ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A' Grade by NAAC (5th Cycle)

Thoothukudi - 628001, Tamil Nadu

(**Affiliated to Manonmaniam Sundaranar University**)

Syllabus

M.Sc. Computer Science

School of Computing Sciences

Outcome Based Curriculum

(w.e.f. 2026)

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.	At the end of the M.Sc. Program, the students will be able to
PO- 1	attain advanced and in-depth knowledge of the chosen science discipline and apply it to address current developmental issues at local, regional, national, and global levels, contributing meaningfully to society and industry. K1
PO- 2	demonstrate critical, analytical, logical, reflective and creative thinking abilities to evaluate scientific concepts and solve complex scientific, technological, and societal problems and showcase readiness for lifelong learning, adaptability to emerging scientific advancements, and development of employability, leadership, teamwork, and entrepreneurial skills across academic, professional and real-life contexts. K2
PO- 3	identify and frame scientific research problems, employ research methodologies, analyse data using appropriate research techniques, and present research outcomes in compliance with ethical standards, academic integrity, constitutional principles, inclusiveness, environmental awareness, and social responsibility in scientific research, professional conduct and community-oriented activities. K4
PO- 4	evaluate and communicate scientific ideas, findings, and interpretations through oral, written, and digital modes through ICT tools, digital technologies, computational methods, and information resources to enhance learning, research analysis, innovation and professional efficiency in science-related domains. K5 & K3
PO- 5	apply interdisciplinary and multidisciplinary approaches by integrating knowledge from science and allied fields, fostering holistic understanding with emphasis on cross-cutting issues, Indian Knowledge Systems (IKS) and the Sustainable Development Goals (SDGs). K3 & K6

Program Specific Outcome:

PSO. No.	Students of M.Sc. Computer Science will be able to	PO addressed
PSO-1	apply advanced knowledge of Computer Science to design and implement efficient solutions for real-world scientific, industrial, and societal problems	**PO-1, PO-5**
PSO-2	analyze complex computational problems using logical, analytical, and creative thinking and demonstrate adaptability to emerging technologies and lifelong learning.	**PO-2**
PSO-3	identify research problems, apply appropriate computational and research methodologies, and adhere to ethical standards in research and professional practice.	**PO-3**
PSO-4	evaluate and communicate technical ideas, solutions, and research findings effectively using oral, written, and digital platforms with modern ICT tools.	**PO-4**
PSO-5	integrate Computer Science with interdisciplinary domains to develop sustainable, innovative, and socially responsible solutions aligned with SDGs.	**PO-5**

M.Sc. COMPUTER SCIENCE
Course Details (w.e.f. 2026)

Sem	Course Category	Course Code	Components	Title of the Course	Contact Hours	Credits	Max. Marks		
							CIA	ESE	Total
I	CC	26PCSCC11	Core Course 1	Design and Analysis of Algorithms	5	4	40	60	100
		26PCSCC12	Core Course 2	Advanced Java Programming	5	4	40	60	100
		26PCSCC13	Core Course 3	Advanced Database Management Systems	5	4	40	60	100
	CP	26PCSCP11	Core Practical 1	Design and Analysis of Algorithms Lab	4	2	40	60	100
		26PCSCP12	Core Practical 2	Advanced Java Programming Lab	4	2	40	60	100
	ED	26PCSED11	Discipline Specific Elective 1	React JS	4	3	40	60	100
		26PCSED12		Multimedia and its Applications					
	SP	26PCSSP11	Skill Enhancement Course 1	React JS lab	3	3	40	60	100
	SL	26PCSSL11	Self Learning (Mandatory) Extra Credit Course	Indian Knowledge System		2			100
				Total	**30**	**24**			
II	CC	26PCSCC21	Core Course 4	Data Mining using R Programming	5	4	40	60	100
		26PCSCC22	Core Course 5	Web Application Development in Python	5	4	40	60	100
		26PCSCC23	Core Course 6	Digital Image Processing	5	4	40	60	100
	CP	26PCSCP21	Core Practical 3	Data Mining using R Programming Lab	4	2	40	60	100
		26PCSCP22	Core Practical 4	Web Application Development in Python Lab	4	2	40	60	100
	ED	26PCSED21	Discipline Specific Elective 2	Robotic Process Automation	4	3	40	60	100
		26PCSED22		Blockchain Technology					
	SP	26PCSSP21	Skill Enhancement Course 2	Digital Image Processing Lab	3	3	40	60	100
	ECC			NPTEL / Swayam (12 weeks Course)		+3			
				Total	**30**	**22 +3**			
III	CC	26PCSCC31	Core Course 7	Research Methodology	6	5	40	60	100
		26PCSCC32	Core Course 8	Data Science and Machine Learning	5	4	40	60	100
		26PCSCC33	Core Course 9	Cryptography and Network Security	5	4	40	60	100
	CP	26PCSCL31	Core Practical 5	Data Science and Machine Learning Lab	4	2	40	60	100
	ED	26PCSED31	Discipline Specific Elective 3	Emerging Trends in Modern Computing	4	3	40	60	100
		26PCSED32		Web Services					
	EG	26PCSEG31	Generic Elective 1	AI Tools for Academic Excellence (MD)	3	3	40	60	100
	SP	26PCSSP31	Skill Enhancement Course 3	Dart Programming Lab	3	2	40	60	100
	ECC	26PCSIP31		Internship (80 hours)		+2			
				Total	**30**	**23 +2**			

Sem	Course Category	Course Code	Components	Title of the Course	Contact Hours	Credits	Max. Marks		
							CIA	ESE	Total
IV	CC	26PCSCC41	Core Course 10	Advanced Software Engineering	6	5	40	60	100
		26PCSCC42	Core Course 11	Internet of Things	5	4	40	60	100
	CL	26PCSCL41	Core Practical 6	IoT with Simulation and Arduino Lab	4	2	40	60	100
	PV	26PCSPV41	Project	Project Work and Viva voce	10	7	40	60	100
	EG	26PCSEG41	Generic Elective 2	Data Analysis Tools and Applications	3	3	40	60	100
	SE	26PCSSE41	Life Skill Course	Professional Communication and Placement Readiness	2	2	40	60	100
				Total	**30**	**23**			
	Total				**120**	**92 (5)**			

Semester	Components	No. of Courses	Hours	Credits
I -- IV	Core Courses	11	57	46
I -- IV	Core Practical	6	24	12
I -- IV	Discipline Specific Elective	3	12	9
III & IV	Generic Elective	2	6	6
I -- III	Skill Enhancement Course	3	9	8
IV	Life Skill Course	1	2	2
IV	Project	1	10	7
I	Self Learning	1		2
II & III	Extra Credit Courses	2		+5
Total		**30**	**120**	**92 + 5**

SEMESTER – I			
CORE COURSE 1	**DESIGN AND ANALYSIS OF ALGORITHMS**		
Course Code: 26PCSCC11	**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 COURSE 1	**DESIGN AND ANALYSIS OF ALGORITHMS**		
Course Code: 26PCSCC11	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 4**

UNIT: 1 FUNDAMENTALS

Introduction - Performance analysis - Space complexity-Time Complexity- Asymptotic Notations - Elementary Data Structure: Stacks and Queues - Heap – Heap sort- Graph. Divide and Conquer: General Method – Binary Search – Merge Sort – Quick Sort.

UNIT: 2 TRAVERSAL TECHNIQUES AND GREEDY METHODS

Basic Traversal and Search Techniques: Techniques for Binary Trees-Techniques for Graphs-Greedy Method–Knapsack Problem–Minimum Cost Spanning Tree - Single Source Shortest Path - **Net Exam Related Problems.**

UNIT: 3 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 - **Net Exam Related Problems.**

UNIT: 4 BACKTRACKING

Backtracking: General Method–8-Queens Problem–Sum of Subsets–Graph Coloring– Hamiltonian Cycles – Knapsack.

UNIT: 5 BRANCH AND BOUND

Branch and Bound: Least Cost Search. Bounding: FIFO Branch and Bound and LC Branch and Bound – 0/1 Knapsack problem - Traveling Salesperson problem.

Text Books:

1. Ellis Horowitz. *Computer Algorithms* Galgotia Publications.
2. Alfred V. Aho, John E. Hopcroft, Jeffery 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 [MOOC, SWAYAM, NPTEL, Websites etc.]

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	3	2	3	2	3	3	2	3	2
CO-2	2	3	3	2	3	3	2	3	2	3
CO-3	3	2	3	3	2	2	3	3	3	3
CO-4	3	3	2	2	3	3	2	2	3	3
CO-5	2	3	3	3	3	2	3	3	2	3
Ave.	2.6	2.8	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.8

SEMESTER –I			
CORE COURSE 2	**ADVANCED JAVA PROGRAMMING**		
Course Code: 26PCSCC12	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Objectives:

1. To understand advanced Java features.
2. To learn collections, I/O, and event handling.
3. To develop GUI and multithreaded applications.
4. To implement database and web applications using JDBC and Servlets.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall advanced Java concepts.	K1
CO-2	explain collections, I/O, and GUI components.	K2
CO-3	apply AWT, Swing, and multithreading in programs.	K3
CO-4	analyze streams, servlets, and RMI concepts.	K4
CO-5	evaluate JDBC and Servlet-based database applications.	K5

SEMESTER –I			
CORE COURSE 2	**ADVANCED JAVA PROGRAMMING**		
Course Code: 26PCSCC12	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

UNIT: 1 CORE AND ADVANCED JAVA FEATURES

Exception Handling – Multithreaded Programming-Enumerations, Autoboxing, and Annotations-Generics-Lambda Expressions.

UNIT: 2 JAVA COLLECTIONS, I/O AND EVENT HANDLING

The Collections Framework -Input/Output: Exploring java.io-Exploring NIO-Event Handling.

UNIT: 3 JAVA GUI, CONCURRENCY, STREAMS AND RMI

Using AWT Controls, Layout Managers, and Menus-The Concurrency Utilities-The Stream API-Regular Expressions and Other Packages: Remote Method Invocation.

UNIT: 4 SWING, JAVABEANS AND SERVLETS

Introducing Swing-Exploring Swing-Introducing Swing Menus-Java Beans-Introducing Servlets.

UNIT: 5 DATABASE PROGRAMMING

The Design of JDBC – Structured Query Language – JDBC Configuration – Working with JDBC Statements – Query Execution – Scrollable and Updatable Result Sets – Row sets – Metadata – Transactions.

Text Books

1. Herbert Schildt, *The Complete Reference: Java 2*, Tata Mc Graw Hill, 11th Edition, 2019. (Chapter – 10-12.14,15,19,21,22,24,26,28-35)
2. Cay S. Horstmann, *Core Java Volume II: Advanced Features,* Pearson Education, 12th Edition, 2022. (Chapter -5)

Reference Books

1. Maydene Fisher, Jon Ellis, Jonathan Ellis & Jonathan Bruce*, JDBC™ API Tutorial and Reference,* Addison-Wesley Professional, 3rd Edition,2003.
2. Bryan Basham, Kathy Sierra & Bert Bates*, Head First Servlets and JSP,* O'Reilly Media, 2nd Edition (2008).

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

1. https://docs.oracle.com/javase/tutorial/jdbc/basics/
2. https://docs.oracle.com/javaee/7/tutorial/servlets.htm
3. https://archive.nptel.ac.in/courses/106/105/106105191/

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	3	3	2	2	2	3
CO-2	3	3	2	3	2	3	3	2	3	2
CO-3	3	3	3	2	3	3	3	3	2	3
CO-4	2	3	3	3	2	2	3	3	3	2
CO-5	3	3	3	3	3	3	3	3	3	3
Average	2.8	2.8	2.6	2.6	2.6	2.8	2.8	2.6	2.6	2.6

SEMESTER –I			
CORE COURSE 3	**ADVANCED DATABASE MANAGEMENT SYSTEMS**		
Course Code: 26PCSCC13	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Objectives:

1. To understand SQL and relational database design.
2. To learn Big Data technologies and analytics concepts.
3. To study query processing and transaction management.
4. To explore advanced database technologies and blockchain

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall SQL commands, transaction properties, and Big Data basics.	K1
CO-2	summarize ER modeling, query processing, and MapReduce concepts.	K2
CO-3	implement SQL queries, indexing methods, and transaction controls.	K3
CO-4	differentiate query optimization strategies and concurrency control mechanisms.	K4
CO-5	assess Big Data frameworks and advanced database technologies.	K5

SEMESTER –I			
CORE COURSE 3 ADVANCED DATABASE MANAGEMENT SYSTEMS			
Course Code: 26PCSCC13	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

UNIT: 1 RELATIONAL LANGUAGES

Introduction to SQL-Intermediate SQL-Advanced SQL-Database design using the E-R Model-Relational Database Design.

UNIT: 2 BIG DATA ANALYTICS

Big Data: Motivation -Big Data Storage Systems -The MapReduce Paradigm -Beyond MapReduce: Algebraic-Operations- Streaming Data - Graph Databases. Data Analytics: Overview of Analytics-Data Warehousing- Online Analytical Processing- Data Mining.

UNIT: 3 QUERY PROCESSING AND OPTIMIZATION

Query Processing: Overview -Measures of Query Cost- Selection Operation - Sorting -Join Operation -Other Operations - Evaluation of Expressions -Query Processing in Memory. Query Optimization: Overview -Transformation of Relational Expressions-Estimating Statistics of Expression Results -Choice of Evaluation Plans Materialized Views -Advanced Topics in Query-Optimization - **Net Exam Related Problems**.

UNIT: 4 TRANSACTION MANAGEMENET

Transactions: Transaction Concept -A Simple Transaction Model -Storage Structure-Transaction Atomicity and Durability-Transaction Isolation-Serializability-Transaction Isolation and Atomicity Transaction Isolation Levels- Implementation of Isolation Levels -Transactions as SQL Statements. Concurrency Control-Recovery System - **Net Exam Related Problems.**

UNIT: 5 ADVANCED DATABASE TECHNOLOGIES

Advanced Indexing Techniques **-** Advanced Application Development- Blockchain Databases.

Text Books

1. Abraham Silberschatz, Henry F Korth, S. Sudharshan, *Database System Concepts*, Seventh Edition, McGraw Hill, 2019.
   (Chapter – 3-7,10,11,15-19,24-26)

Reference Books

1. Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database Systems,* Pearson,7th Edition, 2016.
2. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, *Mining of Massive Datasets,* Cambridge University Press, 2nd Edition, 2014.
3. Imran Bashir*, Mastering Blockchain,* Packt Publishing,3rd Edition, 2020.

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

1. https://www.coursera.org/learn/intro-sql
2. https://hadoop.apache.org/
3. https://neo4j.com/use-cases/blockchain/

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	2
CO-2	2	3	2	3	2	3	2	3	2	3
CO-3	3	3	2	2	3	3	2	3	2	3
CO-4	2	3	3	2	3	2	3	2	3	3
CO-5	3	2	3	3	2	3	3	2	2	3
Average	2.6	2.6	2.6	2.4	2.6	2.6	2.6	2.4	2.4	2.8

SEMESTER – I			
CORE PRACTICAL 1 DESIGN AND ANALYSIS OF ALGORITHMS LAB			
Course Code: 26PCSCP11	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 2**

Course Objectives:

1. To understand and implement stacks and circular queues using linked lists.
2. To apply tree traversal techniques in binary search trees.
3. To analyze and implement greedy and backtracking algorithms.
4. To solve optimization problems using suitable algorithmic strategies.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental data structures such as stacks, queues, trees, and graphs.	K1
CO-2	explain traversal techniques, sorting methods, and greedy algorithms.	K2
CO-3	implement data structure operations and basic algorithms to solve computational problems.	K3
CO-4	analyze the time and space complexity of optimization algorithms.	K4
CO-5	evaluate the effectiveness of backtracking and dynamic programming methods for solving combinatorial problems.	K5

LIST OF PROGRAMS

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

2) Analyze various operations in a circular queue.

3) Analyze traversal techniques in a binary search tree.

4) Analyze different sorting algorithms.

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

6) Analyze the Knapsack problem using the greedy method.

7) Analyze the Single Source Shortest Path algorithm.

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

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

10) Analyze 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	2	3	3	2	2	3	2	3	3	2
CO-2	3	3	2	3	2	3	3	3	2	3
CO-3	3	2	3	2	3	3	2	3	3	3
CO-4	3	3	2	3	3	3	3	3	3	2
CO-5	3	3	3	2	3	2	3	3	3	3
Ave.	2.8	2.8	2.6	2.6	2.6	2.8	2.6	3.0	2.8	2.6

SEMESTER – I			
CORE PRACTICAL 2 ADVANCED JAVA PROGRAMMING LAB			
Course Code: 26PCSCL12	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 2**

Course Objectives:

1. To understand Java GUI development using Swing and event handling.
2. To learn client–server communication using RMI and Servlets.
3. To develop database applications using Java and SQL.
4. To analyze data handling and transaction processing in Java applications.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall Java GUI components, RMI, Servlets, and JDBC concepts.	K1
CO-2	explain event handling, client–server interaction, and file handling in Java.	K2
CO-3	apply Java programs to process files, hash tables, and database operations.	K3
CO-4	analyze SQL query results, metadata, and transaction mechanisms in Java.	K4
CO-5	evaluate database applications using JDBC, batch execution, and CRUD operations.	K5

LIST OF PROGRAMS

1. Examine the layout design and event-handling mechanisms of a Swing-based JApplet form with multiple input controls.
2. Analyze the client–server interaction model implemented using Java RMI.
3. Examine the password validation process implemented through a servlet-based form.
4. Write a Java program loads phone no, name from a text file using hash table.
5. Write a Java program that takes tab separated data from a text file and inserts them into a database.
6. Analyze SQL query results using ResultSet metadata in Java.
7. Examine the insertion of multiple records using SQL batch execution in Java.
8. Analyze the use of SQL transactions with commit and rollback in Java.
9. Examine the SQL database and driver information retrieved using Java metadata.
10. Analyze the SQL CRUD operations on a student table using Java JDBC.

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	3	3	2	2	3	2	3	2	3	2
CO-3	2	3	3	2	3	3	2	3	2	3
CO-4	3	2	3	3	2	3	3	2	3	2
CO-5	3	3	3	3	3	3	3	3	3	3
Average	2.8	2.6	2.6	2.6	2.6	2.8	2.6	2.6	2.6	2.6

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE 1 REACT JS			
Course Code: 26PCSED11	**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			
DISCIPLINE SPECIFIC ELECTIVE 1 REACT JS			
Course Code: 26PCSED11	**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

Redux: State-Actions-Reducers-The store-Action Creators- React Redux-Testing Redux-ESLint-Testing Redux-Testing react Components-Snapshot Testing.

Text Book

1. Alex Banks and Eve Porcello. *Learning React Functional Web Development with React and Redux.* O'Reilly Media, Inc.,Second Edition.

Reference Books

1. Robin Weiruch. *The Road to learn React.2016 edition.*
2. Zac Gordon. *React Explained. 2020 edition.*

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

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	2	3	3	2	2	3	3	3	3	2
CO-2	3	3	2	3	2	3	2	3	3	3
CO-3	3	2	3	2	3	2	3	3	3	3
CO-4	3	3	2	3	3	3	2	3	3	2
CO-5	3	3	3	2	3	3	3	3	2	3
Ave.	2.8	2.8	2.6	2.6	2.6	2.8	2.6	2.8	3.0	2.6

SEMESTER – I			
SKILL ENHANCEMENT COURSE 1 REACT JS LAB (PRACTICAL ONLY)			
Course Code: 26PCSSP11	**Hrs / Week: 3**	**Hrs / Sem: 45**	**Credits: 3**

Course Objectives:

1. To understand basic React concepts like components, state, and props.
2. To apply React hooks, routing, and form handling in applications.
3. To develop interactive React applications using state and components.
4. To analyze component behavior, styling, and API usage.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	identify basic React concepts and components.	K1
CO-2	explain state, props, routing, and lifecycle methods.	K2
CO-3	apply React features to build simple applications.	K3
CO-4	analyze state changes and component interactions.	K4
CO-5	evaluate the design and responsiveness of small React-based applications.	K5

LIST OF PROGRAMS

1. Analyze the use of useState in a React app by dynamically displaying user input.
2. Examine how data is passed from a parent component to Header and Footer components using props.
3. Analyze state management in a Counter application with increment, decrement, reset, and boundary control.
4. Examine the working of a To-Do List application using state for task addition, deletion, and status tracking.
5. Analyze component composition by displaying multiple images and captions using parent and child components with props.
6. Examine form validation techniques in React by validating name, email, and password inputs.
7. Analyze the use of external CSS and inline styling in designing a responsive Profile Card component.
8. Examine task management and filtering logic in a Reminder application with completed and pending tasks.
9. Analyze client-side routing using react-router-dom to navigate between Home, About, and Contact pages.
10. Examine the use of React class component lifecycle methods to fetch, update, and display API data.

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	3	2	2	3	3	3	3	2
CO-2	3	3	2	3	2	2	3	3	2	3
CO-3	3	2	3	2	3	3	2	3	3	3
CO-4	3	3	2	3	3	3	3	3	2	2
CO-5	2	3	3	3	3	3	3	2	3	3
Ave.	2.6	2.8	2.6	2.6	2.6	2.8	2.8	2.8	2.6	2.6

SEMESTER- II			
CORE COURSE 4	**DATA MINING USING R PROGRAMMING**		
Course Code: 26PCSCC21	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 4**

Course Objectives:

1. Introduce basic concepts, tasks, and techniques of data mining.
2. Explain classification, clustering, and association rule mining methods.
3. Provide hands-on knowledge of R programming for data analysis.
4. Apply data mining techniques to real-world datasets and web data.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall fundamental data mining concepts and techniques.	K1
CO-2	explain classification, clustering, and association rules.	K2
CO-3	apply R programming for data mining tasks.	K3
CO-4	analyze data patterns using mining algorithms.	K4
CO-5	evaluate suitable data mining techniques for practical problems.	K5

SEMESTER- II			
CORE COURSE 4 DATA MINING USING R PROGRAMMING			
Course Code: 26PCSCC21	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 4**

UNIT: Introduction to Data Mining

Introduction: Basic Data Mining Tasks- Data Mining Versus Knowledge Discovery in Databases. Data Mining Techniques: Introduction-A Statistical Perspective on Data Mining-Similarity Measures- Decision Trees-Neural Networks-Genetic Algorithms

UNIT: 2 Classification

Classification: Introduction- Statistical Based Algorithms-Distance Based Algorithms-Decision Tree Based Algorithms-Neural Network Based Algorithms- Rule Based Algorithms-Combining Techniques - **Net Exam Related Problems**.

UNIT: 3 Clustering

Clustering: Introduction - Similarity and Distance Measures-Outliers Hierarchical Algorithms - Partitional Algorithms - **Net Exam Related Problems**.

UNIT: 4 Introduction to R programming

Introduction: Overview and History of R, Getting Help, Data Types, Subsetting, Vectorized Operations, Reading and Writing Data. (5L) Control Structures, Functions, lapply, tapply, split, mapply, apply, Coding Standards. (5L) Scoping Rules, Debugging Tools, Simulation, R Profiler.

UNIT: 5 Association rules

Association rules - frequent itemsets - Basic Association Rules-Web Mining-Introduction-Content Mining-Social Network Analysis-HITS and Page rank-Usage Mining

Text Books:

1. Margaret H. Dunham. Data *Mining Introductory and Advanced Topics.* Pearson publications, Ninth Impression, 2002.
2. Roger .D.Peng. R *programming for Data Science*,2015.

Reference Books:

1. K. P. Soman, ShyamDivakar and V. Ajay. *Insight in to Data Mining Theory and Practice.* PHI Learning Pvt. Ltd, 2006.
2. Jiawei Han, MichelineKamber and Jian Pei. *Data Mining Concepts and Techniques.*Morgan Kaufmann Publishers, 3rd Edition.
3. Bing Liu. *Web Data Mining: Exploring Hyperlinks, Contents and Usage Data*.Springer, 2006.

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

1. https://www.tutorialspoint.com/data_mining/dm_quick_guide.htm
2. https://www.geeksforgeeks.org/machine-learning/web-mining
3. https://www.tutorialspoint.com/data_mining/dm_quick_guide.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	2	3	2	2	2	3	2	3	2	3
CO-2	3	3	2	3	2	3	3	3	2	2
CO-3	3	2	3	2	3	3	3	3	3	3
CO-4	3	3	3	3	2	3	2	3	3	3
CO-5	2	3	3	3	3	2	3	3	3	3
Ave.	2.6	2.8	2.6	2.6	2.6	2.8	2.6	3.0	2.6	2.8

SEMESTER – II			
CORE COURSE 5	**WEB APPLICATION DEVELOPMENT IN PYTHON**		
Course Code: 26PCSCC22	**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 – II			
CORE COURSE 5	**WEB APPLICATION DEVELOPMENT IN PYTHON**		
Course Code: 26PCSCC22	**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.

Text Books:

1. Nigel George. *Mastering Django: Core - The Complete guide to Django 1.8.* Packet Publishing Ltd., 2016.(Chapters:1-4,12,13)
2. Daniel Rubio F. Bahia, Ensenada, Baja California. *Beginning Django: Web Application Development and Deployment with Python*. Mexico press publication, 2017.(Chapters:5,6,8)

Reference Books

1. 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.
2. Nigel George. *Build a website with Django.* GNW Independent Publishing. 1st Edition 2019.
3. Ray Yao," *Django in 8 Hours: For Beginners, Learn Coding Fast. Independently published Edition. 2nd Edition 2020.*
4. Andrew Pinkham. *Django Unleashed.* Pearson Education, Inc. 2016.

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

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	3	3	3	2	3
CO-2	2	3	2	3	2	3	3	3	3	2
CO-3	3	3	3	2	3	2	3	3	2	3
CO-4	2	3	2	3	3	2	2	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	3.0	2.6	2.8

SEMESTER- II			
CORE COURSE 6	**DIGITAL IMAGE PROCESSING**		
Course Code: 26PCSCC23	**Hrs / week: 5**	**Hrs / Sem: 75**	**Credits: 4**

Course Objectives:

1. To understand the fundamentals of digital image processing and image acquisition.
2. To learn image enhancement and restoration techniques.
3. To study image compression methods and standards.
4. To analyze image segmentation techniques for object detection.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall basic concepts and steps of digital image processing.	K1
CO-2	explain image enhancement, restoration, and compression techniques.	K2
CO-3	apply spatial filtering and transformation techniques to images.	K3
CO-4	analyze noise models and segmentation methods in images.	K4
CO-5	evaluate suitable image processing techniques for real-world applications.	K5

SEMESTER- II			
CORE COURSE 6	**DIGITAL IMAGE PROCESSING**		
Course Code: 26PCSCC23	**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 - **Net Exam Related Problems**.

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-Estimating the degradation function -Geometric Transformations.

UNIT: 4 IMAGE COMPRESSION

Image Compression: Fundamentals–Image compression models–Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards - **Net Exam Related Problems.**

UNIT: 5 IMAGE SEGMENTATION

Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based 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 [MOOC, SWAYAM, NPTEL, Websites etc.]

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	2	3	2	3	2	2	3	2	3	2
CO-2	3	2	3	2	3	3	2	3	2	3
CO-3	3	3	2	3	2	3	3	2	3	2
CO-4	2	3	3	2	3	2	3	3	2	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	2.6	2.6

SEMESTER- II			
CORE PRACTICAL 3 DATA MINING USING R PROGRAMMING LAB			
Course Code: 26PCSCL21	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

Course Objectives:

1. Understand basic R programming concepts and data structures.
2. Analyze functions, loops, and scoping rules in R.
3. Apply statistics, graphics, and *dplyr* for data analysis.
4. Improve R programs using debugging and profiling tools.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall basic R concepts and data structures.	K1
CO-2	explain functions, loops, and scoping rules.	K2
CO-3	apply R programming techniques to solve problems.	K3
CO-4	analyze data using statistics, graphics, and *dplyr*.	K4
CO-5	evaluate and optimize R programs using debugging tools.	K5

LIST OF PROGRAMS

1. Analyze vectorization techniques for efficient data processing in R.
2. Analyze the structure and operations of data frames and matrices.
3. Analyze function design by developing a calculator application.
4. Analyze scoping rules and their impact on variable behavior.
5. Analyze loop functions to understand iterative data processing.
6. Analyze basic statistical methods and graphical outputs.
7. Analyze data manipulation workflows using *dplyr* and related tools.
8. Analyze debugging and profiling techniques to improve code performance.
9. Analyze methods for subsetting R objects to extract meaningful data.

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	2	3	2	3	2
CO-2	3	3	2	3	3	3	2	3	2	3
CO-3	3	2	3	2	3	3	3	2	3	2
CO-4	2	3	3	3	3	2	3	3	3	2
CO-5	3	3	3	2	3	3	2	3	3	3
Ave.	2.6	2.8	2.6	2.6	2.8	2.6	2.6	2.6	2.8	2.6

SEMESTER – II			
CORE PRACTICAL 4 WEB DEVELOPMENT IN PYTHON LAB			
Course Code: 26PCSCL22	**Hrs / Week: 4**	**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 basic components of Django architecture.	K1
CO-2	explain views, URL routing, and redirection in Django.	K2
CO-3	apply forms, emails, and CRUD operations to build web apps.	K3
CO-4	analyze session and cookie handling for user data management.	K4
CO-5	evaluate Django features for better 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 the process of sending emails in Django.
4. Analyse form processing techniques in Django.
5. Analyse form validation 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	2	3	2	3	2	2	3	2	3	2
CO-2	3	3	2	3	3	3	2	3	3	3
CO-3	3	2	3	2	3	3	3	2	3	2
CO-4	2	3	3	3	3	2	3	3	3	3
CO-5	3	3	3	2	3	3	3	3	3	3
Ave.	2.7	2.8	2.6	2.6	2.8	2.6	2.8	2.6	3.0	2.6

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE 2 ROBOTIC PROCESS AUTOMATION			
Course Code: 26PCSED21	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. To understand basic concepts and benefits of Robotic Process Automation.
2. To apply RPA tools, control flow, and data manipulation techniques.
3. To analyze advanced automation methods like recording, scraping, and debugging.
4. To develop and deploy assistant bots using triggers and server tools.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall RPA concepts and components.	K1
CO-2	explain RPA tools and workflows.	K2
CO-3	implement automation using RPA activities.	K3
CO-4	analyze assistant bots and triggers.	K4
CO-5	evaluate bot deployment and maintenance.	K5

SEMESTER- II			
DISCIPLINE SPECIFIC ELECTIVE 2 ROBOTIC PROCESS AUTOMATION			
Course Code: 26PCSED21	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

UNIT: 1 INTRODUCTION TO ROBOTIC PROCESS AUTOMATION

RPA BASICS: History of Automation -What is RPA - RPA vs Automation- Scope and automation techniques- Robotic process automation - Benefits of RPA-Components of RPA-RPA platforms-The future of automation. – UiPath stack-Downloading and Installing UiPath Studio-Learning UiPath Studio.

UNIT: 2 RPA TOOL INTRODUCTION AND BASICS

Introduction to RPA Tool - The User Interface - Variables – Managing Arguments -Naming Best Practices – The Arguments Panel - Using Arguments - About Imported Namespaces -Importing New Namespaces- Control Flow -Control Flow Introduction - Control Flow Activities – The Assign Activity - The Delay Activity - The Do While Activity - The If Activity – The Switch Activity – The While Activity - The For Each Activity - The Break Activity - Data Manipulation-Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation – Data Manipulation

UNIT: 3 ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES

Recording Introduction - Basic and Desktop Recording - Web Recording – Input / Output Methods – Screen Scraping - Data Scraping - Scraping Advanced Techniques - Selectors - Defining and Assessing Selectors - Customization -Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text Advanced Citrix Automation Tables PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel.

UNIT: 4 ASSISTANT BOTS AND EVENT-BASED TRIGGERS

What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger – System trigger -Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event

UNIT: 5 DEPLOYING AND MAINTAINING THE BOT

Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates -Managing packages - Uploading packages - Deleting packages

Text Book:

1. Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018.

Reference Books

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, “Introduction to Robotic Process Automation: a Primer”, Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant”, Independently Published, 1st Edition 2018.
3. Srikanth Merianda,Robotic Process Automation Tools, Process Automation and their benefits:Understanding RPA and Intelligent Automation, Consulting Opportunity Holdings LLC, 1st Edition 2018.

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

1. https://www.javatpoint.com/robotic-process-automation-rpa
2. https://docs.uipath.com/studio/docs/control-flow
3. https://docs.uipath.com/assistant/docs/uipath-assistant-overview

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	2	2	3	2	2	3	2
CO-2	3	3	2	3	2	2	3	2	3	3
CO-3	3	2	3	3	3	3	2	3	2	3
CO-4	2	3	3	2	3	2	3	3	3	2
CO-5	3	3	3	3	3	3	3	3	2	3
Ave.	2.6	2.8	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE 2 BLOCKCHAIN TECHNOLOGY			
Course Code : 26PCSED22	**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 key players, platforms, and regulatory bodies in blockchain	K1
CO-2	explain cryptographic principles and their applications in blockchain	K2
CO-3	apply cryptographic techniques to secure blockchain transactions .	K3
CO-4	analyze cryptocurrency regulations and stakeholder perspectives.	K4
CO-5	design blockchain solutions for real-world problems with regulatory compliance.	K5

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SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE 2 BLOCKCHAIN TECHNOLOGY			
Course Code : 26PCSED22	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	2	3	2	3	2	2	3	2	3	2
CO-2	3	3	2	3	3	3	2	3	3	3
CO-3	3	2	3	2	3	3	3	2	3	2
CO-4	2	3	3	3	3	2	3	3	3	3
CO-5	3	2	3	2	3	3	3	3	2	3
Ave.	2.6	2.6	2.6	2.6	2.8	2.6	2.8	2.6	2.8	2.6

SEMESTER – II			
SKILL ENHANCEMENT COURSE II DIGITAL IMAGE PROCESSING LAB (PRACTICAL ONLY)			
Course Code: 26PCSSE2	**Hrs / Week: 3**	**Hrs / Sem: 45**	**Credits: 3**

Course Objectives:

1. To introduce the fundamentals of digital image processing concepts.
2. To explain image enhancement techniques using transformations and filtering.
3. To apply spatial and frequency domain methods for noise reduction and restoration.
4. To analyze image segmentation and compression techniques for practical applications.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	describe basic image processing concepts.	K1
CO-2	explain enhancement and filtering techniques.	K2
CO-3	apply image processing methods using programs.	K3
CO-4	analyze transformations, compression, and restoration techniques.	K4
CO-5	evaluate image segmentation methods.	K5

LIST OF PROGRAMS

1. Analyze image sampling (upsampling & down sampling) and quantization.
2. Correlate the Basic relationship between Pixels (Nieghbourhood, Adjacency, Connectivity, Paths, Regions and Boundaries).
3. Articulate Basic gray level Transformations (Image Negatives, Log Transformations, Power Law Transformations, Piecewise Linear Transformations (Contrast Stretching, Gray level slicing, Bit plane slicing))
4. Compare histogram processing techniques (histogram equalization and histogram matching)
5. Automate enhancement using arithmetic and logic operations (add, multiply, subtract, divide, average, AND, OR, NOT).
6. Examine smoothing spatial filters (ideal low pass, Butterworth low pass, Gaussian low pass filters).
7. Examine sharpening spatial filters (ideal high pass, Butterworth high pass, Gaussian high pass filters).
8. Analyze periodic noise reduction using spatial domain filtering (mean filter, order statistic filter, adaptive filter).
9. Analyze periodic noise reduction using frequency domain filtering (band reject, band pass, notch, optimum notch filter).

10. Generalize the concept of different filters (Inverse filtering, Minimum mean square Error (Weiner)Filtering, Constrained least squares filtering, Geometric mean filter)
11. Distinguish geometric transformations in image interpolation (nearest neighbour, bilinear, bicubic).
12. Analyze image compression techniques (error-free compression and lossy compression).
13. Simulate image segmentation based on detection of discontinuities (point, line, and edge detection).
14. Examine edge linking and boundary detection methods (local processing, global processing via Hough transform, graph-theoretic techniques).
15. Discriminate thresholding techniques (basic global, basic adaptive, optimal global and adaptive thresholding).
16. Classify region-based segmentation (basic formulation, region growing, region splitting and merging).
17. Simulate segmentation using morphological watersheds.

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	3	3	2	3	2	3	3	2	3	2
CO-3	2	3	3	3	3	2	3	3	2	3
CO-4	3	3	3	2	3	3	3	3	2	3
CO-5	3	3	3	3	3	3	3	3	3	3
Average	2.8	2.8	2.8	2.6	2.8	2.8	2.8	2.8	2.6	2.8