ST. MARY'S COLLEGE (Autonomous)

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

Thoothukudi-628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)

M.Sc. Computer Science

School of Computing Sciences

Outcome Based Curriculum

(W.e.f.2023)

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 analyze 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 startups 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. 2023)

Semester – I

Components	Course Code	Course Title	Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core I	23PCSC11	Analysis and Design of Algorithms	7	5	25	75	100
Core II	23PCSC12	Object Oriented Analysis and Design and C++	7	5	25	75	100
Core III	23PCSC13	Python Programming	6	4	25	75	100
Discipline Specific Elective I	23PCSE11/ 23PCSE12	**Advanced Software Engineering** Multimedia and its Applications	5	3	25	75	100
Discipline Specific Elective II	23PCSER1	Algorithm and OOPS Lab	5	3	40	60	100
		Total	**30**	**20**			

Semester- II

Components	Course Code	Course Title	Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core IV	23PCSC21	Data Mining and Warehousing	5	5	25	75	100
Core V	23PCSC22	Advanced Java Programming	5	5	25	75	100
Discipline Specific Elective III	23PCSE21/ 23PCSE23	**Artificial Intelligence and Machine Learning** Embedded Systems	4	3	25	75	100
Discipline Specific Elective IV	23PCSE22/ 23PCSE24	**Internet of Things** Web Services	4	3	25	75	100
Core Practical I	23PCSCR1	Data Mining Lab using R	4	2	40	60	100
Core Practical II	23PCSCR2	Advanced Java Lab	4	2	40	60	100
Skill Enhancement Course I	23PCSSE1	Basic of Web Design	4	2	25	75	100
MOOC (Compulsory)				+2			
		Total	**30**	**22+2**			

Semester –III

Components	Course Code	Course Title	Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core VI	23PCSC31	Digital Image Processing	5	5	25	75	100
Core VII	23PCSC32	Cloud Computing	5	5	25	75	100
Core VIII	23PCSC33	Network Security and Cryptography	4	4	25	75	100
Core Practical III	23PCSCR3	Digital Image Processing using MATLAB Lab	4	2	40	60	100
Core Practical IV	23PCSCR4	Network Security and Cryptography Lab	4	2	40	60	100
Discipline Specific Elective V	23PCSE31/ 23PCSE32	**Mobile Computing** Blockchain Technology	4	3	25	75	100
Skill Enhancement Course II	23PCSSE2	Web Application Development and Hosting Lab	4	3	40	60	100
Internship / Self-Study (Optional)	23PCSI31/ 23PCSSS1	Course on Competitive Exams		+2		100	100
			30	**24+2**			

Semester – IV

Components	Course Code	Course Title	Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core IX	23PCSC41	Advanced Operating Systems	5	5	25	75	100
Core X	23PCSC42	Data Science and Analytics	5	5	25	75	100
Core Practical V	23PCSCR5	Machine Learning using Python Programming Lab	4	2	40	60	100
Core Practical VI	23PCSCR6	IoT with Simulation and Arduino Lab	4	2	40	60	100
Core XI	23PCSP41	Project and Viva Voce	12	10	40	60	100
			30	**24**			

Note:

1. It is mandatory for all I PG students to complete a MOOC course in the Swayam NPTEL Portal. Two credits will be awarded to the students who successfully pass the MOOC course in the Portal. Students who fail to pass in their first and second attempts via the Swayam NPTEL Portal will be eligible to take a supplementary exam given by the college for which one credit will be given.
2. Internship can be completed during the second semester vacation.

Master of Science (Computer Science)

Components	No. of Courses	No. of. Hours	Total Credits	Extra Credits
Core	10	54	48	
Practical	6	24	12	
Elective	5	22	15	
Skill Enhancement	2	8	5	
Project	1	12	10	
MOOC	1			+2
Self-Study Course/ Internship	1			+2
		120	**90**	**+4**

SEMESTER – I			
CORE I - ANALYSIS AND DESIGN OF ALGORITHMS			
Course Code : 23PCSC11	**Hrs / Week : 7**	**Hrs / Sem : 105**	**Credits : 5**

Course Objectives:

1. Enable the students to learn the Elementary Data Structures and algorithms.
2. Presents an introduction to the algorithms, their analysis and design
3. Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking
4. Understood 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	compare between different data structures and pick up appropriate data structures for a design situation	K4
CO-4	demonstrate the major graph algorithms and employ when appropriate	K3
CO-5	recommend the correct algorithm for problems.	K5

SEMESTER – I			
CORE I - ANALYSIS AND DESIGN OF ALGORITHMS			
Course Code : 23PCSC11	**Hrs / Week : 7**	**Hrs / Sem : 105**	**Credits : 5**

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.
4. Robert Sedgewick, Phillipe Flajolet. *An Introduction to the Analysis of Algorithms.* Addison-Wesley Publishing Company, 1996.

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	2	3	2	3	2	3	3	2	2	2
CO-2	3	2	3	2	2	2	2	3	3	2
CO-3	3	2	2	2	2	2	2	2	3	2
CO-4	2	2	2	3	3	3	2	2	2	3
CO-5	2	2	3	2	3	2	2	3	2	3
Ave.	2.4	2.2	2.4	2.4	2.4	2.4	2.2	2.4	2.4	2.4

SEMESTER – I			
CORE II - OBJECT ORIENTED ANALYSIS AND DESIGN AND C++			
Course Code : 23PCSC12	**Hrs / Week : 7**	**Hrs / Sem : 105**	**Credits : 5**

Course Objectives:

1. Present the object model, classes and objects, object orientation, machine view and model management view.
2. Enables the students to learn the basic functions, principles and concepts of object oriented analysis and design.
3. Enable the students to understand C++ language with respect to OOAD

Course Outcomes:

CO. No.	**Upon Completion of this course, students will be able to**	**CL**
CO-1	understand the concept of Object-Oriented development and modeling techniques	K1
CO-2	gain knowledge about the various steps performed during object design	K2
CO-3	relate abstract object-based views for generic software systems	K3
CO-4	combine OOAD with C++ language	K6
CO-5	analyze the basic concept of OOPs and familiarize to write C++ program	K4

SEMESTER – I			
CORE II- OBJECT ORIENTED ANALYSIS AND DESIGN AND C++			
Course Code : 23PCSC12	**Hrs / Week : 7**	**Hrs / Sem : 105**	**Credits : 5**

UNIT: 1 OBJECT MODEL

The Object Model: The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects**.**

UNIT: 2 CLASSES AND OBJECTS

Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification –identifying classes and objects –Key Abstractions and Mechanism.

UNIT: 3 C++ INTRODUCTION

Introduction to C++-Input and output statements in C++-Declarations-control structures– Functions in C++.

UNIT: 4 INHERITANCE AND OVERLOADING

Classes and Objects–Constructors and Destructors–operators overloading–Type Conversion-Inheritance – Pointers and Arrays.

UNIT: 5 POLYMORPHISM AND FILES

Memory Management Operators-Polymorphism–Virtual functions–Files–Exception Handling – String Handling -Templates

Text Books

1 Grady Booch. *Object Oriented Analysis and Design with Applications.* Pearson Education, Second Edition.

2 Ashok N. Kamthane. *Object-Oriented Programming with ANSI & Turbo C++*. Pearson Education. First Indian Print -2003.

Reference Books

1 Balagurusamy. *Object Oriented Programming with C++*. TMH, Second Edition, 2003.

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

1 https://onlinecourses.nptel.ac.in/noc19_cs48/preview

2 https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/

3 https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.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	3	3	3	2	2	3
CO-2	3	2	2	3	3	3	2	2	3	3
CO-3	2	3	2	3	3	3	3	2	2	3
CO-4	2	2	3	2	2	2	2	3	2	2
CO-5	2	3	2	3	2	3	3	2	2	2
Ave.	2.2	2.6	2.2	2.8	2.6	2.8	2.6	2.2	2.2	2.6

SEMESTER – I			
CORE III- PYTHON PROGRAMMING			
Course Code : 23PCSC13	**Hrs / Week : 6**	**Hrs / Sem : 90**	**Credits : 4**

Course Objectives:

1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds
2. Use functions for structuring Python programs
3. Understand different Data Structures of Python
4. Represent compound data using Python lists, tuples and dictionaries

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	understand the basic concepts of Python Programming	K1,K2
CO-2	compute File operations, Classes and Objects	K2,K3
CO-3	acquire Object Oriented Skills in Python	K3,K4
CO-4	develop web applications using Python	K5
CO-5	develop Client Server Networking applications	K5

SEMESTER – I			
CORE III- PYTHON PROGRAMMING			
Course Code : 23PCSC13	**Hrs / Week : 6**	**Hrs / Sem : 90**	**Credits : 4**

UNIT: 1 INTRODUCTION

Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets–Comparison.

UNIT: 2 CODE STRUCTURES

Code Structures: if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.

UNIT: 3 MODULES, PACKAGES AND CLASSES

Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library.

Objects and Classes: Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super–In self Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

UNIT: 4 DATA TYPES AND WEB

Data Types: Text Strings–Binary Data. Storing and Retrieving Data: File Input/Output–Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores.

Web: Web Clients –Web Servers–Web Services and Automation.

UNIT: 5 SYSTEMS AND NETWORKS

Systems: Files–Directories–Programs and Processes–Calendars and Clocks.

Concurrency: Queues– Processes–Threads–Green Threads and gevent–twisted–Redis.
Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.

Text Books

1. Bill Lubanovic. *Introducing Python*. O'Reilly, First Edition-Second Release, 2014.
2. Mark Lutz. *Learning Python.* O'Reilly, Fifth Edition, 2013.

Reference Books

1. David M. Beazley. *Python Essential Developer's Library Reference*. Fourth Edition, 2009.
2. Sheetal Taneja, NaveenKumar. *Python Programming-A Modular Approach.* Pearson Publications.

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

1 https://www.programiz.com/python-programming/
2 https://www.tutorialspoint.com/python/index.htm
3 https://onlinecourses.swayam2.ac.in/aic20_sp33/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	2	2	2	2	2	2	3	2
CO-2	3	2	2	3	2	3	2	2	3	2
CO-3	3	2	3	3	3	3	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	2.4	2.6	2.8	2.6	2.8	2.6	2.6	2.6	2.6

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE I - ADVANCED SOFTWARE ENGINEERING			
Course Code : 23PCSE11	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 3**

Course Objectives:

1. Introduce to Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.
3. Learn about Software Project Management, Software Design & Testing.

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	formulate test cases to perform different levels of testing	K6

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE I- ADVANCED SOFTWARE ENGINEERING			
Course Code : 23PCSE11	**Hrs / Week : 5**	**Hrs / Sem : 75**	**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 [MOOC, SWAYAM, NPTEL, Websites etc.]

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	2	3	2	2	2	2	2	2	2	2
CO-2	2	3	2	2	2	2	2	2	2	2
CO-3	3	2	3	3	3	3	3	3	3	3
CO-4	3	2	3	3	3	3	3	3	3	3
CO-5	3	2	3	3	3	3	3	3	3	3
Ave.	2.6	2.4	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE I - MULTIMEDIA AND ITS APPLICATIONS			
Course Code : 23PCSE12	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 3**

Course Objectives:

1. Understand the fundamentals of multimedia and its components.
2. Learn multimedia and design principles and authoring tools.
3. Develop skills in creating and editing multimedia content.
4. 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	analyze 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 - MULTIMEDIA AND ITS APPLICATIONS			
Course Code : 23PCSE12	**Hrs / Week : 5**	**Hrs / Sem : 75**	**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 [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/multimedia/index.htm
2. https://nptel.ac.in/courses/106105163/
3. W3schools.com/html/html-media.asp

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	2	2	2	2	2	2	2	2	2
CO-2	2	2	2	3	2	3	2	2	2	2
CO-3	3	3	3	3	2	3	3	3	3	2
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	2	3	3	3	3	2	3	3
Ave.	2.6	2.6	2.4	2.8	2.4	2.8	2.6	2.4	2.6	2.4

SEMESTER – I			
DISCIPLINE SPECIFIC ELECTIVE II - ALGORITHM AND OOPS LAB			
Course Code : 23PCSER1	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 3**

Course Objectives:

1. This course covers the basic data structures like Stack, Queue, Tree, List.
2. This course enables the students to learn the applications of the data structures using various techniques
3. It also enable the students to understand C++ language with respect to OOAD concepts Application of OOPS concepts.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	Understand the concepts of object oriented with respect to C++	K1,K2
CO-2	Understand OOPS concepts	K3,K4
CO-3	Implement data structures like Stack, Queue, Tree, List using C++	K4,K5
CO-4	Apply data structures for Sorting, Searching using different techniques.	K5,K6
CO-5	Analyze OOPS using C++	K4

LIST OF PROGRAMS

1) Write a program to solve the tower of Hanoi using recursion.
2) Write a program to traverse through binary search tree using traversals.
3) Write a program to perform various operations on stack using linked list.
4) Write a program to perform various operation in circular queue.
5) Write a program to sort an array of an elements using quick sort.
6) Write a program to solve number of elements in ascending order using heap sort.
7) Write a program to solve the knapsack problem using greedy method
8) Write a program to search for an element in a tree using divide& conquer strategy.
9) Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack.
10) Write a C++ program to perform Virtual Function
11) Write a C++ program to perform Parameterized constructor
12) Write a C++ program to perform Friend Function
13) Write a C++program to perform Function Overloading
14) Write a C++program to perform Single Inheritance
15) Write a C++program to perform Employee Details using files.

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	2	2	2	2	2	2	2
CO-3	3	2	3	2	3	2	3	3	3	3
CO-4	3	2	3	3	3	3	3	3	3	3
CO-5	3	2	2	3	3	3	3	2	3	3
Ave.	2.8	2.2	2.6	2.4	2.6	2.4	2.6	2.6	2.8	2.6

SEMESTER – II			
CORE IV- DATAMINING AND WAREHOUSING			
Course Code : 23PCSC21	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

Course Objectives:

1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.
2. Develop skills of using recent data mining software for solving practical problems.
3. Develop and apply critical thinking, problem-solving, and decision-making skills.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	understand the evolutionary path that has led to the purpose of adapting to Data Warehouse and Data Mining techniques in various domains	K2
CO-2	comprehend the importance and role that Data Warehouse and Data Mining play in various fields	K5
CO-3	describe different methodologies used in data mining and data ware housing.	K1
CO-4	compare different approaches of data ware housing and data mining with various technologies.	K4
CO-5	relate the strengths and limitations of various data mining and data warehousing models	K3

SEMESTER – II			
CORE IV- DATA MINING AND WAREHOUSING			
Course Code : 23PCSC21	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

UNIT: 1 BASICS AND TECHNIQUES

Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective.

Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.

UNIT: 2 ALGORITHMS

Classification: Introduction –Statistical based algorithms -distance based algorithms-decision tree-based algorithms-neural network–based algorithms–rule-based algorithms–combining techniques.

UNIT: 3 CLUSTERING AND ASSOCIATION

Clustering: Introduction–Similarity and Distance Measures–Outliers–Hierarchical Algorithms-Partitional Algorithms.

Association rules: Introduction - large item sets - basic algorithms – parallel &distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.

UNIT: 4 DATA WAREHOUSING AND MODELING

Data warehousing: Introduction-characteristics of a data warehouse–data marts–other aspects of data mart.Online analytical processing: introduction -OLTP & OLAP systems. Data modeling –star schema for multi dimensional view –data modeling – multi fact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.

UNIT: 5 APPLICATIONS OF DATA WAREHOUSE

Developing a data warehouse: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse.Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.

Text Books

1. Margaret H. Dunham. *Data Mining: Introductory and Advanced Topics*. Pearson education, 2003.
2. C.S.R. Prabhu. *Data Warehousing Concepts, Techniques, Products and Applications*. PHI, Second Edition.

Reference Books

1. Arun K.Pujari. *Data Mining Techniques.* India: Universities PressPvt. Ltd., 2003.
2. Alex Berson, Stephen J.Smith. *Data Warehousing, Data Mining and OLAP*. TMCH, 2001.
3. Jiawei Han & Micheline Kamber. *Data Mining Concepts &Techniques*. Academic press, 2001.

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

1. https://www.javatpoint.com/data-warehouse
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3. https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

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

SEMESTER – II			
CORE V - ADVANCED JAVA PROGRAMMING			
Course Code : 23PCSC22	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

Course Objectives:

1. Enable the students to learn the basic functions, principles and concepts of advanced java programming.
2. Provide knowledge on concepts needed for distributed application Architecture.
3. Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	identify the basic concepts of Java Programming	K1
CO-2	explore and understand use of Java Server Programming	K2
CO-3	apply and analyze Java in Database	K3,K4
CO-4	handle different event in java using the delegation event model, event listener and class	K5
CO-5	develop advanced skills for programming in Java	K6

SEMESTER – II			
CORE V- ADVANCED JAVA PROGRAMMING			
Course Code : 23PCSC22	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

UNIT: 1 BASICS OF JAVA

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

UNIT: 2 REMOTE METHOD INVOCATIONS

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

UNIT: 3 DATABASES

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

UNIT: 4 SERVLETS

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

UNIT: 5 ADVANCED TECHNIQUES

JAR file format creation–Internationalization–Swing Programming–Advanced java techniques

Text Books

1. Jamie Jaworski. *Java Unleashed*. SAMS Tech media Publications, 1999.
2. Campione, Walrath and Huml. *The Java Tutorial.* Addison Wesley, 1999.

Reference Books

1. Jim Keogh. *The Complete Reference J2EE.* Tata Mc Graw Hill Publishing Company Ltd, 2010.
2. David Sawyer Mc Farland. *Java Script and JQuery-The Missing Manual*. Oreilly Publications. 3rd Edition 2011.
3. Deitel and Deitel. *Java How to Program*. Asia: PHI/Pearson Education. Third Edition.

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

1. https://www.javatpoint.com/servlet-tutorial
2. https://www.tutorialspoint.com/java/index.htm
3. https://onlinecourses.nptel.ac.in/noc19_cs84/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	2	2	2	2	2	2	3	2
CO-2	2	2	3	2	2	2	2	3	2	2
CO-3	3	2	3	3	2	3	2	3	3	2
CO-4	3	3	3	3	2	3	3	3	3	2
CO-5	3	3	2	3	3	3	3	2	3	3
Ave.	2.8	2.4	2.6	2.6	2.2	2.6	2.4	2.6	2.8	2.2

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE III - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING			
Course Code: 23PCSE21	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.
2. ProvideknowledgeonconceptsofRepresentationsandMappingsandPredicate Logic.
3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud.
4. Study about Applications & Impact of ML.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	demonstrate AI problems and techniques	K1,K2
CO-2	understand machine learning concepts	K2,K3
CO-3	apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning	K3,K4
CO-4	analyze the impact of machine learning on applications	K4,K5
CO-5	analyze and design a real world problem for implementation and understand the dynamic behavior of a system	K5

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE III **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**			
Course Code : 23PCSE21	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :3**

UNIT: 1 INTRODUCTION

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

UNIT: 2 SEARCH TECHNIQUES

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

UNIT: 3 PREDICATE LOGIC

Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural vs Declarative knowledge-Logic programming-Forward vs Backward reasoning -Matching-Control knowledge.

UNIT: 4 MACHINE LEARNING

Understanding Machine Learning: What is Machine Learning? -Defining Big Data-Big Data in Context with Machine Learning-The Importance of the Hybrid Cloud-Leveraging the Power of Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.

UNIT: 5 APPLICATIONS OF MACHINE LEARNING

Looking Inside Machine Learning: The Impact of Machine Learning on Applications-Data Preparation-The Machine Learning Cycle.

Text Books

1. Elaine Rich and Kevin Knight. *Artificial Intelligence.* Tata Mc Graw Hill Publishers company Pvt Ltd, Second Edition, 1991.
2. George Fluger. *Artificial Intelligence.* Pearson Education Publication, 4th Edition 2002.

Reference Books

1. Judith Hurwitz, Daniel Kirsch. *Machine Learning for Dummies.* IBM Limited Edition.

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

1. https://www.ibm.com/downloads/cas/GB8ZMQZ3
2. https://www.javatpoint.com/artificial-intelligence-tutorial
3. https://nptel.ac.in/courses/106/105/106105077/

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	2	3	2	2	2
CO-2	2	2	2	2	2	2	2	2	2	2
CO-3	3	2	2	3	2	3	2	2	3	2
CO-4	3	2	3	3	2	3	2	3	3	2
CO-5	3	2	3	3	2	3	2	3	3	2
Ave.	2.6	2.2	2.4	2.6	2	2.6	2.2	2.4	2.6	2

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE III - EMBEDDED SYSTEMS			
Course Code : 23PCSE23	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

Course Objectives:

1. Understand the architecture and functionalities of the 8051 microcontroller.
2. Utilize Embedded Software Development Tools.
3. Learn the instruction set and programming basics for embedded systems.
4. Explore Real-Time Operating Systems (RTOS) and design Embedded Systems using RTOS.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	identify the basic instruction set and addressing modes used in embedded systems programming.	K1
CO-2	understand the interfacing of embedded systems with peripherals such as keyboards, displays, and A/D and D/A converters.	K2
CO-3	apply debugging techniques to test and validate embedded software on host machines and target systems.	K3
CO-4	analyze the design requirements for embedded systems using RTOS, considering hard real-time scheduling, memory space optimization, and power-saving techniques.	K4
CO-5	design and develop embedded system projects using the 8051 microcontroller, incorporating advanced programming techniques and peripheral interfacing.	K5

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE III - EMBEDDED SYSTEMS			
Course Code : 23PCSE23	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

UNIT: 1 8051 MICROCONTROLLER

8051Microcontroller: Introduction-8051 Architecture-Input/Output Pins, Ports and Circuits-External Memory - Counters / Timers - Serial Data Input / Output –Interrupts

UNIT: 2 PROGRAMMING BASICS

Instruction Set and Programming Moving Data-Addressing Modes-Logical operations-Arithmetic Operation-Jump and Call Instructions-Simple Program. Applications: Keyboard Interface- Display Interface-Pulse Measurements-DIA and AID Conversions-Multiple Interrupts.

UNIT: 3 CONCEPTS ON RTOS

CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states - Tasks and data- Semaphores and shared data. MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.

UNIT: 4 DESIGN USING RTOS

Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.

UNIT: 5 SOFTWARE TOOLS

SOFTWARE TOOLS: Embedded software Development Tools: Hosts and Target Machines-Linker/Locators for Embedded software-getting Embedded software into the Target systems. Debugging Techniques: Testing on your Host machine -Instruction set simulators- The assert macro- using laboratory tools.

Text Books

1. David E.Simon. *An Embedded Software primer.* Pearson Education Asia. 2003.
2. Kenneth J Ayala. *The 8051 Microcontroller and Architecture programming and application.* Second Edition. Penram International.

Reference Books

1. RajKamal. *Embedded Systems – Architecture, programming and design*. TataMcGraw–Hill, 2003.

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

1. https://onlinecourses.nptel.ac.in/noc20_cs14/preview
2. https://www.javatpoint.com/embedded-system-tutorial
3. https://www.tutorialspoint.com/embedded_systems/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	2	2	2	2	2	2	2	2	2
CO-2	2	3	2	2	2	2	3	2	2	2
CO-3	3	2	3	3	2	3	2	3	3	2
CO-4	3	2	3	3	2	3	2	3	3	2
CO-5	3	3	3	3	2	3	3	3	3	2
Ave.	2.6	2.4	2.6	2.6	2	2.6	2.4	2.6	2.6	2

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE IV - INTERNET OF THINGS			
Course Code : 23PCSE22	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
2. Enable students to learn the Architecture of IoT and IoT Technologies
3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODE MCU using Arduino IDE.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	understand the vision of IoT from a local as well as global context.	K2
CO-2	describe what IoT is and how it works in current environment	K1
CO-3	test the environment using Arduino	K5
CO-4	analyze about sensors and actuators	K4
CO-5	design IoT in real time applications using today's internet & wireless technologies	K6

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE IV - INTERNET OF THINGS			
Course Code: 23PCSE22	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

UNIT: 1 INTRODUCTION

Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT

UNIT: 2 BASIC ELECTRONICS FOR IoT

Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.

UNIT: 3 PROGRAMMING USING ARDUINO

Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

UNIT: 4 SENSORS AND ACTUATORS

Sensors and Actuators: Analog and Digital Sensors–Interfacing temperature sensor,ultrasound Sensor and infrared(IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.

UNIT: 5 SENSOR DATA ININTERNET

Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (Thing Speak).

Text Books

1. Arshdeep Bahga and Vijay Madisetti. *Internet of Things: A Hands- On Approach.* 2014.
2. Boris Adryan, Dominik Obermaier and Paul Fremantle. *The Technical Foundations of IoT.* Artech Houser Publishers, 2017.

Reference Books

1. Michael Margolis. *Arduino Cookbook.* O'Reilly, 2011.
2. Marco Schwartz. *Internet of Things with ESP8266.* PacktPublishing, 2016.
3. Dhivya Bala. *ESP8266:Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit.* 2018.

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

1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2. https://www.javatpoint.com/iot-internet-of-things
3. https://www.tutorialspoint.com/internet_of_things/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	2	2	2	2	2	3	2
CO-2	2	3	3	2	2	2	3	3	2	2
CO-3	3	3	3	2	2	2	3	3	3	2
CO-4	3	3	3	2	2	2	3	3	3	2
CO-5	3	2	3	3	2	3	2	3	3	2
Ave.	2.8	2.6	2.8	2.2	2	2.2	2.6	2.8	2.8	2

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE IV – WEB SERVICES			
Course Code : 23PCSE24	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

Course Objectives:

1. Explore the role of web services in enterprises and the organizations that standardize web services platforms.
2. Learn how to process XML documents effectively.
3. Understand the SOAP model, including SOAP messages and encoding.
4. Highlight the importance of Quality of Service (QoS) for web services.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall the fundamental concepts and importance of web services in distributed computing.	K1
CO-2	understand the specifications and core data structures of UDDI and its registry access methods.	K2
CO-3	implement SOAP-based web services and define their interfaces using WSDL.	K3
CO-4	analyze advanced web service technologies and standards, including WSCL and workflow management systems.	K4
CO-5	develop and manage QoS-enabled web services and applications, ensuring they meet specified performance and reliability standards.	K5

SEMESTER – II			
DISCIPLINE SPECIFIC ELECTIVE IV – WEB SERVICES			
Course Code : 23PCSE24	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

UNIT: 1 INTRODUCTION

Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.

UNIT: 2 XML FUNDAMENTALS

XML Fundamentals–XML documents-XML Namespaces-XML Schema–Processing XML.

UNIT: 3 SOAP MODEL

SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure-interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI

UNIT: 4 TECHNOLOGIES AND STANDARDS

Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management- workflows and workflow management systems Security: Basics-data handling and forwarding- data storage-errors-Web services security issues.

UNIT: 5 QUALITY OF SERVICE

Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoS enabled web services-QoS enabled applications. Web services management-web services standards and future trends.

Text Books

1. Sandeep Chatterjee, James Webber. *Developing Enterprise Web Services: An Architects Guide.* Prentice Hall, Nov 2003.
2. Keith Ballinger. *NET Web services: Architecture and Implementation with .Net.* Pearson Education, First Edition, Feb 2003.

Reference Books

1. Ramesh Nagappan. *Developing Java Web Services: Architecting and developing secure Web Services Using Java*. John Wiley and Sons, First Edition Feb 2003.
2. Eric A Marks and Mark J Werrell. *Executive Guide to Web services*. John Wiley and sons, March 2003.
3. Anne Thomas Manes. *Web Services: A managers Guide*. Addison Wesley, June 2003.

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

1. https://www.tutorialspoint.com/webservices/index.htm

2. https://www.javatpoint.com/web-services-tutorial
3. https://www.btechguru.com/training--programming--xml--web-services--web-servicespart-1-video-lecture--11801--24--147.html

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	2	2	2	2	2	2	2	2	2
CO-2	3	2	2	2	2	2	2	2	3	2
CO-3	3	2	3	3	2	3	2	3	3	2
CO-4	3	3	3	3	2	3	3	3	3	2
CO-5	3	3	2	3	2	3	3	2	3	2
Ave.	2.8	2.4	2.4	2.6	2	2.6	2.4	2.4	2.8	2

SEMESTER – II			
CORE PRACTICAL I - DATAMINING LAB USING R			
Course Code : 23PCSCR1	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

Course Objectives:

1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression
2. To understand & write programs using the DM algorithms
3. To apply statistical interpretations for the solutions Able to use visualizations techniques for interpretations

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	write programs using R for Association rules, Clustering techniques	K1,K2
CO-2	implement data mining techniques like classification, prediction.	K2,K3
CO-3	use different visualizations techniques using R	K4,K5
CO-4	apply different data mining algorithms to solve real world applications.	K5,K6
CO-5	make Statistical Visualization of data	K6

LIST OF PROGRAMS

1. Implement Apriori algorithm to extract association rule of data mining.
2. Implement k-means clustering technique.
3. Implement anyone Hierarchal Clustering.
4. Implement Classification algorithm.
5. Implement Decision Tree.
6. Linear Regression.
7. Data Visualization.

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	2	2	2	3	2	2	2
CO-3	3	3	2	2	2	2	3	2	3	2
CO-4	3	2	3	3	2	3	2	3	3	2
CO-5	3	2	3	3	2	3	2	3	3	2
Ave.	2.8	2.4	2.4	2.4	2	2.4	2.4	2.4	2.8	2

SEMESTER – II			
CORE PRACTICAL II - ADVANCED JAVA LAB			
Course Code : 23PCSCR2	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

Course Objectives:

1. To enable the students to implement the simple programs using JSP,JAR
2. To provide knowledge on using Servlets, Applets
3. To introduce JDBC and navigation of records
4. To understand RMI & Socket programming its implementation

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	understand to the implement concepts of Java using HTML forms, JSP & JAR.	K1,K2
CO-2	implement JDBC and RMI concepts.	K3,K4
CO-3	write Applets with Event handling mechanism.	K4,K5
CO-4	create interactive web based applications using servlets and jsp.	K5,K6
CO-5	acquire knowledge in Socket programming.	K4

LIST OF PROGRAMS

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

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	2	2	2	3	2	2	2
CO-3	3	3	2	2	2	2	3	2	3	2
CO-4	3	2	3	3	2	3	2	3	3	2
CO-5	3	2	3	3	2	3	2	3	3	2
Ave.	2.8	2.2	2.4	2.4	2	2.4	2.2	2.4	2.8	2

SEMESTER – II			
SKILL ENHANCEMENT COURSE I - BASIC OF WEB DESIGN			
Course Code: 23PCSSE1	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

Course Objectives:

1. To create standards-based websites that are accessible.
2. To introduce the fundamentals of Internet, and the principles of web design.
3. To construct basic websites using HTML and Cascading Style Sheets.
4. To build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	describe the concepts of World Wide Web, and the requirements of effective web design.	K1
CO-2	understand HTML and HTML 5 tags.	K2
CO-3	apply basic programming principles to the construction of websites.	K4
CO-4	organize a presentation of a document written in a mark up language like HTML.	K3
CO-5	evaluate dynamic language programming.	K5

SEMESTER – II			
SKILL ENHANCEMENT COURSE I - BASIC OF WEB DESIGN			
Course Code: 23PCSSE1	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

UNIT: 1 INTRODUCTION

Introduction to Web Design - Introduction of Internet – WWW- Website- Working of Websites- Webpages- Front End- Back End- Client and Server Scripting Languages- Responsive Web Designing- Types of Websites (Static and Dynamic Websites).

UNIT: 2 HTML BASICS

HTML Basics HTML: Introduction- Basic Structure of HTML- Head Section and Elements of Head Section- HTML 5 Introduction- HTML5 New Elements: Section- Nav- Article- Aside- Audio Tag- Video Tag- HTML5.Form Validations: Require Attribute. Autofocus Attribute- email- number type- date type- Range type- HTML embed multimedia- HTML Layout- HTML Iframe

UNIT: 3 INTRODUCTION TO CSS

Introduction to CSS- Types of CSS- CSS Selectors: Universal Selector- ID selector- Tag Selector- Class Selector- Sub Selector- Attribute Selector- Group Selector- CSS Properties: Back Ground properties- Block Properties- Box properties- List properties- Border Properties- Positioning Properties- CSS Lists CSS Tables- CSS Menu Design CSS Image Gallery

UNIT: 4 JAVASCRIPT AND ANGULAR JS

Introduction to Client Side Scripting Language- Variables in Java Script- Operators in JS, Conditions Statements-JS Popup Boxes.

UNIT: 5 JS EVENTS

Basic Form Validations in JavaScript - Introduction to Angular JS: Expressions- Modules - Directives.

Text Book:

1. Lemay Laura. *Mastering HTML, CSS & Java Script Web Publishing*. BPB publications.

Reference Books:

1. Kogent Learning Solution Inc .*HTML5, Black Book*. Wiley India Pvt. Limited, 2014.
2. Thomas Powell. *HTML & CSS: The Complete Reference. Mc Graw Hill. 5th Edition.*

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

SEMESTER – III			
CORE VI - DIGITAL IMAGE PROCESSING			
Course Code : 23PCSC31	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

Course Objectives:

1. Learn basic image processing techniques for solving real problems.
2. Gain knowledge in image transformation and Image enhancement techniques.
3. Learn Image compression and Segmentation procedures.

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 – III			
CORE VI- DIGITAL IMAGE PROCESSING			
Course Code : 23PCSC31	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

UNIT: 1 FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

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 Books

1. Nick Efford. *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	3	2	2	2	2	2	2	2	3	2
CO-2	3	2	2	2	2	2	2	2	3	2
CO-3	3	3	3	2	2	2	3	3	3	2
CO-4	3	3	3	3	2	3	3	3	3	2
CO-5	2	3	3	3	3	3	3	3	2	3
Ave.	2.8	2.6	2.6	2.4	2.2	2.4	2.6	2.6	2.8	2.2

SEMESTER – III			
CORE VII - CLOUD COMPUTING			
Course Code : 23PCSC32	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

Course Objectives:

1. Gain knowledge on cloud computing, cloud services, architectures and applications.
2. Enable the students to learn the basics of cloud computing with real time usage
3. Know to store and share, in and from cloud.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	learn the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges.	K1
CO-2	explain the core concepts of the cloud computing, the characteristics, advantages and challenges brought about by the various models in cloud computing.	K2
CO-3	apply the fundamental concepts in data centers to understand the trade offs in power, efficiency and cost.	K4
CO-4	analyse various cloud programming models and apply them to solve problems on the cloud.	K3
CO-5	evaluate open source cloud implementation for their feasibility in Enterprise Application.	K5

SEMESTER – III			
CORE VII- CLOUD COMPUTING			
Course Code : 23PCSC32	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 5**

UNIT: 1 OVERVIEW OF CLOUD COMPUTING

Cloud Computing :Introduction- From Collaboration to cloud-Working of cloud computing-pros and cons-benefits- developing cloud computing services- Cloud service development-discovering cloud services.

UNIT: 2 CLOUD COMPUTING FOR EVERYONE

Centralizing email communications- cloud computing for community- collaborating on schedules- collaborating on group projects and events- cloud computing for corporation-mapping- schedules-managing projects- presenting on road.

UNIT: 3 CLOUD SERVICES

Collaborating on calendars- Schedules and task management- exploring on line scheduling and planning- collaborating on event management- collaborating on contact management- collaborating on project management- collaborating on word processing, spreadsheets, and databases.

UNIT: 4 OUTSIDE THE CLOUD

Evaluating web mail services- Evaluating instant messaging- Evaluating web conference tools- creating groups on social networks- Evaluating online groupware-collaborating via blogs and wikis.

UNIT: 5 STORING AND SHARING

Understanding cloud storage- evaluating on line file storage-exploring on line book marking services- exploring on line photo editing applications- exploring photo sharing communities- controlling it with web based desktops.

Text Books

1. Michael Miller. *Cloud Computing*. New Delhi :Pearson Education, 2009.

Reference Books

1. Anthony T. Velte. *Cloud Computing: A Practical Approach*. Tata McGraw Hill Education Private Limited, 1st Edition 2009.

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

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.javatpoint.com/cloud-computing-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	2	2	2	2	2	2	3	2
CO-2	3	2	2	2	2	2	2	2	3	2
CO-3	2	3	3	3	2	3	3	3	2	2
CO-4	2	2	3	3	2	3	2	3	2	2
CO-5	2	3	3	3	2	3	3	3	2	2
Ave.	2.4	2.4	2.6	2.6	2	2.6	2.4	2.6	2.4	2

SEMESTER – III			
CORE VIII - NETWORK SECURITY AND CRYPTOGRAPHY			
Course Code : 23PCSC33	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 4**

Course Objectives:

1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography.
2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.
3. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall basic understanding of cloud computing, its services (through tools) and deployments models.	K1
CO-2	understand the current legal issues towards information.	K2
CO-3	identify the security issues in the network and resolve it.	K4
CO-4	analyze the vulnerabilities in any computing system.	K3
CO-5	evaluate risks faced by computer systems.	K5

SEMESTER – III			
CORE VIII- NETWORK SECURITY AND CRYPTOGRAPHY			
Course Code : 23PCSC33	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 4**

UNIT: 1 OVERVIEW OF CRYPTOGRAPHY

Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.

UNIT: 2 MATH BACKGROUND

Math Background: Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem.

UNIT: 3 CRYPTOSYSTEM

Public-key Crypto system: Introduction to Number Theory-RSA Algorithm–Key Management-Diffie-Hellman Key exchange–Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.

UNIT: 4 NETWORK SECURITY

Network Security Practice: Authentication Applications–Kerberos–X.509Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.

UNIT: 5 WEB SECURITY

Web Security-Secure Socket Layer–Secure Electronic Transaction System Security-Intruders and Viruses – Firewalls– Password Security.

Text Books

1. William Stallings. *Cryptography and Network Security*. PHI/Pearson Education.
2. Bruce Schneir. *Applied Cryptography*. CRC Press.

Reference Books

1. Wenbo Mao. *Modern Cryptography: Theory and Practice.* Prentice Hall PTR.
2. William Stallings. *Network Security Essentials: Applications and Standards*. Prentice Hall.
3. Douglas R. Stinson. *Cryptography: Theory and Practice.* CRC press.

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

1. https://nptel.ac.in/courses/106/105/106105031/
2. http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3. https://www.tutorialspoint.com/cryptography/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	2	2	2	2	2	2	2
CO-2	3	2	2	2	3	2	2	2	2	3
CO-3	2	3	3	3	3	3	3	3	3	3
CO-4	2	3	3	3	2	3	3	3	3	2
CO-5	3	3	2	3	2	3	3	2	3	2
Ave.	2.6	2.6	2.4	2.6	2.4	2.6	2.6	2.4	2.6	2.4

SEMESTER – III			
CORE PRACTICAL III - DIGITAL IMAGE PROCESSING USING MATLAB LAB			
Course Code : 23PCSCR3	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :2**

Course Objectives:

1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques.
2. To enable the students to learn the fundamentals of image compression and Segmentation.
3. Implementation of the above using MATLAB.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	relate programs in MATLAB for image processing using the techniques.	K1
CO-2	understand different techniques and implement in real environment.	K2
CO-3	utilize theoretical knowledge and algorithms in programming.	K3
CO-4	analyze specific problems and propose appropriate solutions through a combination of theoretical knowledge and programming techniques.	K4
CO-5	compare various filtering methods.	K5

LIST OF PROGRAMS

1. Implement Image enhancement Technique.
2. Histogram Equalization
3. Image Restoration.
4. Implement Image Filtering.
5. Edge detection using Operators (Roberts, Prewitts and Sobels operators)
6. Implement image compression.
7. Image Subtraction
8. Boundary Extraction using morphology.
9. Image Segmentation

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	3	2	2	3	2	3	2	2	3	2
CO-3	2	3	2	3	3	3	3	2	2	3
CO-4	3	2	3	3	3	3	2	3	3	3
CO-5	3	3	3	2	3	2	3	3	3	3
Ave.	2.8	2.4	2.4	2.6	2.6	2.6	2.4	2.6	2.8	2.6

SEMESTER – III			
CORE PRACTICAL IV - NETWORK SECURITY AND CRYPTOGRAPHY LAB			
Course Code : 23PCSCR4	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

Course Objectives:

1. To learn different cipher techniques.
2. To implement the algorithms DES, RSA.
3. To use network security tools and vulnerability assessment tools.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	recall basic understanding of cloud computing, its services (through tools) and deployments models.	K1
CO-2	demonstrate the network security system using open source tools.	K2
CO-3	construct code for authentication algorithms.	K3
CO-4	analyze the vulnerabilities in any computing system.	K4
CO-5	evaluate risks faced by computer systems.	K5

LIST OF PROGRAMS

1. Implement the DES algorithm logic.
2. Apply AES algorithm for practical applications.
3. Implement the Blowfish algorithm logic.
4. Implement RSA algorithm.
5. Implement the Diffie-Hellman Key Exchange mechanism
6. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
7. Implement the Signature Scheme – Digital Signature Standard

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	3	2	2	2	2	2	2	2	3	2
CO-3	2	3	3	3	2	3	3	3	2	2
CO-4	2	3	3	3	2	3	3	3	2	2
CO-5	3	3	2	3	3	3	3	2	3	3
Ave.	2.6	2.6	2.4	2.6	2.2	2.6	2.6	2.4	2.6	2.2

SEMESTER – III			
DISCIPLINE SPECIFIC ELECTIVE V – MOBILE COMPUTING			
Course Code : 23PCSE31	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :3**

Course Objectives:

1. Present the overview of Mobile computing, Applications and Architectures.
2. Describe the futuristic computing challenges.
3. Enable the students to learn the concept of mobile computing.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	define mobile technologies in terms of hardware, software, and communications.	K1
CO-2	infer knowledge about mobile communications and its services.	K2
CO-3	utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.	K3
CO-4	analyze next generation mobile communication system.	K4
CO-5	evaluate the effectiveness of different mobile computing frameworks.	K5

SEMESTER – III			
DISCIPLINE SPECIFIC ELECTIVE V – MOBILE COMPUTING			
Course Code : 23PCSE31	**Hrs / Week :4**	**Hrs / Sem :60**	**Credits :3**

UNIT: 1 OVERVIEW OF MOBILE COMPUTING

Introduction to Mobile Computing- Telecommunication Generations- Cellular systems- Electromagnetic Spectrum- Antenna-Signal Propagation-Signal Characteristics- Multiplexing-Spread Spectrum: DSSS & FHSS-Co- channel interference.

UNIT: 2 GSM SERVICES AND GPRS

GSM Mobile services-System Architecture-Radio interface- Protocols- Localization and Calling-Handover-security (A3, A5 & A8)-GPRS system and protocol architecture.

UNIT: 3 MOBILE NETWORKING

Mobile Networking: Medium Access Protocol-Internet Protocol and Transport layer-Mobile IP: IP Packet Delivery- Agent Advertisement and Discovery- Registration-Tunneling and Encapsulation-Reverse Tunneling-Mobile TCP: Traditional TCP-Classical TCP Improvements like Indirect TCP- Snooping TCP & Mobile TCP- Fast Retransmit/ Fast Recovery-Transmission/Timeout Freezing-Selective Retransmission.

UNIT: 4 MOBILITY MANAGEMENT

Mobility Management: Introduction- IP Mobility- Optimization- IPv6 -Macro Mobility: MIPv6-FMIPv6-Micro Mobility: Cellular IP- HAWAII- HMIPv6.

UNIT: 5 LONG-TERM EVOLUTION (LTE)

Long-Term Evolution (LTE) of 3GPP: LTE System Overview- Evolution from UMTS to LTE -LTE/SAE Requirements-SAE Architecture-EPS: Evolved Packet System- E-UTRAN, Voice over LTE (VoLTE), Introduction to LTE-Advanced Self Organizing Network (SON-LTE)-SON for Heterogeneous Networks (HetNet)-Comparison between Different Generations (2G, 3G, 4G and 5G)- Introduction to 5G.

Text Books:

1. Jochen Schilller. *Mobile Communication.* Addision wisely, Pearson Education.
2. William Stallings. *Wireless Communications & Networks.* Pearson Education, Second Edition.
3. Christopher Cox. *An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications.* Wiley publications.
4. Raj Kamal. *Mobile Computing.* Oxford University Press-New, 2nd edition.

Reference Books:

1. Seppo Hamalainen, Henning Sanneck and Cinzia Sartori. *LTE Self-Organizing Networks (SON): Network Management Automation for Operational Efficiency*. Wiley publications.
2. Ashutosh Dutta, Henning Schulzrinne. *Mobility Protocols and Handover Optimization: Design, Evaluation and Application.* Wiley Publication, IEEE Press.
3. Michael Gregg. *Build your own security lab*. India: Wiley edition.

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

1. https://www.coursera.org/learn/smart-device-mobile-emerging-technologies
2. https://nptel.ac.in/courses/106/106/106106167/
3. https://www.tutorialspoint.com/mobile_computing/index.htm
4. https://www.javatpoint.com/mobile-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	2	2	2	2	3	2	2	2	2	3
CO-2	3	2	2	3	2	3	2	2	3	2
CO-3	2	3	3	2	2	2	3	3	2	2
CO-4	2	3	3	3	2	3	3	3	2	2
CO-5	2	3	3	2	2	2	3	3	2	2
Ave.	2.2	2.6	2.6	2.4	2.2	2.4	2.6	2.6	2.2	2.2

SEMESTER – III			
DISCIPLINE SPECIFIC ELECTIVE V - BLOCKCHAIN TECHNOLOGY			
Course Code : 23PCSE32	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 3**

Course Objectives:

1. Provide an overview of blockchain technology, including its origins and the differences between Bitcoin, crypto currencies, and blockchain.
2. Address privacy and security issues associated with blockchain technology.
3. Understand the principles of symmetric-key and public-key cryptography, digital signatures, and their applications in blockchain.
4. 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 – III			
DISCIPLINE SPECIFIC ELECTIVE V - BLOCKCHAIN TECHNOLOGY			
Course Code : 23PCSE32	**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). Strategic analysis of the space – 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. Cryptoeconomics– 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 [MOOC, SWAYAM, NPTEL, Websites etc.]

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	2	2	2	2	2	2	2	3	2
CO-3	2	2	3	2	2	2	2	3	2	2
CO-4	2	2	3	3	3	3	2	3	2	3
CO-5	2	3	3	3	3	3	3	3	2	3
Ave.	2.4	2.2	2.6	2.6	2.4	2.6	2.2	2.6	2.4	2.4

SEMESTER – III			
SKILL ENHANCEMENT COURSE II - WEB APPLICATION DEVELOPMENT AND HOSTING LAB			
Course Code : 23PCSSE2	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Course Objectives:

1. To enable the students to use Framesets, hyperlinks and different formatting features of HTML tags.
2. Enable the students to use Forms & other controls in a webpage.
3. To create interactive applications using PHP.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	choose several components of web page in creating interactive page.	K1
CO-2	understand & implement the servlet to create dynamic web pages.	K2
CO-3	develop dynamic web applications in JSP.	K3
CO-4	analyze a web page and identify its elements and attributes.	K4
CO-5	explain the JDBC and their support.	K5

LIST OF PROGRAMS

1. Create web pages to understand the various server controls.
2. Create web pages to understand and use to validate user inputs.
3. Create web pages to learn how to navigate between web pages and servers.
4. Programming to learn data binding.
5. Creation of dynamic content in web application using servlets.
6. Handling Sessions in web applications.
7. Usage of Filters in web applications.
8. Creation of dynamic content in web application using JSP.
9. Providing data store support for web site using JDBC.
10. Handling database using PHP and MySQL.

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	2	2	3	3	3	2	2	3	3
CO-3	2	3	3	2	3	2	3	3	2	3
CO-4	2	3	3	2	3	2	2	3	2	3
CO-5	2	2	3	2	2	2	2	3	2	2
Ave.	2.4	24	2.6	2.4	2.6	2.4	2.2	2.6	2.4	2.6

Semester III	
SELF-STUDY COURSE – COURSE ON COMPETITIVE EXAMS	
Course Code: 23PCSSS1	**Credits: 2**

Objectives:

- To provide a platform to the students for building the fundamentals of basic mathematics for competitive examinations preparation strategy
- Establish a framework to help students acquire knowledge and expertise necessary to secure employment opportunities in the government sector

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 ON COMPETITIVE EXAMS	
Course Code: 23PCSSS1	**Credits: 2**

UNIT - I

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

(Chapter: 1&2, pages 1 – 46)

UNIT - II

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

(Chapter: 3 &4, pages 47 – 94)

UNIT - III

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 - IV

Permutations & combinations and Probability.

(Chapter: 18, pages 391 - 416)

UNIT - V

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.

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	3	2	2	2	2	2	2	2	3	2
CO-3	2	3	2	3	2	3	3	2	2	2
CO-4	2	3	2	3	2	3	3	2	2	2
CO-5	2	2	3	3	2	3	2	3	2	2
Ave.	2.4	2.4	2.2	2.6	2	2.6	2.4	2.2	2.4	2

SEMESTER – IV			
CORE IX - ADVANCED OPERATING SYSTEMS			
Course Code : 23PCSC41	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 5**

Course Objectives:

1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain insight into the components and management aspects of real time and mobile operating systems.
3. Learn case studies in Linux Operating Systems.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	learning the recent development of Operating Systems and understanding the new techniques that advance the start-of-the-art of Operating Systems.	K1
CO-2	understand the high-level structure of the Linux kernel both in concept and source code.	K2
CO-3	identifying the major research challenges in current research of Operating Systems.	K3
CO-4	analyze the performance of operating system subsystems.	K4
CO-5	evaluate and present important OS research papers and contribute to developing system-related software and research.	K5

SEMESTER – IV			
CORE IX - ADVANCED OPERATING SYSTEMS			
Course Code : 23PCSC41	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 5**

UNIT: 1 BASICS OF OPERATING SYSTEMS

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

UNIT: 2 DISTRIBUTED OPERATING SYSTEMS

Distributed Operating Systems: Issues – Communication Primitives – Lamport's Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

UNIT: 3 REAL TIME OPERATING SYSTEM

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

UNIT: 4 HANDHELD SYSTEM

Operating Systems for Handheld Systems: Requirements–Technology Overview– Handheld Operating Systems–Palm OS-Symbian Operating System.

UNIT: 5 ANDROID OPERATING SYSTEM

The Android Software Stack, The Linux Kernel – its functions, essential hardware drivers. Libraries - Surface Manager, Media framework, SQLite, WebKit, OpenGL. Android Runtime - Dalvik Virtual Machine, Core Java Libraries. Application Framework -Activity Manager, Content Providers, Telephony Manager, Location Manager, Resource Manager. Android Application – Activities and Activity Lifecycle, applications such as SMS client app, Dialer, Web browser, Contact manager.

Text Books

1. Abraham Silberschatz; Peter BaerGalvin, GregGagne. *Operating System Concept*s. John Wiley & Sons, Seventh Edition, 2004.
2. Mukesh Singhal and Niranjan G. Shivaratri,. *Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems*. Tata McGraw-Hill, 2001.

Reference Books

1. Rajib Mall. *Real-Time Systems: Theory and Practice.* India: Pearson Education.
2. Pramod Chandra P.Bhatt. *An Introduction to Operating Systems Concept and Practice. PHI,* Third edition *2010.*
3. Daniel.P.Bovet & Marco Cesati. *Understanding the Linux kernel*. O'Reilly, 3rd edition.

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

1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2. https://www.udacity.com/course/advanced-operating-systems--ud189
3. https://developer.android.com/index.html.

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	3
CO-2	3	2	2	3	2	3	2	2	3	3
CO-3	2	3	2	3	2	3	3	2	2	3
CO-4	2	3	3	2	3	2	3	3	2	2
CO-5	2	3	3	2	3	2	3	3	2	2
Ave.	2.4	2.6	2.4	2.6	2.4	2.6	2.6	2.4	2.4	2.6

SEMESTER – IV			
CORE X- DATA SCIENCE AND ANALYTICS			
Course Code : 23PCSC42	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 5**

Course Objectives:

1. To enable the students to understand the concepts of data science and apply data analysis in various application areas.
2. To provide comprehensive knowledge of programming tools required for Data Science.
3. Gain knowledge to collect data and illustrate it efficiently and understandably.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	choose statistical and computational tools for applied problems.	K1
CO-2	interpret data findings effectively to any audience, orally, visually, and in written formats.	K2
CO-3	make use of appropriate models of data analysis to solve hidden solutions to business-related challenges.	K4
CO-4	analyze critically and speak publicly about field-specific scholarly research, projects executed in class, and data management issues.	K3
CO-5	assess, and select among statistical learning methods and models for solving a particular real-world problem, weighing their advantages and disadvantages.	K5

SEMESTER – IV			
CORE X - DATA SCIENCE AND ANALYTICS			
Course Code : 23PCSC42	**Hrs / Week: 5**	**Hrs / Sem: 75**	**Credits: 5**

UNIT: 1 STATISTICS FOR DATA SCIENCE

Standard Deviation-Variance-Mean-Median-Mode-Moments-Skewness and Kurtosis- Regression-Correlation.

UNIT: 2 DATA SCIENCE CONCEPTUAL INTRODUCTION

Data Science- Data Science Relate to Other Fields- The Relationship between Data Science and Information Science- Data: Introduction- Data Types- Data Collections- Data Pre-processing–Techniques: Introduction – Data analysis and Data analytics- Descriptive Analysis- Diagnostic analytics-predictive analytics- prescriptive analytics- exploratory analysis – mechanistic analysis

UNIT: 3 TOOLS FOR DATA SCIENCE

Tools for Data Science: UNIX: Introduction- Getting access to UNIX- Connecting to a UNIX server- Basic commands- Editing on UNIX- Redirecting and piping-Python: Introduction-Getting access to Python- Examples- Control structures- statistics essentials-R: Getting Access to R-Getting started with R-Graphics and Visualization-Introduction to other Popular Database.

UNIT: 4 MACHINE LEARNING FOR DATA SCIENCE

Machine Learning and introduction and Regression: machine Learning-Regression-Gradient Descent-Supervised Learning: Logistic Regression-Softmax regression-Classification with KNN- Decision Tree-Random Forest-Naïve Bayes-SVM- Hands-on-problem. Unsupervised Learning: Agglomerative Algorithm-Divisive Clustering-EM-Introduction to Reinforcement Learning.

UNIT: 5 APPLICATION, EVALUATION AND METHODS

Data Collection methods- picking Data Collection and Analysis Methods- Evaluation-Hands-on-problem with solving Data Problems- Collecting and analyzing Twitter Data, YouTube Data-Analyzing Yelp Review and Ratings.

Text Books

1. Chirag Shah. *A Hands-on Introduction to Data Science*. Cambridge University Press, 1st Edition 2020.
2. Dr.S.Arumgam & Mr.A.Thangapandi Issac. *Statistics.* New Gamma Publications.

Reference Books

1. Lars Nielson. *A simple introduction to Data Science.* 2015.
2. Davy Cielen, Arno D.B.Meysman and Mohamed Ali. *Introducing Data Science*. Manning Publication, 2016.

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

1. https://www.tutorialspoint.com/python_data_science/index.htm
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	2	2	2	2	2	2	3	2
CO-2	3	2	2	2	2	2	2	2	3	2
CO-3	3	2	3	3	3	3	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	2.4	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6

SEMESTER – IV			
CORE PRACTICAL V - MACHINE LEARNING USING PYTHON PROGRAMMING LAB			
Course Code : 23PCSCR5	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

Course Objectives:

1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples.
2. To understand and write simple Python programs using machine learning techniques.
3. To understand the Supervised and un-supervised learning concepts using Python.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	learn the concepts in Bayesian analysis from probability models and methods.	K1
CO-2	understand the features of machine learning to apply on real world problems.	K2
CO-3	apply the concept of Machine learning.	K3
CO-4	analyze the supervised and un-supervised learning techniques.	K4
CO-5	design Python programs for various machine learning algorithms.	K6

LIST OF PROGRAMS

1. Implement elementary data items, lists, dictionaries and tuples.
2. Implement Classification Algorithms Examples.
3. Implement Naïve Bayes Classification algorithm.
4. Implement clustering algorithm.
5. Implement k-means clustering algorithm.
6. Implement Apriori algorithm.
7. Implement handwriting recognition system.
8. Implement mean square error.

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	3	2	2	2	2	2	2	2	3	2
CO-3	3	2	3	3	2	3	2	3	3	2
CO-4	3	2	3	3	2	3	2	3	3	2
CO-5	3	2	2	3	3	3	2	2	3	3
Ave.	3	2	2.4	2.6	2.2	2.6	2	2.4	3	2.2

SEMESTER – IV			
CORE PRACTICAL VI - IOT WITH SIMULATION AND ARDUINO LAB			
Course Code: 23PCSCR6	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 2**

Course Objectives:

1. This course can help bridge the skills gap in the industry.
2. To understand and write simple programs to simulate in wokwi micro python.
3. To developing IoT applications and Security in IoT,
4. To write programs for simulation with Sensors and Actuators.

Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	CL
CO-1	find what IoT is and how it simulated in current environment.	K1
CO-2	understand the vision of IoT from a local as well as global context.	K2
CO-3	develop IoT in real time applications using today's internet & wireless technologies.	K3
CO-4	analyze about sensors and actuators.	K4
CO-5	test the environment using Arduino.	K5

LIST OF PROGRAMS

1. Simulate blink a RGB LED light in wokwi micro python.
2. Simulate using pullup button in wokwi micro python.
3. Simulate using seven segment display in wokwi micro python.
4. Simulate using Stepper motor in wokwi micro python.
5. Simulate using PIR motion sensor in wokwi micro python.
6. Simulate using Servo motor in wokwi micro python.
7. Simulate using Potentiometer in wokwi micro python.
8. Implement smart irrigation using Arduino.
9. Implement smart dustbin using Arduino.
10. Implement smart home using Arduino.

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	3	2	2	2	2	2	2	2	3	2
CO-3	2	3	3	3	2	3	3	3	2	2
CO-4	2	2	3	3	2	3	2	3	2	2
CO-5	2	2	3	3	2	3	2	3	2	2
Ave.	2.4	2.2	2.6	2.6	2	2.6	2.2	2.6	2.4	2