optimized searching, insertion, and deletion operations.
3. To analyze and implement various algorithmic paradigms, including greedy algorithms and backtracking.
4. To solve complex optimization problems, such as the Travelling Salesman Problem and Single-Source Shortest Path, using appropriate algorithmic strategies.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental data structures and algorithmic strategies including stacks, queues, trees, and graphs.	K1
CO-2	describe the working principles of traversal, sorting, and greedy methods in solving algorithmic problems.	K2
CO-3	implement basic and advanced data structure operations (stack, queue, BST) and algorithms (sorting, shortest path) using appropriate programming constructs.	K3
CO-4	analyse the performance and complexity of algorithms such as Prim's, Knapsack, and Single Source Shortest Path in solving optimization problems.	K4
CO-5	evaluate the suitability of backtracking and dynamic programming techniques in solving combinatorial problems like N-Queen, Sum of Subsets, and Travelling Salesman Problem.	K5

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LIST OF PROGRAMS

1) Analyse various operations on a stack using a linked list.

2) Analyse various operations in a circular queue.

3) Analyse traversal techniques in a binary search tree.

4) Analyse different sorting algorithms.

5) Analyse Prim's Algorithm for minimum spanning trees.

6) Analyse the Knapsack problem using the greedy method.

7) Analyse the Single Source Shortest Path algorithm.

8) Analyse the N-Queen problem and its solutions.

9) Analyse the Sum of Subsets problem and its approach.

10) Analyse the Travelling Salesman Problem and its solutions.

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	3	2	3	2
CO-2	2	3	2	3	3	2	3	3	2	3
CO-3	3	3	2	2	3	3	2	3	3	2
CO-4	2	3	3	3	2	2	3	2	3	3
CO-5	3	2	3	2	3	3	3	3	2	3
Ave.	2.6	2.6	2.6	2.6	2.6	2.6	2.8	2.6	2.6	2.6

SEMESTER – I			
CORE PRACTICAL II - WEB DEVELOPMENT IN PYTHON - LAB			
Course Code: 24PCSCR2	**Hrs / Week :3**	**Hrs / Sem :45**	**Credits :2**

Course Objectives:

1. To learn how to design framework with Django.
2. To work with forms and authentication with Django.
3. To implement database interaction using SQLite.
4. To deploy website using Django.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall the core components of Django architecture, including views, models, forms, sessions, and cookies.	K1
CO-2	explain the functionality of function-based and class-based views, URL mapping, and redirection mechanisms in Django.	K2
CO-3	apply Django's form handling, email-sending mechanisms, and CRUD operations using models to develop dynamic web applications.	K3
CO-4	analyse session and cookie management techniques in Django to maintain state and user data securely across requests.	K4
CO-5	evaluate the advantages of class-based views and the effectiveness of various Django components in enhancing application performance and user experience.	K5

LIST OF PROGRAMS

1. Analyse function-based views and apply URL mapping in Django.
2. Analyse class-based views in Django and their advantages.
3. Analyse page redirection mechanisms in Django.
4. Analyse the process of sending emails in Django.
5. Analyse form processing techniques in Django.
6. Analyse Django models and perform CRUD operations.
7. Analyse cookie handling in Django.
8. Analyse session management and handling in Django.

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	3	2	3	3
CO-2	2	3	2	3	3	2	3	3	2	3
CO-3	3	3	3	2	3	3	2	3	3	2
CO-4	3	2	3	3	3	3	3	2	3	3
CO-5	2	3	2	3	3	3	2	3	3	3
Ave.	2.6	2.6	2.6	2.8	2.8	2.8	2.6	2.6	2.8	2.8

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE I A - SOFT COMPUTING			
Course Code : 24PCSE11	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

Course Objectives:

1. To understand the fundamentals of Artificial Neural Networks.
2. To explore different neural network models.
3. To develop a strong foundation in fuzzy logic.
4. To analyze and implement Genetic Algorithms and their applications in optimization problems.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	define the fuzzy systems.	K1
CO-2	understand soft computing techniques and their role in problem solving.	K2
CO-3	identify the roles of neural network, fuzzy logic and genetic algorithms to build intelligent machines.	K3
CO-4	analyse and integrate various soft computing techniques in order to solve problems effectively and efficiently.	K4
CO-5	evaluate and compare solutions by various soft computing approaches for a given problem.	K5

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE I A - SOFT COMPUTING			
Course Code: 24PCSE11	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

UNIT: 1 NEURAL NETWORKS FUNDAMENTALS

Fundamentals of ANN: The Biological Neural Network, Artificial Neural Networks - Building Blocks of ANN and ANN terminologies: Architecture, setting of weights, activation functions-McCulloch-pitts neuron model-Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules – Hebbian Learning rule- Perceptron learning rule-Delta Learning Rule.

UNIT: 2 CATEGORIES OF NEURAL NETWORKS

Models of ANN: Single layer perceptron- Architecture, Algorithm, application procedure. Feedback Networks: Hopfield Net and BAM - Feed Forward Networks: Backpropagation Network (BPN) and Radial Basis Function Network (RBFN) - Self Organizing Feature Maps: SOM and LVQ.

UNIT: 3 BASIC CONCEPTS OF FUZZY SET

Fuzzy Sets, properties and operations - Fuzzy relations, cardinality, operations and properties of fuzzy relations, fuzzy composition

UNIT: 4 MEMBERSHIP FUNCTION & FIS

Fuzzy variables - Types of membership functions - fuzzy rules: Takagi and Mamdani - fuzzy inference systems: fuzzification, inference, rule base, defuzzification.

UNIT: 5 GENETIC ALGORITHMS

Genetic Algorithm (GA): Biological terminology – elements of GA: encoding, types of selection, types of crossover, mutation, reinsertion – a simple genetic algorithm – General Genetic algorithm -The Schema Theorem - Classification of Genetic Algorithm - Applications of Genetic Algorithm.

Text Books:

1. S. N. Sivanandam, S. Sumathi and S.N. Deepa. *Introduction to Neural Networks using MATLAB 6.0*. New Delhi: Tata McGraw-Hill 2006.

2. S. N. Sivanandam and S.N. Deepa. *Principles of Soft Computing.* India: Wiley 2008.

Reference Books:

1. Simon Haykin. *Neural networks A Comprehensive Foundation*. Pearson Prentice Hall 2005
2. S.Rajasekaran and G.A.V.Pai. *Neural Networks, Fuzzy Logic and Genetic Algorithms.* PHI 2004.
3. S.N.Sivanandam and S.N.Deepa. *Introduction to Genetic Algorithms.* Springer 2007.
4. Timothy J.Ross. *Fuzzy Logic with Engineering Application.* McGraw Hill 2000.

Related Online Contents

1. https://nptel.ac.in/courses/117105084
2. https://www.tutorialspoint.com/fuzzy_logic/fuzzy_logic_set_theory.htm
3. https://github.com/topics/genetic-algorithms?l=java&utf8=%E2%9C%93

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	2	3	3	2	3
CO-2	2	3	2	3	2	3	2	3	3	2
CO-3	3	3	3	2	3	3	3	2	3	3
CO-4	3	2	3	3	3	2	3	3	2	3
CO-5	2	3	2	3	2	3	3	3	3	3
Ave.	2.6	2.6	2.6	2.6	2.6	2.6	2.8	2.8	2.6	2.8

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE I B- MULTIMEDIA AND ITS APPLICATIONS			
Course Code: 24PCSE12	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. To understand the fundamentals of multimedia and its components.
2. To learn multimedia and design principles and authoring tools.
3. To develop skills in creating and editing multimedia content.
4. To apply multimedia concepts to real world projects.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recognize the various file formats used in multimedia.	K1
CO-2	understand the technologies behind multimedia applications.	K2
CO-3	apply multimedia design principles to create engaging and effective content.	K3
CO-4	analyse the concepts of sound, images, video and animation.	K4
CO-5	assess the impact and effectiveness of multimedia content in various context.	K5

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE I B- MULTIMEDIA AND ITS APPLICATIONS			
Course Code : 24PCSE12	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

UNIT: 1 INTRODUCTION

Definition - Classification - Multimedia application -Multimedia Hardware - Multimedia software - CDROM - DVD.

UNIT: 2 MULTIMEDIA AUDIO

Multimedia Audio: Digital medium - Digital audio technology - sound cards - recording - editing - MP3 - MIDI fundamentals - Working with MIDI - audio file formats - adding sound to Multimedia project.

UNIT: 3 MULTIMEDIA TEXT

Multimedia Text: Text in Multimedia -Multimedia graphics: coloring - digital imaging fundamentals - development and editing - file formats - scanning and digital photography

UNIT: 4 MULTIMEDIA ANIMATION

Multimedia Animation: Computer animation fundamentals - Kinematics - morphing - animation s/w tools and techniques. Multimedia Video: How video works - broadcast video standards - digital video fundamentals – digital video production and editing techniques - file formats.

UNIT: 5 MULTIMEDIA PROJECTS

Multimedia Project: stages of project - Multimedia skills - design concept - authoring - planning and costing –Multimedia Team. Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing

Text Books

1. S.Gokul. *Multimedia Magic*. BPB Publications, 2nd Edition.
2. Tay Vaughen. *Multimedia Making it Work.* TMH, 6th Edition.

Reference Books

1. Jiran Thakrar, Prabhat.k.and leigh. *Multimedia System Design*. Prentice Hall India.
2. Malay k Pakhira. *Computer graphics, Multimedia and Animation*. Prentice Hall India, 2nd Edition.

Related Online Contents

1. https://www.tutorialspoint.com/multimedia/index.htm
2. https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm
3. https://nptel.ac.in/courses/117/105/117105083/

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	3	2	3	2	3
CO-2	2	3	3	3	2	2	3	2	3	3
CO-3	3	3	2	3	3	3	2	3	3	2
CO-4	3	2	3	3	3	2	3	2	3	3
CO-5	2	3	2	3	2	3	3	3	3	2
Ave.	2.6	2.6	2.6	2.8	2.6	2.6	2.6	2.6	2.8	2.6

SEMESTER – I			
SKILL ENHANCEMENT COURSE I - REACT JS			
Course Code: 24PCSSE1	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. To understand the new JavaScript language features, including classes, modules, and array functions.
2. To explore the basic architecture of a React application.
3. To gain a deep understanding of JSX and the virtual DOM.
4. To use React components to build interactive interfaces.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recognize the basic components of React JS.	K1
CO-2	understand the challenges in web development and how React addresses them, preparing for future advancements in React's ecosystem.	K2
CO-3	develop dynamic user interfaces using React JS with reusable components.	K3
CO-4	analyze and write unit testing for React components.	K4
CO-5	evaluate the effectiveness of modern JavaScript and React techniques.	K5

SEMESTER – I			
SKILL ENHANCEMENT COURSE I - REACT JS			
Course Code : 24PCSSE1	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

UNIT: 1 JAVA SCRIPT FOR REACT

Declaring Variables-Creating Functions-Compiling JavaScript - Objects and Arrays Asynchronous JavaScript-Classes.

UNIT: 2 FUNCTIONAL PROGRAMMING WITH JAVASCRIPT

Functional Programming with JavaScript: Functional Concepts-Page Setup-React Elements-React DOM-React Components.

UNIT: 3 REACT WITH JS

React with JSX: React Elements as JSX - Babel - Recipes as JSX- React Fragments - Intro to web pack.

UNIT: 4 REACT STATE MANAGEMENT

Building a star Rating component – State in Component Trees – Building Forms – React Context.

UNIT: 5 INCORPORATING DATA

Requesting Data – Render Drops – Virtualized Lists-Introducing GraphQL.

Text Book

1. Alex Banks and Eve Porcello. *Learning React Modern Patterns for Developing React Apps.* O'Reilly Media, Inc.,Second Edition.

Reference Books

1. Robin Weiruch. *The Road to React.*
2. Zac Gordon. *React Explained. 2020 edition.*

Related Online Contents

1. https://react.dev/
2. https://legacy.reactjs.org/
3. https://www.tutorialspoint.com/reactjs/reactjs_state.htm

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	3	3	3	3	2
CO-2	2	3	3	3	2	3	3	3	2	3
CO-3	3	3	2	3	3	2	3	3	3	2
CO-4	3	2	3	3	2	3	2	3	3	3
CO-5	2	3	3	2	3	3	3	2	3	3
Ave.	2.6	2.6	2.8	2.6	2.6	2.8	2.8	2.8	2.8	2.6

SEMESTER –II			
CORE IV- COMPILER DESIGN			
Course Code:24PCSC21	**Hrs/week:5**	**Hrs/Semester:75**	**Credits:4**

Course Objectives:

1. To gain knowledge of compiler structures, lexical analysis, and token recognition using finite automata and regular expressions.
2. To explore different parsing methods, including top-down and bottom-up parsing, to understand syntax analysis in compilers.
3. To develop the ability to translate expressions, perform type checking, and construct three-address code for efficient compilation.
4. To examine storage organization, stack allocation, and code optimization techniques like peephole optimization and data-flow analysis.

Course Outcomes:

CO. No	Upon Completion of this course, students will be able to	CL
CO-1	learn the basic principles of compiler in high level programming language.	K1
CO-2	understand language tokens using regular expressions, finite automata.	K2
CO-3	apply parsing techniques and able to write Context Free Grammars for various languages.	K3
CO-4	analyze the knowledge of intermediate code generation to build efficient systems.	K4
CO-5	prove the knowledge on Run-time Environment.	K5

SEMESTER –II			
CORE IV- COMPILER DESIGN			
Course Code:24PCSC21	**Hrs/week: 5**	**Hrs/Semester:75**	**Credits: 4**

UNIT: 1 LEXICAL ANALYSIS

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens –Finite Automata – Regular Expressions to Automata – Minimizing the number of states of a DFA.

UNIT: 2 SYNTAX ANALYSIS

Introduction – Context-free Grammars – Writing a Grammar – Top-Down Parsing – Bottom-Up parsing – LR Parsing – Ambiguous Grammar – Parser Generators.

UNIT: 3 INTERMEDIATE CODE GENERATION

Syntax Directed Definitions - Evaluation Orders for Syntax Directed Definitions - Variants of Syntax trees – Three-Address Code – Types and Declarations – Translation of Expressions – Type Checking.

UNIT: 4 RUN TIME ENVIRONMENTS AND CODE GENERATION

Storage Organization – Stack Allocation of Space - Access to Nonlocal Data on the Stack - Issues in the Design of a Code Generator – Target Language – Address in the Target Language - A Simple Code Generator.

UNIT: 5 CODE OPTIMIZATION

Basic Blocks and Flow Graphs - Optimization of Basic Blocks - Peephole Optimization - Machine-Independent Optimizations: Introduction to Data-Flow Analysis.

Text Book

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffery D.Ullman. *Compilers: Principles, Techniques and Tools*. Pearson, 2nd Edition, 2014.

Reference Books

1. J.P. Tremblay and P.G. Sorrenson. *The Theory and Practice of Compiler Writing*. McGraw Hill, 1985.
2. David Galles. *Modern Compiler Design.* Pearson Education Asia, 2007.
3. Steven S. Muchnick. *Advanced Compiler Design & Implementation*. Morgan Kaufmann Pulishers, 2000.

Related Online Contents

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3. https://www.javatpoint.com/daa-tutorial

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	3	2	3	2
CO-2	2	3	2	3	3	2	3	3	2	3
CO-3	3	3	2	3	3	3	2	3	3	2
CO-4	3	2	3	3	2	3	3	2	3	3
CO-5	2	3	3	2	3	2	3	3	3	3
Ave.	2.6	2.6	2.6	2.8	2.6	2.6	2.8	2.6	2.8	2.6

SEMESTER –II			
CORE V- NETWORK PROGRAMMING USING JAVA			
Course Code:24PCSC22	**Hrs/week:5**	**Hrs/Semester:75**	**Credits:4**

Course Objectives:

1. To develop a deep understanding of networking fundamentals, including socket programming, TCP/IP, and UDP communication, to build robust client-server applications in Java.
2. To gain expertise in JDBC programming, learning various JDBC drivers, database transactions, CRUD operations, and result set handling to create efficient database-driven applications.
3. To learn J2EE architecture, servlet lifecycle, JSP scripting, and session management to design and deploy secure, scalable web applications.
4. To apply networking and database concepts to solve real-world problems, improving critical thinking and programming proficiency in Java-based enterprise applications.

Course Outcomes:

CO. No	Upon Completion of this course, students will be able to	CL
CO-1	recall the advanced concepts of Java Programming.	K1
CO-2	understand JDBC and RMI concepts.	K2
CO-3	apply and analyze Java in Database.	K3
CO-4	examine different event in java using the delegation event model, event listener and class.	K4
CO-5	design interactive applications using Java Servlet, JSP and JDBC	K4

SEMESTER –II			
CORE V- NETWORK PROGRAMMING USING JAVA			
Course Code:24PCSC22	**Hrs/week:5**	**Hrs/Semester:75**	**Credits:4**

UNIT: 1 ADVANCE NETWORKING

Networking Basics-Introduction of Socket- Types of Socket- Socket.API, TCP-IP: Client/Server Sockets-URL, UDP: Datagrams-java.net package classes: Socket-Server Socket- Inet Address-URL-URL Connection-RMI Architecture-Client Server Application using RMI.

UNIT: 2 JDBC PROGRAMMING

JDBC Architecture-Types of JDBC Drivers-Introduction to major JDBC-Classes and Interface-Creating simple JDBC Application-Types of Statement (Statement Interface, Prepared Statement, Callable Statement)-Exploring ResultSet Operations-Batch Updates in JDBC-Creating CRUD Application-Using RowSet Objects- Managing-Database Transaction.

UNIT: 3 J2EE AND WEB DEVELOPMENT

J2EE Architecture Types- J2EE Containers- Types of Servers in J2EE Application-HTTP Protocols and API- Request Processing in Web Application- Web Application Structure- Web Containers and Web Architecture Models.

UNIT: 4 SERVLET API AND OVERVIEW

Servlet Introduction-Servlet Life Cycle(SLC)- Types of Servlet-Servlet Configuration with Deployment Descriptor- Working with Servlet Context and Servlet Config Object-Attributes in Servelt-Response and Redirection using Request Dispacher and using sendRedirect Method-Filter API-Manipulating Responses using Filter API- Session Tracking: using Cookies-HTTP Session-Hidden Form Fields and URL Rewriting-Types of Servlet Event: Context Level and SessionLevel.

UNIT: 5 JAVA SERVER PAGES

Introduction to JSP - Comparison with Servlet- JSP Architecture-JSP: Life Cycle-Scripting Elements- Directives-Action Tags- Implicit Objects- Expression Language(EL)-JSP Standard Tag Libraries(JSTL)-Custom Tag- Session Management-Exception Handling-CRUD Application.

Text Books

1. Keogh. *J2EE:The Complete Reference*. McGraw Hill India, 2002.
2. Phil Hanna. *The Complete Reference JSP*, Osborne/Mc Graw-Hill Publication, 2003.
3. Jamie Jaworski. *Java Unleased*. SAMS Techmedia Publications,1999.

Reference Books

1. Budi Kurnaiwan. *Java for Web with Servlets,JSP and EJB:A Developer's Guide to J2EE Solutions.* New Riders Publishing.
2. Herbert Schildt. *Java, The Complete Reference*.Twelth Edition.

Related Online Contents

1. https://www.tutorialspoint.com/java/java_networking.htm
2. https://www.tpointtech.com/java-networking
3. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	3	3	2	3	2
CO-2	2	3	3	3	2	2	3	3	2	3
CO-3	3	3	2	3	3	3	2	3	3	2
CO-4	3	2	3	3	2	3	3	3	3	3
CO-5	2	3	3	2	3	2	3	3	2	3
Ave.	2.6	2.6	2.8	2.6	2.6	2.6	2.8	2.8	2.6	2.6

SEMESTER – II			
CORE VI - DIGITAL IMAGE PROCESSING			
Course Code : 24PCSC23	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 4**

Course Objectives:

1. To understand the fundamentals of digital image processing.
2. To apply image enhancement techniques.
3. To analyse image restoration and compression methods.
4. To implement image segmentation techniques.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	learn different techniques employed for the enhancement of images.	K1
CO-2	understand the need for image transforms.	K2
CO-3	utilize theoretical knowledge and algorithms as the course progresses to solve more complex problems (e.g. for image restoration).	K4
CO-4	analyze specific problems and propose appropriate solutions through a combination of theoretical knowledge and programming techniques.	K3
CO-5	assess the performance of image processing algorithms and systems.	K5

SEMESTER – II			
CORE VI - DIGITAL IMAGE PROCESSING			
Course Code : 24PCSC23	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 4**

UNIT: 1 FUNDAMENTALS

Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.

UNIT: 2 IMAGE ENHANCEMENT

Image Enhancement in the spatial domain:- Background – some basic gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

UNIT: 3 IMAGE RESTORATION

Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.

UNIT: 4 IMAGE COMPRESSION

Image Compression: Fundamentals–Image compression models–Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.

UNIT: 5 IMAGE SEGMENTATION

Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.

Text Books

1. Rafael C.Gonzalez, Richard E.Woods, *Digital Image Processing.* PHI/Pearson Education, Second Edition.
2. B.Chanda,D.Dutta Majumder. *Digital Image Processing and Analysis*. PHI, 2003.

Reference Book

1. NickEfford. *Digital Image Processing-a practical introducing using Java.* Pearson Education, 2004.

Related Online Contents

1. https://nptel.ac.in/courses/117/105/117105135/
2. https://www.tutorialspoint.com/dip/index.htm
3. https://www.javatpoint.com/digital-image-processing-tutorial

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	3	3	2	3	2
CO-2	2	3	3	3	2	2	3	3	2	3
CO-3	3	3	2	3	3	3	2	3	3	2
CO-4	3	2	3	3	2	3	3	3	3	3
CO-5	2	3	3	2	3	2	3	3	2	3
Ave.	2.6	2.6	2.8	2.6	2.6	2.6	2.8	2.8	2.6	2.6

SEMESTER – II			
CORE PRACTICAL III - DIGITAL IMAGE PROCESSING LAB			
Course Code : 24PCSCR3	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :2**

Course Objectives:

1. To introduce advanced image processing techniques for enhancement, restoration, and filtering.
2. To analyse the effectiveness of various edge detection, morphological, and segmentation methods in image processing.
3. To develop skills in evaluating and comparing different image compression and noise reduction techniques for optimized performance.
4. To facilitate critical thinking in applying image analysis techniques to real-time or research-based applications.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental concepts of image processing techniques, including enhancement, restoration, filtering, and compression.	K1
CO-2	explain the principles and objectives of image enhancement and restoration techniques, such as histogram equalization and noise reduction methods.	K2
CO-3	apply various edge detection methods (Roberts, Prewitt, Sobel) and filtering techniques to solve image processing problems.	K3
CO-4	analyse the effectiveness of different image segmentation techniques and the impact of image subtraction and morphological operations on image quality.	K4
CO-5	evaluate the performance of image compression and enhancement techniques based on their efficiency, image quality, and application suitability.	K5

LIST OF PROGRAMS

1. Analyse the effectiveness of different image enhancement techniques.
2. Analyse the impact of histogram equalization on image contrast.
3. Analyse various image restoration techniques for noise reduction.
4. Analyse the role of different image filtering techniques in image processing.
5. Analyse edge detection methods using Roberts, Prewitt, and Sobel operators.

6. Analyse the efficiency of various image compression techniques.
7. Analyse the effect of image subtraction in image processing applications.
8. Analyse boundary extraction methods using morphological operations.
9. Analyse the effectiveness of different image segmentation techniques.

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	2	3	2	3	2	3	3	2
CO-2	2	3	3	3	3	3	3	2	2	3
CO-3	3	2	3	3	2	2	3	3	3	2
CO-4	3	3	2	2	3	3	3	3	2	3
CO-5	2	3	3	2	3	2	3	2	3	3
Ave.	2.6	2.8	2.6	2.6	2.6	2.6	2.8	2.6	2.6	2.6

SEMESTER – II			
CORE PRACTICAL IV - JAVA PROGRAMMING LAB			
Course Code : 24PCSCR4	**Hrs / Week :3**	**Hrs / Sem : 45**	**Credits :2**

Course Objectives:

1. To provide knowledge on using Servlets.
2. To introduce JDBC and navigation of records.
3. To understand RMI & its implementation.
4. To introduce Socket programming.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental concepts of distributed computing, JDBC connectivity, and web technologies including Servlets and JSP.	K1
CO-2	explain the functioning of connection-oriented and connection-less protocols, and the interaction between web components and databases.	K2
CO-3	implement Client-Server applications using RMI and perform CRUD operations in JDBC using both statement objects and stored procedures.	K3
CO-4	analyze the roles and configuration of Servlets, deployment descriptors, and various session management techniques like Cookies, HttpSession, and URL Rewriting.	K4
CO-5	evaluate the effectiveness of Servlet and JSP integration in dynamic web applications with database connectivity.	K5

LIST OF PROGRAMS

1. Examine the implementation of a Client-Server application using RMI.
2. Examine the functions of connection-less and connection-oriented communication.
3. Examine CRUD operations in a JDBC application using a statement object.
4. Examine a JDBC application with a database using stored procedures.
5. Examine the functionality of a Servlet and its deployment descriptor.
6. Examine various state management techniques (Cookies, HttpSession, URL Rewriting).
7. Examine the integration of Servlet-based database operations.
8. Examine database access mechanisms through JSP.

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	3	2	3	2	3	2	3
CO-2	2	3	3	2	3	2	3	2	3	2
CO-3	3	2	3	3	2	3	2	3	3	3
CO-4	2	3	2	3	3	3	3	2	3	2
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	2.6	2.6	2.6	2.8	2.6	2.8	2.6	2.6	2.8	2.6

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE II A - BLOCKCHAIN TECHNOLOGY			
Course Code : 24PCSE21	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

Course Objectives:

1. To provide an overview of blockchain technology, including its origins and the differences between Bitcoin, crypto currencies, and blockchain.
2. To address privacy and security issues associated with blockchain technology.
3. To understand the principles of symmetric-key and public-key cryptography, digital signatures, and their applications in blockchain.
4. To explore the application of blockchain in machine-to-machine communication and data management within Industry 4.0.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	identify the key players, platforms, and regulatory bodies involved in the blockchain industry.	K1
CO-2	understand the principles of symmetric-key cryptography, public-key cryptography, and digital signatures, and their application in blockchain.	K2
CO-3	apply cryptographic techniques to secure blockchain transactions and ensure data integrity.	K3
CO-4	analyze the regulatory environment for cryptocurrencies and blockchain technology, including the perspectives of different stakeholders.	K4
CO-5	design and develop blockchain-based solutions for complex problems in various industries, ensuring compliance with regulatory requirements.	K5

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE II A - BLOCKCHAIN TECHNOLOGY			
Course Code : 24PCSE21	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

UNIT: 1 INTRODUCTION

Introduction to Blockchain - The big picture of the industry – size, growth, structure, players. Bitcoin versus Cryptocurrencies versus Blockchain - Distributed Ledger Technology (DLT) – Blockchain platforms, regulators, application providers. The major application: currency, identity, chain of custody.

UNIT: 2 NETWORK AND SECURITY

Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Blockchain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy, Security issues in Blockchain.

UNIT: 3 CRYPTOCURRENCY

Cryptocurrency - History, Distributed Ledger, Bitcoin protocols -Symmetric-key cryptography - Public-key cryptography - Digital Signatures -High and Low trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Blockchain

UNIT: 4 CRYPTOCURRENCY REGULATION

Cryptocurrency Regulation- Stakeholders, Roots of Bitcoin, Legal views- exchange of cryptocurrency- Black Market- Global Economy. Crypto economics– assets, supply and demand, inflation and deflation – Regulation.

UNIT: 5 CHALLENGES IN BLOCKCHAIN

Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication –Data management in industry 4.0–future prospects. Block chain in Health 4.0 - Blockchain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using blockchain for healthcare data.

Text Books

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder. *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction*. Princeton University Press, 2016.
2. Andreas Antonopoulos. *Mastering Bitcoin: Unlocking Digital Cryptocurrencies.* O'Reilly, First edition, 2015.

Reference Books

1. Satoshi Nakamoto. *Bitcoin: A Peer-to-Peer Electronic Cash System*. 2009."
2. Rodrigoda Rosa Righi,Antonio Marcos Alberti and Madhusudan Singh. *Blockchain Technology for Industry 4.0.* Springer 2020.

Related Online Contents

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2. https://www.javatpoint.com/blockchain-tutorial
3. https://www.tutorialspoint.com/blockchain/index.htm

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	3	2	3	2	2	3	2
CO-2	3	3	2	2	2	2	3	2	3	2
CO-3	3	3	3	2	3	2	3	3	3	3
CO-4	2	3	3	3	3	3	3	3	2	3
CO-5	2	3	3	3	3	3	3	3	2	3
Ave.	2.6	2.8	2.6	2.6	2.6	2.6	2.8	2.6	2.6	2.6

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE II B – THEORY OF COMPUTATION			
Course Code : 24PCSE22	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :3**

Course Objectives:

1. To understand the Fundamentals of Automata Theory.
2. To analyze Regular Expressions and Formal Languages.
3. To examine Context-Free Grammars and Pushdown Automata.
4. To evaluate Computability and Undecidability.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	define what a Regular Language is and construct a finite state machine for it.	K1
CO-2	understand Turing Machines and the simple primitive mechanisms needed for all computation.	K2
CO-3	solve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.	K3
CO-4	analyse languages of Turing machine.	K4
CO-5	decide what makes some problems computationally hard and others easy.	K5

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE II B – THEORY OF COMPUTATION			
Course Code : 24PCSE22	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :3**

UNIT: 1 AUTOMATA FUNDAMENTALS

Introduction to formal proof — Additional forms of Proof — Inductive Proofs –Finite Automata — Deterministic Finite Automata — Non-deterministic Finite Automata — Finite Automata with Epsilon Transitions

UNIT: 2 REGULAR EXPRESSIONS AND LANGUAGES

Regular Expressions — FA and Regular Expressions — Proving Languages not to be regular — Closure Properties of Regular Languages — Equivalence and Minimization of Automata.

UNIT: 3 CONTEXT FREE GRAMMAR AND LANGUAGES

CFG — Parse Trees — Ambiguity in Grammars and Languages — Definition of the Pushdown Automata — Languages of a Pushdown Automata — Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

UNIT: 4 PROPERTIES OF CONTEXT FREE LANGUAGES

Normal Forms for CFG — Pumping Lemma for CFL — Closure Properties of CFL — Turing Machines — Programming Techniques for TM.

UNIT: 5 UNDECIDABILITY

Non Recursive Enumerable (RE) Language — Undecidable Problem with RE — Undecidable Problems about TM — Undecidability of Post's Correspondence Problem, The Class NP and co-NP.

Text Books

1. John E. Hopcroft, Rajeev Motwani and Jeffery D. Ullman. *Automata Theory, Languages, and Computation*. Pearson Education, 3rd Edition, 2008.
2. Michael Sipser. *Introduction to the Theory of Computation.* Books/Cole Thomson Learning, 2001.
3. JE Hopcroft and JD Ullman. *Introduction to Automata Theory, Languages, and Computation.* Addison-Wesley.

Reference Book

1. Michael Sipser. *Introduction to the Theory of Computation*. Cengage Learning, 3rd Edition, 2013.

Related Online Contents

1. https://onlinecourses.nptel.ac.in/noc25_cs70/preview
2. https://www.tutorialspoint.com/automata_theory/index.htm
3. https://www.tpointtech.com/context-free-grammar

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	3	3	2	3	2
CO-2	2	3	3	3	2	2	3	3	2	3
CO-3	3	3	2	3	3	3	2	3	3	2
CO-4	3	2	3	3	2	3	3	3	3	3
CO-5	2	3	3	2	3	2	3	3	2	3
Ave.	2.6	2.6	2.8	2.6	2.6	2.6	2.8	2.8	2.6	2.6

SEMESTER – II			
SKILL ENHANCEMENT COURSE II – SOFT SKILLS			
Course Code : 24PCSSE2	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :3**

Course Objectives:

1. To provide a focused training on soft skills for students in colleges for better job prospects.
2. To communicate effectively and professionally.
3. To help the students take active part in group dynamics.
4. To familiarize students with numeracy skills for quick problem solving.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall various soft skill sets.	K1
CO-2	understand personal effectiveness in any managerial positions.	K2
CO-3	apply verbal and non-verbal reasoning skills to solve problems.	K3
CO-4	differentiate problems at work and home and design solutions to maintain work-life balance.	K4
CO-5	assess growth and sustainability and infuse creativity in employment that increases professional productivity.	K5

SEMESTER – II			
SKILL ENHANCEMENT COURSE II – SOFT SKILLS			
Course Code : 24PCSSE2	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :3**

UNIT: 1 EFFECTIVE COMMUNICATION & PROFESSIONAL COMMUNICATION

Definition of communication, Barriers of Communication, Non-verbal Communication; Effective Communication - Conversation Techniques, Good manners and Etiquettes; Speech Preparations & Presentations; Professional Communication.

UNIT: 2 RESUME WRITING & INTERVIEW SKILLS

Resume Writing: What is a résumé? Types of résumés, - Chronological, Functional and Mixed Resume, Purpose and Structure of a Resume, Model Resume. Interview Skills: Types of Interviews, Preparation for an interview, Attire, Body Language, Common interview questions, Mock interviews & Practicum.

UNIT: 3 GROUP DISCUSSION & PERSONAL EFFECTIVENESS

Basics of Group Discussion, Parameters of GD, Topics for Practice, Mock GD & Practicum & Team Building. Personal Effectiveness: Self Discovery; Goal Setting with questionnaires & Exercise.

UNIT: 4 NUMERICAL ABILITY

Introducing concepts Average, Percentage; Profit and Loss, Simple Interest, Compound Interest; Time and Work, Pipes and Cisterns.

UNIT: 5 TEST OF REASONING

Introducing Verbal Reasoning: Series Completion, Analogy; Data Sufficiency, Assertion and Reasoning; and Logical Deduction. Non-Verbal Reasoning: Series; and Classification.

Text Books

1. Dr. R.S. Aggarwal. *Quantitative Aptitude for Competitive Examinations*. S. Chand and Company Limited, New Delhi.
2. Aggarwal, R. S. *A Modern Approach to Verbal and Non-Verbal Reasoning.* S.Chand. 2010.
3. Melchias G., Balaiah, J. & Joy. *Winner in the Making: A Primer on soft Skills.* Trichy, India: St. Joseph's College. J. L. (Eds), 2018.

Reference Books

1. Covey.S.*7 Habits of Highly effective people.* Free Press. 2004
2. Gerard.E. *The Skilled Helper.* Brooks/Cole, 5th Edition, 1994.
3. Khera, S. *You Can Win.* Macmillan Books, 2003.
4. Murphy, R. *Essential English Grammar*. Cambridge University Press, 2nd edition, 1998.
5. Sankaran, K., & Kumar, M. *Group Discussion and Public Speaking* .M.I. Publications, 5th edition, 2010.

Related Online Contents

1. https://onlinecourses.nptel.ac.in/noc25_hs72/preview
2. https://www.slideshare.net/slideshow/numerical-abilitypptx/261103256
3. https://www.indiabix.com/verbal-reasoning/questions-and-answers/

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	2	2	2	2	2	3	2
CO-2	2	3	2	3	3	3	3	2	2	3
CO-3	3	2	3	2	3	3	3	3	3	3
CO-4	2	3	3	3	3	3	3	3	2	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	2.6	2.6	2.6	2.6	2.8	2.8	2.8	2.6	2.6	2.8

SEMESTER – III			
CORE VII - DATA SCIENCE AND MACHINE LEARNING			
Course Code: 24PCSC31	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 5**

Course Objectives:

1. To introduce fundamental concepts of data science and machine learning by exploring NumPy and its structured data manipulation capabilities.
2. To develop proficiency in handling and analysing data using Pandas, including indexing, selection, grouping, and handling missing data.
3. To equip students with visualization techniques using Matplotlib and Seaborn for effective data representation.
4. To apply machine learning algorithms such as Naïve Bayes, linear regression, SVM, and decision trees for predictive analytics and model building.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental concepts of NumPy, including data types, array operations, and structured data.	K1
CO-2	explain data manipulation techniques using Pandas, including merging, aggregation, and handling missing values.	K2
CO-3	apply data visualization techniques using Matplotlib and Seaborn to analyse and interpret datasets.	K4
CO-4	analyse machine learning models and evaluate their performance using validation techniques and hyperparameter tuning.	K3
CO-5	design and implement predictive models using decision trees, SVM, and regression techniques for real-world applications.	K5

SEMESTER – III			
CORE VII - DATA SCIENCE AND MACHINE LEARNING			
Course Code: 24PCSC31	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 5**

UNIT: 1 INTRODUCTION TO NUMPY

Introduction to NumPy: Understanding Data Types in Python - The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions – Aggregations - Computation on Arrays: Broadcasting – Comparisons, Masks and Boolean Logic - Fancy Indexing - Sorting Arrays - Structured Data: NumPy's Structured Arrays.

UNIT: 2 DATA MANIPULATION WITH PANDAS

Data Manipulation with Pandas: Introducing Pandas Objects - Data Indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Hierarchical Indexing.

UNIT: 3 WORKING WITH DATASETS USING PANDAS

Combining Datasets: Concat and Append - Combining Datasets: Merge and Join - Aggregation and Grouping - Pivot Tables - Vectorized String Operations - Working with Time Series - High-Performance Pandas -eval() and query().

UNIT: 4 VISUALIZATION WITH MATPLOTLIB

General MatplotLib - Simple Line Plots, -Simple Scatter Plots - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Text and Annotation - Three-Dimensional Plotting in Matplotlib - Geographic Data with Basemap - Visualization with Seaborn.

UNIT: 5 MACHINE LEARNING

Machine learning – Introducing Scikit-Learn – Hyperparameters and Model Validation – Feature Engineering – Naïve Bayes Classification – Linear regression – Support vector machines – Decision trees and random forests – Gaussian mixture models.

Text Book

1. Jake VanderPlas. *Python Data Science Handbook: Essential Tools for Working with Data*. O'reilly Media. 2017.

Reference Books

1. Joel Grus. *Data Science from Scratch: First Principles with Python*. O'reilly Media. Second Edition. 2019.
2. Daniel. *Python for Data Science: The Ultimate Step-by-Step Guide to Python Programming*. O'reilly. 2021.

Related Online Contents

1. https://www.coursera.org/professional-certificates/ibm-data-science.
2. https://www.javatpoint.com/data-science.
3. https://nptel.ac.in/courses/106/106/106106179/

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	3	3	2	3	2
CO-2	2	3	3	3	2	3	3	3	2	3
CO-3	3	3	2	3	3	2	3	3	3	2
CO-4	3	2	3	3	2	3	2	3	3	3
CO-5	2	3	3	2	3	3	3	3	3	3
Ave.	2.6	2.6	2.8	2.6	2.6	2.8	2.8	2.8	2.8	2.6

SEMESTER- III			
CORE VIII - INTERNET OF THINGS			
Course Code: 24PCSC32	**Hrs / week: 4**	**Hrs / Sem: 60**	**Credits: 4**

Course Objectives:

1. To introduce the fundamental concepts of IoT, including its definition, characteristics, physical and logical design, communication models, and enabling technologies.
2. To develop an understanding of IoT and M2M platforms, including architecture, design methodology, and integration of devices and components for application development.
3. To explore the IoT functional stack, covering sensor-actuator layers, communication networks, data management, and application analytics.
4. To examine domain-specific IoT applications, including home automation, smart cities, healthcare, agriculture, industry, and other real-world implementations.

Course Outcomes:

CO.No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental concepts, architectures, and technologies of IoT, including sensors, actuators, and communication protocols	K1
CO-2	explain IoT functional stacks, deployment models, and domain-specific applications.	K2
CO-3	implement IoT solutions using Raspberry Pi and other IoT devices for real-world applications.	K3
CO-4	analyse IoT platforms, M2M communication, and network layers to design efficient IoT systems.	K4
CO-5	evaluate various IoT architectures and methodologies for optimizing performance, security, and scalability.	K5

SEMESTER- III			
CORE VIII - INTERNET OF THINGS			
Course Code: 24PCSC32	**Hrs / week :4**	**Hrs / Sem: 60**	**Credits: 4**

UNIT: 1 INTRODUCTION TO INTERNET OF THINGS

Internet of Things: Introduction-Definition & Characteristics of IoT - Physical design of IoT: Things in IoT – IoT protocols - Logical design of IoT: Functional blocks – Communication Models and APIs - IoT Enabling Technologies: WSNs, Cloud Computing, Big Data Analytics, Communication Protocols and Embedded Systems. IoT levels and deployment templates.

UNIT: 2 M2M AND IOT PLATFORMS DESIGN METHODOLOGY

IoT and M2M: Introduction - M2M - Difference between IoT and M2M – oneM2M IoT Standardized Architecture. IoT Platforms design Methodology: Purpose and requirement specification, Process specification, Domain model specification, Information model specification, Service specification, IoT level specification, Functional view, Operational view, Device and component integration, Application development

UNIT: 3 IOT FUNCTIONAL STACK

The Core IoT Functional Stack - Layer 1: Things: Sensors and Actuators Layer - Layer 2: Communications Network Layer - Access Network Sublayer - Gateways and Backhaul Sublayer - Network Transport Sublayer - IoT Network Management Sublayer - Layer 3: Applications and Analytics Layer - Sensors, Actuators, and Smart Objects.

UNIT: 4 DOMAIN SPECIFIC IOTS

Introduction - Home Automation – Cities – Environment – Energy – Retail – Logistic – Agriculture – Industry – Health & Lifestyle.

UNIT: 5 IOT PHYSICAL DEVICES

Basic building blocks of an IoT device – Raspberry Pi: About the board – Linux on Raspberry Pi – Raspberry Interfaces – Programming Raspberry Pi with Python – Other IoT devices.

Text Books

1. Arshdeep Bahga and Vijay Madisetti. *Internet of Things-A Hands-on Approach* Universities Press Amir (India), 2021.
2. David G. Hanes, Gonzalo Salgueiro, and Patrick Grossetete. *IoT Fundamentals:Networking Technologies, Protocols, and Use Cases for the Internet of Things*. 2017.

Reference Books

1. Rajkumar Buyya and Vahid Dastjerdi. *Internet of Things: Principles and Paradigms.* Cloud Computing and Distributed Systems (Clouds) Laboratory, Manja Soft Pty Ltd., Australia, 2016.
2. Jamil Y. Khan, Mehmet R. Yuce. *Internet of Things (IoT) Systems and Applications*. Jenny Stanford Publishing, 2019.
3. Olivier Hersent, David Boswarthick, Omar Elloumi. *The Internet of Things – Key applications and Protocols*. John Wiley & Sons Ltd. 2012.

Related Online Contents

1. https://onlinecourses.nptel.ac.in/noc19_cs65
2. https://www.etsi.org/technologies/internet-of-things
3. https://www.internetsociety.org/issues/iot

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	3	2	3	2	3	2	3	3	2
CO-2	3	2	3	3	3	3	3	2	3	3
CO-3	3	3	2	3	3	3	2	3	2	3
CO-4	2	3	3	2	3	2	3	2	3	2
CO-5	3	2	3	3	2	3	3	3	3	3
Ave.	2.6	2.6	2.6	2.8	2.6	2.8	2.6	2.6	2.8	2.6

SEMESTER- III			
CORE IX	**CRYPTOGRAPHY AND NETWORK SECURITY**		
Course Code: 24PCSC33	**Hrs / week: 4**	**Hrs / Sem: 60**	**Credits: 4**

Course Objectives:

1. To introduce the fundamental principles of cryptography and network security, including security threats, attack models, authentication mechanisms, and encryption techniques.
2. To explore symmetric encryption techniques, including classical ciphers, Data Encryption Standard and Advanced Encryption Standard for secure data transmission.
3. To analyze asymmetric encryption and key management techniques, including Public-Key Cryptography, RSA, Diffie-Hellman Key Exchange, and message authentication methods.
4. To understand and apply modern security mechanisms, including IP security, web security (SSL/TLS), intrusion detection systems, firewalls, and malware defense strategies.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	list various algorithms for network security used to protect against threats in networks.	K1
CO-2	understand the fundamental concepts of various encryption techniques.	K2
CO-3	demonstrate the process to maintain the confidentiality, Integrity and Availability of data.	K3
CO-4	apply the concept of public key cryptography.	K4
CO-5	analyse solutions for effective key management and distribution.	K5

SEMESTER- III			
CORE IX	**CRYPTOGRAPHY AND NETWORK SECURITY**		
Course Code: 24PCSC33	**Hrs / week: 4**	**Hrs / Sem: 60**	**Credits: 4**

UNIT: 1 INTRODUCTION

Introduction: Information OSI Security Architecture - Security Attacks-Passive Attacks-Active Attacks-Security Services – Authentication-Access Control - Data Confidentiality – Data Integrity – Nonrepudiation – Availability Service - Security Mechanisms - Model for Network security

UNIT: 2 SYMMETRIC CIPHERS

Classical Encryption Techniques - Symmetric Cipher Model - Substitution Techniques - Transposition Techniques - Block Ciphers and the Data Encryption Standard: Block Cipher Principles - The Data Encryption Standard -Strength of DES-Advanced Encryption Standard - The AES Cipher

UNIT: 3 ASYMMETRIC CIPHERS

Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems - The RSA Algorithm- Key Management Diffie-Hellman Key Exchange- Message Authentication and Hash Functions: Authentication Requirements-Authentication Functions -Message Authentication Codes - Hash Functions.

UNIT: 4 INTERNET SECURITY

IP Security: IP security overview, IP security architecture, Authentication header, Encapsulating security pay load, combining security association - Web security considerations, Secure socket layer and Transport layer security.

UNIT: 5 SYSTEM SECURITY

System Security: Intruders - Intrusion Detection - Malicious software: viruses and related threats - Firewalls: Firewall Design Principles-Trusted Systems.

Text Book:

1. William Stallings. *Cryptography and Network Security Principles and Practices*. 6th Edition, 2013.

References Books:

1. Behrouz A. Ferouzan. *Cryptography & Network Security*, Tata McGraw Hill, 2007.
2. Charlie Kaufman, Radia Perlman and Mike Speciner. *Network Security.* Prentice Hall of India, 2002.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://onlinecourses.nptel.ac.in/noc22_cs90/preview
2. https://www.comparitech.com/blog/information-security/cryptography-guide/
3. https://www.nesoacademy.org/cs/11-cryptography-and-network-security

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	2	3	2	3	3	3	3	2
CO-2	3	2	3	2	3	2	2	2	3	3
CO-3	2	3	3	3	2	3	3	2	2	3
CO-4	3	3	2	3	3	3	3	3	3	2
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	2.8	2.8	2.6	2.8	2.6	2.8	2.8	2.6	2.8	2.6

SEMESTER – III			
CORE PRACTICAL V – DATA SCIENCE AND MACHINE LEARNING LAB			
Course Code: 24PCSCR5	**Hrs / Week: 3**	**Hrs / Sem: 45**	**Credits: 2**

Course Objectives:

1. To develop skills in data manipulation and preprocessing using Pandas for effective data analysis.
2. To evaluate and compare different classification algorithms, including Naïve Bayes, based on their accuracy and efficiency.
3. To analyze clustering techniques, such as k-means, and their impact on data segmentation and pattern discovery.
4. To apply predictive modeling techniques, including linear regression and mean square error evaluation, for real-world data analysis.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall and describe fundamental concepts of NumPy arrays, dataframes, and basic operations like reshape, join, split, and statistical measures.	K1
CO-2	interpret data preprocessing methods including handling missing values, processing CSV files, and transforming data structures using Pandas and NumPy.	K2
CO-3	apply Python libraries (NumPy, Pandas, Matplotlib) to manipulate data, perform visualizations, and carry out descriptive analytics.	K3
CO-4	analyze and compare the output of data visualization and statistical measures using plots, histograms, and dataframe operations.	K4
CO-5	evaluate and justify machine learning models like classification and regression based on accuracy and data characteristics.	K5

LIST OF PROGRAMS

1. Given two NumPy arrays as matrices, output the result of multiplying the two matrices and its transpose of a matrix (as a NumPy array).
2. Calculate the difference between the maximum and the minimum values of a given NumPy array along the second axis.
3. Calculate the Average, Variance and Standard Deviation using NumPy.
4. Using a NumPy module create array and check the following:
    - Reshape 3x4 array to 2x2x3 array
    - Sequence of integers from 0 to 30 with steps of 5
    - Join two Arrays.
    - Split two Arrays.
5. Write a NumPy program that allows you to read and convert written data in a file into an array.
6. Create a Data Frame and List the attributes of a Data Frame.
7. Create a Data frame and list the functions that help in selecting the subset of the Data Frame.
8. Write a program to read .CSV file into the Data Frame and then convert it into Pandas Series.
9. Write a Pandas program for Handling Missing Data, i.e. is NaN.
10. Write a program to create data frame for 3 student including name and roll numbers and add new columns for 5 subjects and 1 column to calculate percentage. It should include random numbers in marks of all subjects.
11. Draw the histogram based on the Production of Wheat in different Years
    Year:2000,2002,2004,2006,2008,2010,2012,2014,2016,2018
    Production:4,6,7,15,24,2,19,5,16,
12. Write Panda function for Data Analysis and Manipulation.
13. Create basic visualization in python
14. Write a program to perform different classification algorithms with examples.
15. Write a program for predictive modeling using linear regression.

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	3	2	3	2
CO-2	2	3	2	3	3	2	3	3	2	3
CO-3	3	3	3	2	3	3	2	3	3	3
CO-4	2	3	3	3	2	3	3	3	3	3
CO-5	3	2	2	3	3	3	2	3	3	2
Ave.	2.6	2.6	2.6	2.8	2.6	2.8	2.6	2.8	2.8	2.6

SEMESTER – III			
DISCIPLINE CENTRIC ELECTIVE III – A EMERGING TRENDS IN MODERN COMPUTING			
Course Code: 24PCSE31	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. To understand the fundamentals of embedded computing systems.
2. To explore GPU computing and CUDA programming.
3. To analyze mobile and cloud computing architectures in distributed environments.
4. To introduce the principles of quantum computing.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	list the fundamental principles of quantum computing and name basic quantum circuit components.	K1
CO-2	explain the components and processes involved in embedded system design and microprocessor instruction sets.	K2
CO-3	apply CUDA programming concepts to solve parallel computing problems effectively.	K3
CO-4	examine the role of cloud computing and mobile computing in modern technological advancements.	K4
CO-5	compare different mobile cloud computing platforms and resource allocation strategies.	K5

SEMESTER – III			
DISCIPLINE CENTRIC ELECTIVE III – A EMERGING TRENDS IN MODERN COMPUTING			
Course Code: 24PCSE31	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

UNIT: 1 INTRODUCTION TO EMBEDDED COMPUTING SYSTEM

Complex Systems and Microprocessors-The Embedded System Design Process-Instruction sets: ARM Processor-CPUs: Programming Input and Output-Supervisor Mode, Exceptions, and Traps-Co-Processors-Memory System Mechanisms-CPU Performance- Program Design and Analysis: Components for Embedded Programs-Models of Programs-Assembly, Linking, and Loading-Basic Compilation Techniques-Program Optimization

UNIT: 2 INTRODUCTION TO GPU COMPUTING & CUDA

GPUs as Parallel Computers-Architecture of a Modern GPU-Evolution of Graphics Pipelines-Introduction to CUDA (Compute Unified Device Architecture)-Data Parallelism-CUDA Program Structure-A Matrix–Matrix Multiplication Example-Device Memories and Data Transfer-Kernel Functions and Threading-CUDA Threads-CUDA Memories

UNIT: 3 INTRODUCTION TO MOBILE COMPUTING & CLOUD COMPUTING

Introduction to Mobile Computing-Architecture of Mobile Network - Generations of Mobile Communication - Applications of Mobile Communication - Challenges of Mobile Communication - Mobility - Introduction to Cloud Computing-Evolution of Cloud Computing-Cloud Computing: What Is It Actually-Characteristics of Cloud Computing-Cloud Computing Architecture-Cloud Computing Deployment Models-Issues of Cloud Computing-Security and Trust-Energy Efficiency-Data Management

UNIT: 4 INTRODUCTION TO MOBILE CLOUD COMPUTING

Introduction to Mobile Cloud Computing-Architecture of Mobile Cloud Computing-Platform and Technologies-Mobile Augmentation Approaches-Issues of Mobile Cloud Computing-Advantages of Mobile Cloud Computing-Applications of Mobile Cloud Computing-Resource-Allocation Strategies in Mobile Cloud Computing

UNIT: 5 INTRODUCTION TO QUANTUM COMPUTING

Introduction to quantum mechanics-The postulates of quantum mechanics-Models for computation-The density operator-The Schmidt decomposition and purifications-EPR and the Bell inequality-Quantum circuits: Quantum algorithm- Single qubit operations, Controlled operations-Measurement- Universal quantum gates- Summary of the quantum circuit model of computation- Simulation of quantum system.

Reference Books

1. Wayne Wolf. *Computers as Components Principles of Embedded Computing System* Design. Morgan Kaufmann Publishers, Second Edition, 2008.

2. David B. Kirk and Wen-mei W. Hwu. *Programming Massively Parallel Processors A Hands-on Approach*. Morgan Kaufmann Publishers, 2010.
3. Debashis De. *Mobile Cloud Computing Architectures, Algorithms and Applications*. CRC Press, 2016.
4. Michael A. Nielsen & Isaac L. Chuang. *Quantum Computation and Quantum Information*. Cambridge University Press, 2010.

Related Online Contents

1. https://www.tutorialspoint.com/embedded_systems/es_overview.htm
2. https://www.bostonindia.in/info/nvidia-kepler/what-is-gpu-computing.aspx
3. https://www.ibm.com/think/topics/quantum-computing

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	2	3	3	3	3	3	2
CO-2	2	3	3	3	2	3	3	3	2	3
CO-3	3	3	2	3	3	2	3	2	3	2
CO-4	3	2	3	3	2	3	2	3	3	3
CO-5	2	3	3	2	3	3	3	3	3	3
Ave.	2.6	2.6	2.8	2.6	2.6	2.8	2.8	2.8	2.8	2.6

SEMESTER – III			
DISCIPLINE CENTRIC ELECTIVE III B - ADVANCED SOFTWARE ENGINEERING			
Course Code : 24PCSE32	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

Course Objectives:

1. To understand the fundamental concepts of software engineering.
2. To explore software requirement engineering, focusing on requirement elicitation, specification, documentation, validation, and management for high-quality software development.
3. To analyze project management techniques, including software size estimation, scheduling, risk management, and team organization to ensure successful project execution.
4. To examine software design and testing methodologies, covering function-oriented and object-oriented design approaches, software testing strategies, debugging, and software maintenance techniques.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	identify and correct typical requirements quality issues.	K1
CO-2	understand about Software project management skills, design and quality management and to explain industrial state of the practice methods of advanced software engineering.	K2
CO-3	apply different testing, code review, code analysis, and code refactoring approaches.	K3
CO-4	analyze on Software Testing, Maintenance and Software Re-Engineering.	K4
CO-5	design a comprehensive set of test cases to evaluate software functionality across multiple testing levels.	K5

SEMESTER – III			
DISCIPLINE CENTRIC ELECTIVE III B - ADVANCED SOFTWARE ENGINEERING			
Course Code : 24PCSE32	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

UNIT: 1 INTRODUCTION

Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.

UNIT: 2 SOFTWARE REQUIREMENTS

Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management –Software Quality, Software Quality Management System, ISO 9000, SEI CMM.

UNIT: 3 PROJECT MANAGEMENT

Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead's software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.

UNIT: 4 SOFTWARE DESIGN

Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.

UNIT: 5 SOFTWARE TESTING

Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging– Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.

Text Books

1. Pankaj Jalote. *An Integrated Approach to Software Engineering.* Delhi: Narosa Publishing House, 3rd Edition.
2. Rajib Mall. *Fundamentals of Software Engineering.* PHI Publication, 3rd Edition.

Reference Books

1 K.K.Aggarwal and Yogesh Singh. *Software Engineering.* New Age International Publishers, 3rd edition.

2 R.S.Pressman. *A Practitioners Approach-Software Engineering.* McGraw Hill.

3 Carlo Ghezzi, M.Jarayeri, D.Manodrioli. *Fundamentals of Software Engineering.* PHI Publication.

Related Online Contents

1. https://www.javatpoint.com/software-engineering-tutorial
2. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3. https://onlinecourses.nptel.ac.in/noc19_cs69/preview

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	3	3	3	2
CO-2	2	3	3	3	3	2	3	3	3	3
CO-3	3	3	2	3	3	3	2	2	3	2
CO-4	3	2	3	3	2	3	3	3	3	3
CO-5	2	3	3	2	3	2	3	3	2	3
Ave.	2.6	2.6	2.8	2.8	2.6	2.6	2.8	2.8	2.8	2.6

SEMESTER – III			
SKILL ENHANCEMENT COURSE III – DART PROGRAMMING LAB (PRACTICAL ONLY)			
Course Code : 24PCSSE3	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. To understand the fundamental concepts of Dart programming, including string manipulation, data types, and control structures for efficient coding.

2. To explore the use of data structures in Dart, such as Lists and Maps, by implementing operations like addition, deletion, and iteration.

3. To analyze algorithmic problem-solving techniques in Dart, including number processing and string operations.

4. To develop interactive mobile applications using Flutter, focusing on widgets like Scaffold and integrating Dart functionalities for UI and state management.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental Dart programming concepts, including data types, operators, string functions, and built-in collections such as lists and maps.	K1
CO-2	explain the use and behaviour of Dart programming constructs like conditional statements and loops for solving simple computational problems.	K2
CO-3	implement Dart programs to perform tasks such as checking for prime numbers, calculating factorials, manipulating lists, and reversing strings.	K3
CO-4	analyse the structure and functionality of Flutter components like Scaffold, AppBar, and widgets to build user-friendly interfaces.	K4
CO-5	design and evaluate a basic Flutter application such as a login screen that incorporates text input fields, buttons, and media elements to achieve a complete UI.	K5

LIST OF PROGRAMS

1. Examine the use of string functions and conversions in a Dart program.
2. Examine the functionality of Maps in Dart by displaying their values.
3. Examine list operations in Dart by creating a list of five courses, adding a new course “Security,” and removing the third-positioned course.
4. Examine the application of operators in Dart programming.
5. Examine the role of conditional statements in Dart programming.
6. Examine an approach to check whether a given number is prime in Dart.
7. Examine the process of calculating the factorial of a given number in Dart.
8. Examine the logic behind reversing a given string in Dart.
9. Examine the construction of a simple app using Dart - Flutter.
10. Examine the implementation of the Scaffold widget in Flutter.
11. Examine the formatting of text bars and app bars in a Flutter application.
12. Examine the design of a login screen with a circular image, text input fields for username and password, and a submit button.

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	2	3	3	3	2	2	3	2
CO-2	2	3	3	3	2	3	3	3	3	3
CO-3	3	2	3	3	3	2	3	3	2	3
CO-4	3	3	3	2	3	3	3	3	3	2
CO-5	2	3	3	3	2	3	3	3	3	3
Ave.	2.6	2.8	2.8	2.8	2.6	2.8	2.8	2.8	2.8	2.6

SEMESTER – IV			
PROJECT	**MINI PROJECT AND VIVA VOCE**		
Course Code : 24PCSCR6	**Hrs / Week : 6**	**Hrs / Sem : 90**	**Credits : 4**

Course Objectives:

1. To enable students to identify and analyse real-world problems and propose viable software or computational solutions.
2. To develop the ability to design and implement efficient systems or applications using appropriate tools, platforms, and programming languages.
3. To promote project planning, documentation, and communication skills through project execution and presentation.
4. To evaluate the effectiveness, innovation, and technical soundness of the developed system through structured viva voce.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	analyse complex real-world problems and translate them into well-defined problem statements with clear objectives and scope.	K4
CO-2	compare and select appropriate tools, technologies, and methodologies for designing and developing effective software solutions.	K4
CO-3	evaluate the performance, usability, and scalability of the developed application or system based on testing.	K5
CO-4	defend the design choices, implementation strategy, and project outcomes effectively through viva voce with technical clarity.	K5
CO-5	assess the completeness and professionalism of project documentation, including design diagrams, code commentary, and user manuals.	K5

SEMESTER – IV			
PROJECT	**MINI PROJECT AND VIVA VOCE**		
Course Code : 24PCSCR6	**Hrs / Week : 6**	**Hrs / Sem : 90**	**Credits : 4**

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	2	3	2	3	3	2	3	2
CO-2	3	2	3	2	3	2	2	3	3	3
CO-3	2	3	3	3	2	3	3	3	2	2
CO-4	3	3	2	3	3	3	3	2	3	3
CO-5	2	2	3	2	3	2	2	3	2	3
Ave.	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6

SEMESTER III	
SELF-STUDY COURSE – COURSE FOR COMPETITIVE EXAMS	
Course Code: 24PCSSS1	**Credits: 2**

Course Objectives:

1. To develop problem-solving skills in numerical aptitude, including number systems, divisibility rules, HCF, LCM, factors, and prime factorization.
2. To enhance mathematical reasoning abilities, covering fractions, decimals, square and cube roots, indices, and surds for efficient calculations.
3. To apply logical and analytical thinking to real-world problems, including time-work relationships, speed-distance calculations, permutations, combinations, and probability.
4. To interpret and analyze data effectively, using set theory, Venn diagrams, and graphical data representation.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	remember concepts in a short way.	K1
CO-2	understand the basic concepts of logical reasoning skills.	K2
CO-3	solve problems applying probabilistic reasoning to make decisions.	K3
CO-4	distinguish between proportional and non-proportional situations and when appropriate apply proportional reasoning.	K4
CO-5	evaluate claims based on empirical, theoretical and subjective probabilities.	K5

SEMESTER III	
SELF-STUDY COURSE – COURSE FOR COMPETITIVE EXAMS	
Course Code: 24PCSSS1	**Credits: 2**

UNIT: 1

Number System (Including divisibility) – HCF and LCM (Including Factors, Multiples and Prime Factorization)

(Chapter: 1&2, pages 1 – 46)

UNIT: 2

Fractions and Decimals – Square and Square roots, Cube and Cube Roots, Indices and Surds.

(Chapter: 3 &4, pages 47 – 94)

UNIT: 3

Time, Work and Wages (Including Pipes & Cistern) – Time, Speed and Distance (Including Trains, Boats and Stream, Circular Motion, Races and Games.

(Chapter: 15 & 16, pages 317 - 374)

UNIT: 4

Permutations & combinations and Probability.

(Chapter: 18, pages 391 - 416)

UNIT: 5

Set Theory (Including Venn Diagram) – Data Analysis and Data Interpretation (Including Caselet, Table, Line Graph, Bar Graph, Mixed Bar)

(Chapter: 24 & 27, pages 559 – 570, 615 – 648)

Text Book

1. Er.Deepak Agarwal and Mr.D.P.Gupta:Rapid, *Quantitative Aptitude with Shortcuts and Tricks for Competitive Exam*, Disha Publication.

Reference Books

1. Dr.R.S.Aggarwal, *Quantitative Aptitude for Competitive Examinations*, S.Chand Publication.
2. Rajesh Verma, *Fast Track Objective Arithemetic*, Arihant Publication.

Related Online Contents

1. https://onlinecourses.nptel.ac.in/noc24_hs73/preview
2. https://www.evidyarthi.in/b/india/notes-for-competitive-exams#google_vignette

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	3	2	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	2	3	3	2	2	2	2	3	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	2.8	2.8	2.8	3	2.8	2.8	2.8	2.8	3	3

SEMESTER – IV			
CORE X - RESEARCH METHODOLOGY AND THESIS WRITING			
Course Code : 24PCSC41	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

Course Objectives:

1. To understand the fundamentals of research methodology, including research types, approaches, and the significance of scientific methods in research.
2. To develop skills in identifying and defining research problems, formulating research designs, and applying case study analysis techniques.
3. To explore data collection and sampling methods, covering probability and non-probability sampling techniques, questionnaire design, and observational studies.
4. To gain proficiency in academic writing, plagiarism detection, and ethical research practices, including intellectual property rights and proper citation methods.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	identify fundamental concepts and steps involved in research processes.	K1
CO-2	compare different methodologies and methods used in research work.	K4
CO-3	understand fundamental concepts of research problem and research design.	K2
CO-4	explain concepts and procedures of sampling, data collection, analysis, and reporting.	K3
CO-5	assess the basic function and working of analytical research tools used in computer science research.	K5

SEMESTER – IV			
CORE X - RESEARCH METHODOLOGY AND THESIS WRITING			
Course Code : 24PCSC41	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

UNIT: 1 INTRODUCTION TO RESEARCH METHODOLOGY

Research Methodology– Introduction - Meaning of research – Objectives of research – Types of Research – Research Approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific Method – Research Process - Criteria of Good Research.

UNIT: 2 DEFINING THE RESEARCH PROBLEM

Research Problem – Selecting the Problem – Necessity of Defining the Problem – Technique involved in defining a problem – Meaning of Research Design – Features of a good design. Case Study: Presentation by students on their area of research

UNIT: 3 SAMPLING DESIGN & DATA COLLECTION

Sampling Design - Steps in sample design - Criteria of selecting a sampling procedure - Different types of sample designs: Non-probability sampling and Probability sampling - Methods of Data Collection- Collection of Primary Data - Observation Method - Interview Method - Collection of Data through Questionnaires - Collection of Data through Schedules - Difference between Questionnaires and Schedules.

UNIT: 4 WRITING THE RESEARCH THESIS, PLAGIARISM AND ETHICAL ISSUES IN RESEARCH AND IPR

Thesis writing – Citations – Plagiarism – Types of Plagiarism – Tools for detecting Plagiarism – Ethical Issues within the research process – Intellectual Property Rights

UNIT: 5 METHODOLOGY OF TEACHING

Methodology of teaching – Objectives for teaching – Structure of teaching – Phases of teaching - Various teaching methods.

Text Book

1. Kothari, C.R. *Research Methodology: Methods and Techniques.* New Delhi, New Age International, 2nd Edition, 2012.

Reference Books

1. Janathan Anderson, Berry H. Durston and Millicent Poole. *Thesis and Assignment Writing*. Wiley Eastern Limited, 1992.
2. EhtiramRaza Khan and Huma Anwar. *Research Methods of Computer Science.* University Science Press, 1st Edition, 2016.
3. Dr.Prabhat Pandey and Dr.Meenu Mishra Pandey. *Research Methodology: Tools and Techniques*. Bridge Center, 1st Edition, 2015.

Related Online Contents

1. https://onlinecourses.nptel.ac.in/noc23_ge36/preview
2. https://research-methodology.net
3. https://methods.sagepub.com

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	2	3	2	3	3	2	3
CO-2	2	3	2	3	2	3	3	3	3	2
CO-3	3	3	3	2	3	3	3	2	3	3
CO-4	2	2	3	3	3	2	2	3	2	3
CO-5	3	3	2	3	3	3	3	2	3	3
Ave.	2.6	2.8	2.6	2.6	2.8	2.6	2.8	2.6	2.6	2.8

SEMESTER – IV			
PROJECT	**MAJOR PROJECT AND VIVA VOCE**		
Course Code : 24PCSP41	**Hrs / Week : 25**	**Hrs / Sem :**	**Credits : 16**

Course Objectives:

1. To apply theoretical knowledge to real-world problems by developing software solutions, data-driven applications, or innovative IT systems in an industry setting.
2. To enhance problem-solving and analytical skills through research, requirement analysis, system design, and implementation of industry-grade projects.
3. To develop proficiency in modern technologies, tools, and frameworks relevant to the industry, ensuring hands-on experience in software development, AI, data science, or networking domains.
4. To improve project management, teamwork, and professional ethics by collaborating with industry professionals, following best coding practices, and documenting project outcomes effectively.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	examine real-world industrial problems, identify constraints, and analyse suitable computing methodologies for effective project development.	K4
CO-2	assess the efficiency, scalability, and performance of the developed software solution using industry benchmarks and best practices.	K5
CO-3	investigate various technologies, frameworks, and algorithms to determine their applicability in solving industry-driven challenges.	K4
CO-4	demonstrate the ability to work collaboratively in a team and communicate effectively with stakeholders.	K5
CO-5	test and validate software solutions using industry-standard tools and methodologies.	K5

SEMESTER – IV			
PROJECT	**MAJOR PROJECT AND VIVA VOCE**		
Course Code : 24PCSP41	**Hrs / Week : 25**	**Hrs / Sem :**	**Credits : 16**

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	3	3	2	3	3	2
CO-2	3	3	2	3	3	3	3	2	3	3
CO-3	2	3	3	3	2	3	3	3	3	3
CO-4	3	3	2	3	3	2	3	3	2	3
CO-5	3	3	3	2	2	3	3	3	3	2
Ave.	2.8	2.8	2.6	2.8	2.6	2.8	2.8	2.8	2.8	2.6