

Sadakathullah Appa College

(Autonomous)

(Reaccredited by NAAC at an 'A' Grade. An ISO 9001:2015 Certified Institution)

Rahmath Nagar, Tirunelveli- 11.

Tamil Nadu.

PG AND RESEARCH DEPARTMENT OF COMPUTER SCIENCE



CBCS SYLLABUS Learning Outcomes-based Curriculum Framework for COMPUTER SCIENCE (M.Sc.)

(Applicable for the students admitted from June 2021 as per
the Resolutions of the Academic Council Meeting held on 20.03.2021)

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POSTGRADUATE DEPARTMENT OF COMPUTER SCIENCE

CBCS SYLLABUS

M.Sc. Computer Science (2021-2024)

COURSE STRUCTURE

I SEMESTER			II SEMESTER		
COURSE	H/W	C	COURSE	H/W	C
DSC – I	5	4	DSC –IV	5	4
DSC – II	5	4	DSC –V	5	4
DSC – III	5	4	DSC –VI	5	4
DSE-I	4	4	DSE-III	4	4
Practical-I	4	2	Practical – III	4	2
Practical-II	4	2	Practical - IV	4	2
IDC – I	2	2	SEC	2	2
Library Hour	1		Library Hour	1	
TOTAL	30	22	TOTAL	30	22
III SEMESTER			IV SEMESTER		
DSC - VII	5	4	DSC – X	5	4
DSC – VIII	5	4	DSC – XI	5	4
DSC – IX	5	4	Project	8	8
DSE – III	4	4	DSE - IV	4	4
Practical-V	4	2	Practical-VII	4	2
Practical-VI	4	2	Practical-VIII	4	2
IDC -II	2	2			
Library Hour	1				
TOTAL	30	22	TOTAL	30	24

DISTRIBUTION OF HOURS, CREDITS, NO. OF PAPERS & MARKS				
SUBJECT	HOURS	CREDITS	NO. OF PAPERS	MARKS
DSC+Project	63	52	12	1250
Practical	32	16	8	400
DSE	16	16	4	400
IDC	4	4	2	100
SEC- SWAYAM-NPTEL Course	2	2	1	50
Library Hour	3			
TOTAL	120	90	27	2200

POSTGRADUATE DEPARTMENT OF COMPUTER SCIENCE
M.Sc. Computer Science (2021-2024)
COURSE STRUCTURE

SEM	Course	Title of the Course	Sub. Code	H/W	L*	T*	P*	C	Marks		
									I	E	T
I	DSC-I	Design and Analysis of Algorithm	21PCCS11	5	4	1	-	4	40	60	100
	DSC-II	Advanced Web Technology	21PCCS12	5	5	-	-	4	40	60	100
	DSC-III	Advanced Database Management System	21PCCS13	5	4	1	-	4	40	60	100
	DSE-I	A) Cloud Computing	21PECS11A	4	4	-	-	4	40	60	100
		B) Social Computing	21PECS11B								
		C) Data Mining	21PECS11C								
	P-I	Design and Analysis of Algorithm Practicals	21PCCS1P1	4	-	-	4	2	40	60	100/2
	P-II	Advanced Web Technology Practicals	21PCCS1P2	4	-	-	4	2	40	60	100/2
II	IDC-I	Digital Literacy	21PICS11	2	2	-	-	2	40	60	100/2
		Library Hour		1	-	1	-	-	-	-	--
	DSC-IV	Advanced Java Programming	21PCCS21	5	5	-	-	4	40	60	100
	DSC-V	Digital Image Processing	21PCCS22	5	5	-	-	4	40	60	100
	DSC-VI	Distributed Operating System	21PCCS23	5	4	1	-	4	40	60	100
	DSE-II	Cryptography and Network Security	21PECS21A	4	4	-	-	4	40	60	100
		Compiler Design	21PECS21B								
		Wireless Networks	21PECS21C								
	P-III	Advanced Java Programming Practicals	21PCCS2P1	4	-	-	4	2	40	60	100/2
	P-IV	Digital Image Processing Practicals	21PCCS2P2	4	-	-	4	2	40	60	100/2
III	SEC	SWAYAM-NPTEL Course	21PSCS21	2	2	-	-	2	25	75	100/2
		Library Hour		1	-	-	-	-	-	-	-
	DSC-VII	Machine Learning	21PCCS31	5	4	1	-	4	40	60	100
	DSC-VIII	Mobile Application Development	21PCCS32	5	4	1	-	4	40	60	100
	DSC-IX	Research Methodology	21PCCS33	5	4	1	-	4	40	60	100
	DSE-III	Artificial Intelligence	21PECS31A	4	4	-	-	4	40	60	100
		Human Computer Interaction	21PECS31B								
		Soft Computing	21PECS31C								
	P-V	Machine Learning Practicals	21PCCS3P1	4	-	-	4	2	40	60	100/2
IV	P-VI	Mobile Application Development Practicals	21PCCS3P2	4	-	-	4	2	40	60	100/2
	IDC-II	Digital Technology	21PICS31	2	2	-	-	2	40	60	100/2
		Library Hour	--	1	-	1	-	-	-	-	-
	DSC-X	Internet of Things	21PCCS41	5	4	1	-	4	40	60	100
	DSC-XI	Data Science with R	21PCCS42	5	4	1	-	4	40	60	100
	P	Project	21PPCS41	8	-	-	8	8	-	-	150
	DSE-IV	Professional Ethics	21PECS41A	4	4	-	-	4	40	60	100
		Green Computing	21PECS41B								
		Embedded Systems	21PECS41C								
	P-VII	Internet of Things Practicals	21PCCS4P1	4	-	-	4	2	40	60	100/2
	P-VIII	Data Science with R Practicals	21PCCS4P2	4	-	-	4	2	40	60	100/2
* L-Lecture Hours * T-Tutorial Hours * P-Practical Hours				120	-	-	-	90	-	-	2200

M.Sc. Computer Science
Programme Learning Outcomes

PLO	Upon completion of M.Sc. Degree Programmes, the graduates will be able to:
PLO 1	Disciplinary Knowledge Acquire in-depth scientific knowledge in the core areas of study.
PLO 2	Creative Thinking and Practical Skills / Problem Solving Skills - Enrich skills of observation to draw logical inferences from scientific experiments /programming and skills of creative thinking to develop novel ideas. - Hone problem solving skills in theoretical, experimental and computational areas and to apply them in real life situations.
PLO 3	Sense of inquiry and Skilled Communicator / Research, Innovation and Entrepreneurship - Develop the capability for raising appropriate questions relating to the current/emerging issues encountered in the scientific field and to plan, execute and express the results of experiments / investigations through technical writings as well as through oral presentations. - Design innovations for exploring the unexplored areas in diverse fields to accomplish socially relevant and economically beneficial innovative research projects. - Become a skilled entrepreneur for launching start-up / business ventures to improve the economy of the nation.
PLO 4	Ethical Awareness / Team Work / Environmental Conservation and Sustainability - Equip them for conducting work as an individual / as a member, or as a leader in diverse teams upholding values such as honesty and precision, and thus preventing unethical behaviours such as fabrication, falsification, misrepresentation of data, plagiarism etc. to ensure academic integrity. - Realise that environment and humans are dependent on one another and to know about the responsible management of our ecosystem for survival, and for the well-being of the future generation as well.
PLO 5	Digital Literacy/Self-Directed Learning/Usage of ICT/Lifelong Learning - Get access to digital resources, to use them judiciously for updation of knowledge and also to engage in remote/independent learning. - Inculcate the habit of learning continuously through the effective adoption of ICT to update knowledge in the emerging areas in Sciences for inventions/discoveries so that the knowledge transferred from laboratory to land would yield fruitful results for the betterment of global society.

Programme Specific Outcomes

PSO	Upon completion of M.Sc. Computer Science Degree Programmes, the students will be able to:	PLOs Mapped
PSO-1	Understand the concepts of Algorithm, Web Design, Artificial Intelligence, Machine Learning and Cloud Computing for designing Intelligent Systems.	PLO1
PSO-2	Identify and apply domain specific tools to solve real world problems in field of Cloud Computing, IoT Technology, and Data Science.	PLO2
PSO-3	Apply computational knowledge and project development skills to provide innovative solutions, carry out research in the advanced areas of Machine Learning and Data Science, besides becoming entrepreneur in the modern computing environment.	PLO3
PSO-4	Develop knowledge to provide solutions for the real-time computational challenges towards environmental sustainability and to practice professional ethics in the field of Computer Science.	PLO4
PSO-5	Create innovative solutions by adapting ICT technologies/tools for industry applications and to pursue lifelong learning in IT and Communication System.	PLO5

Semester – I

Course Title	DESIGN AND ANALYSIS OF ALGORITHM
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS11
Course Type	DSC-I
Credits	4
Marks	100

General Objective:

To provide solutions for the real-time problems by using design and analysis of algorithm.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the techniques of analyzing Algorithm.
CO-2	Apply different methods for designing Algorithm.
CO-3	Analyze the different techniques in solving alternative Algorithm for the given problem.
CO-4	Develop optimal solutions for the issues and challenges concerned using the iterative improvement and backtracking techniques.
CO-5	Evaluate the limitations of algorithmic power.

UNIT I: INTRODUCTION

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamental of Data Structures: Sparse Matrix, Stacks, Queues, Linked Lists, Trees, Binary Search Tree, AVL Tree, B Tree, B+ Tree, Sets, Graphs, Hashing - Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties.

UNIT II: BRUTE FORCE, EXHAUSTIVE SEARCH AND DIVIDE-AND-CONQUER

Brute Force: Selection Sort and Bubble Sort – Sequential Search and Brute Force String Matching - Closest-Pair and Convex-Hull Problems.

Exhaustive Search: Travelling Salesman Problem, Knapsack Problem, Assignment problem - Depth First Search and Breadth First Search. Divide and conquer methodology – Merge sort – Quick sort.

UNIT III: DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE

Dynamic Programming: Knapsack Problem and Memory functions – Optimal Binary Search Trees - Warshall's and Floyd' algorithm. Greedy Technique: Prim's algorithm - Kruskal's Algorithm – Dijkstra's Algorithm - Huffman Trees and codes.

UNIT IV: ITERATIVE IMPROVEMENT AND BACK TRACKING

Iterative Improvement: The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem. Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Problem.

UNIT V: LIMITATIONS OF ALGORITHM POWER AND BRANCH BOUND

Limitations of Algorithm Power: Lower-Bound Arguments-Decision Trees- P, NP and NP-Complete Problems. Branch Bound: Assignment problem – Knapsack Problem – Travelling Salesman Problem.

TEXT BOOK(S):

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2012.
Unit I [Chapter 1 and Chapter 2.1, 2.2], Unit II [Chapter 3 and 5.1, 5.2] Unit III [Chapter 8 and 9], Unit IV [Chapter 10 and 12.1]
Unit V [Chapter 11.1, 11.2, 11.3 and chapter 12.2]

REFERENCE(S):

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.
3. Donald E. Knuth, “The Art of Computer Programming”, Volumes 1& 3 Pearson Education, 2009. Steven S. Skiena, “The Algorithm Design Manual”, Second Edition, Springer, 2008.
4. <http://nptel.ac.in/>

Course Outcomes

CO No.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Comprehend the basic concepts to develop an algorithm.	1,2,5	Understanding
CO-2	Develop knowledge to summarize searching and sorting techniques.	1,2,3,5	Applying
CO-3	Analyze the time and space complexity of algorithms.	1,2,3,5	Analyzing
CO-4	Evaluate the different algorithm design techniques for a given problem.	1,2,3,5	Evaluating
CO-5	Modify the existing algorithm to improve the efficiency.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
I	21PCCS11	Design and Analysis of Algorithm				75	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓	✓		✓	✓	✓			✓
CO-2	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO-3	✓	✓	✓		✓	✓	✓	✓		✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 43 Relationship = High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33)									

Semester – I

Course Title	ADVANCED WEB TECHNOLOGY
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS12
Course Type	DSC-II
Credits	4
Marks	100

General Objective:

To design dynamic Web applications and demonstrate data access, data binding, and security using Asp.net, PHP and Python Programming.

Course Objectives:

CONo.	The learners will be able to
CO-1	Familiarize themselves in building interactive Web Forms with the form controls and improve the performance of ASP.NET applications by taking advantage of caching.
CO-2	Understand the basics of PHP and learn the ways the components of a typical PHP system interact.
CO-3	Develop knowledge to explain functions of PHP's file system and to discuss the security issues of a PHP application besides introducing PEAR, and PECL repositories.
CO-4	Practise the basic concepts, statements and objects of Python.
CO-5	Categorize Python's sequence types: strings, lists, and tuples.

UNIT I: OVERVIEW OF ASP.NET FRAMEWORK

ASP.NET and .NET framework - Standard Controls, Validation Controls, Designing Website with Master Pages - SQL Data Source Control: Creating Database Connections- Executing Database Commands - ASP.NET Parameters with the SqlDataSource Control - Maintaining Application State: Browser Cookies - Session State.

UNIT II: INTRODUCING PHP

History - Features - Basic Development Concepts - Creating your First PHP script. Variables and operators: Storing Data in Variables - Data Types - Constants. Controlling program flow: Conditional Statements - Repeating Actions with Loops. Working with arrays: Storing Data in Arrays - Processing Arrays with Loops and Iterators - Working with Array. Using Functions and Classes: Creating User-Defined Functions - Creating Classes.

UNIT III: WORKING WITH FILES AND DIRECTIVES

Reading Files - Writing Files - Processing Directories - Working with cookies, sessions, and headers - Working databases and SQL: Introducing Databases and SQL - Adding or Modifying Data - Using PHP's MySQLi Extension - securing PHP: Sanitizing Input and Output - Securing Data - Validating User Input -Configuring PHP Security - Extending PHP: PEAR - PECL.

UNIT IV: INTRODUCTION TO PYTHON

Introduction - History - Features - Installing Python -Running Python - Comments - Operators - Variables and Assignment - Python Objects - Standard Types - Other Built-in Types - Internal Types - Standard Type Operators - Standard Type Built-in Functions - Categorizing the Standard Types - Unsupported Types.

UNIT V: LISTS, TUPLES AND LOOPS

Lists - Operators - Built-in Functions - List Type Built-in Methods - Special Features of Lists - Tuples - Tuple Operators and Built-in Functions - Special Features of Tuples - Conditionals and Loops - if statement - else statement - else if statement - while statement - for statement - break statement - continue statement - pass statement - else statement

TEXTBOOKS:

1. Stephen Walther , "ASP.NET 3.5:unleashed", Pearson Education, 2005. -UNIT I (Chapters 1, 2, 3, 5, 9, 24, 25).
2. VikramVaswani, "PHP - A Beginner's Guide", Tata McGraw Hill Edition, 2009. UNIT II. (Chapters 1, 2, 3, 4, 5, 6), UNIT III(Chapters 7, 9, 11, 12).
3. Chun, J Wesley, "CORE Python Programming", 2nd Edition, Pearson, 2007 Reprint 2010.- UNIT IV (Chapters 1, 2, 4), UNIT V (Chapters 6, 8).

REFERENCE BOOKS:

1. J.Liberty, D.Hurwitz, "Programming ASP.NET", 3rd Edition, O'Reilly Media, Inc, 2006.
2. RasmusLerdorf, Kevin Tatroe, Peter MacIntyre, "Programming PHP", 3rd Edition, O'Reilly Media, Inc, 2013.
3. Jeffrey Elkner, Chris Meyers Allen Downey, "Learning with Python", Dreamtech Press, 2015.

Course Outcomes:

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Develop knowledge to use appropriate data sources and data bindings in ASP.NET for dynamic web applications.	1, 2, 3	Understanding
CO-2	Analyze the basic concepts such as functions and class in PHP.	1, 2, 3,5	Analyzing
CO-3	Develop a dynamic and data secured website using PHP and MySQL.	1, 2, 3, 4,5	Applying
CO-4	Compare PHP and Python programming with its internal types and built-in functions.	1, 2, 3	Applying
CO-5	Evaluate the various Python Data Structures.	1, 2, 3, 4,5	Evaluating

Relationship Matrix:

Semester	Course Code	Title of the Course				Hours			Credits	
I	21PCCS12	Advanced Web Technology				75			4	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	✓	✓	✓			✓	✓	✓		
CO 2	✓	✓	✓		✓	✓	✓	✓		✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓			✓	✓	✓		
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of Matches(✓)= 40 Relationship = High									

Semester – I

Course Title	ADVANCED DATABASE MANAGEMENT SYSTEM
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS13
Course Type	DSC –III
Credits	4
Marks	100

General Objective:

To learn and apply knowledge of Database Management System in the emerging trends.

Course Objectives:

CONo.	The learners will be able to
CO-1	Describe the data models, the need for normalization and the various database Architectures.
CO-2	Understand the rchitecture of the Parallel and Distributed Databases.
CO-3	Apply the knowledge of the Parallel and Distributed Databases to maintain an efficient database system.
CO-4	Employ the efficient database system for Big Data and Block Chain.
CO-5	Prepare themselves to advanced topics and techniques that pave the way for research.

UNIT I: DATABASE DESIGN

Relational Database Design: Features of Good Relational Designs - Decomposition Using Functional Dependencies - Normal Forms - Functional-Dependency Theory - Algorithms for Decomposition Using Functional Dependencies - Decomposition Using Multivalued Dependencies - Atomic Domains and First Normal Form.

UNIT II: PARALLEL AND DISTRIBUTED DATABASES

Database-System Architectures: Overview - Centralized Database Systems - Server System Architectures - Parallel Systems - Distributed Systems - Transaction Processing in Parallel and Distributed Systems. Parallel and Distributed Storage: Overview - Data Partitioning - Dealing with Skew in Partitioning - Replication - Parallel Indexing - Distributed File Systems - Parallel Key-Value Stores.

UNIT III: QUERY AND TRANSACTION PROCESSING

Query Processing: Parallel Sort, Join - Other Operations - Parallel Evaluation of Query Plans - Query Processing on Shared-Memory Architectures - Query Optimization for Parallel Execution - Parallel Processing of Streaming Data - Distributed Query Processing. Transaction Processing: Distributed Transactions - Commit Protocols - Concurrency Control in Distributed Databases - Replication - Extended Concurrency Control Protocols - Replication with Weak Degrees of Consistency - Coordinator Selection.

UNIT IV: BIG DATA AND BLOCKCHAIN DATABASES

Big Data: Big Data Storage Systems - The MapReduce Paradigm - Beyond MapReduce: Algebraic Operations - Streaming Data - Graph Databases. Blockchain Databases: Blockchain Properties- Achieving Blockchain Properties via Cryptographic Hash Functions - Consensus - Data Management in a Blockchain - Smart Contracts - Performance Enhancement - Emerging Applications.

UNIT V: POSTGRESQL

Interacting with PostgreSQL - System Architecture - Storage and Indexing - Query Processing and Optimization - Transaction Management in PostgreSQL - SQL Variations and Extensions - Foreign Data Wrappers - PostgreSQL Internals for Developers.

TEXTBOOKS:

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, “Database System Concepts”, 7th edition , McGraw-Hill Education, 2020.
Unit I: (Chapters 7), Unit II⊗ Chapters 20, 21), Unit III: (Chapters 22, 23)
Unit IV:(Chapters 10, 26)

ONLINE RESOURCE(S):

1. <https://www.db-book.com/db7/online-chapters-dir/32.pdf>
Unit V: Chapters 32

REFERENCE BOOKS:

1. RamezElmasri, Shamkant B Navathe, “Fundamental of Database Systems”, Pearson, 7th edition 2016.
2. Thomas M. Connolly, Carolyn E. Begg., “Database Systems a practical approach to Design , Implementation and Management “, Pearson Education, 2015.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the concepts of Functional Dependencies and normal forms.	1, 5	Understanding
CO-2	Compare the Parallel and Distributed Databases.	1, 2, 3, 5	Analyzing
CO-3	Determine the concepts of Query and Transaction Processing.	1, 2, 3, 5	Analyzing
CO-4	Analyze the basic concepts of Big Data and Block Chain Databases.	1, 2, 3, 4, 5	Evaluating
CO-5	Develop the Database using PostgreSQL.	1, 2, 3, 4, 5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours			Credits	
I	21PCCS13	Advanced Database Management System				75			4	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓				✓	✓				✓
CO-2	✓	✓	✓		✓	✓	✓	✓		✓
CO-3	✓	✓	✓		✓	✓	✓	✓		✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 40 Relationship = High									

Semester – I

Course Title	CLOUD COMPUTING
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS11A
Course Type	DSE-I-A
Credits	4
Marks	100

General Objective:

To learn the fundamental concepts of Cloud and its technologies such as Amazon Web Services and Windows Azure.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the basics of Cloud Computing.
CO-2	Classify appropriate techniques and tools to develop Cloud applications.
CO-3	Comprehend the concepts of Virtualization and the design of Cloud Services.
CO-4	Develop the security architecture for a Cloud Environment.
CO-5	Create awareness on Cloud Services.

UNIT I: CLOUD COMPUTING FOUNDATION

Introduction to Cloud Computing - Cloud Computing Basics - History of Cloud Computing - Importance of Cloud Computing - Characteristics - Move to Cloud Computing: Pros and Cons of Cloud Computing - Nature of the Cloud - Technologies in Cloud Computing - Migrating into the Cloud - Seven-step Model. Types of Cloud - Cloud Infrastructure - Cloud Application Architecture. Working of Cloud Computing : Trends in Computing - Cloud Service Models - Cloud Deployment Models

Unit II: CLOUD COMPUTING ARCHITECTURE

Cloud Computing Technology: Cloud Lifecycle Model - Role of Cloud Modelling and Architecture - Reference Model for Cloud Computing-Cloud Industry Standard. Cloud Architecture : Developing Holistic Cloud Computing Reference Model - Cloud

System Architecture. Cloud Modelling and Design: Basic Principles - Model for Federated Cloud Computing- Cloud Eco System - Cloud Governance .

Unit III:VIRTUALIZATION

Definition of Virtualization - Adopting Virtualization -Types of Virtualization - Virtualization Architecture and Software - Virtual Clustering - Introduction to Cluster - Virtualization Application - Pitfalls of Virtualization. Grid, Cloud and Virtualization: Virtualization in Grid - Virtualization in Cloud. Virtualization and Cloud Computing : Anatomy of Cloud Infrastructure - Anatomy of Cloud Computing - Virtual Infrastructures - CPU Virtualization - Network and Storage Virtualization

Unit IV:DATA STORAGE AND AND SECURITY

Data Storage : Introduction to Enterprise Data Storage - Data Storage Management - File Systems - Cloud Data Stores - Using Grids for Data Storage. Cloud Storage: Overview of Cloud Storage - Data Management for Cloud Storage - Provisioning Cloud Storage - Data-intensive Technologies for Cloud Computing. Risks in Cloud Computing: Introduction - Risk Management - Cloud Impact - Enterprise Wide Risk Management - Types of Risks in Cloud Computing . Data Security in Cloud: Introduction - Current State - Homo Sapiens and Digital Information - Cloud, Digital Persona and Data Security - Content Level Security (CLS).

Unit V:CLOUD COMPUTING SERVICES

Cloud Services: Cloud Types and Services - Software as a Service (SaaS)- Platform as a Service (PaaS)- Infrastructure as a Service (IaaS) - Other Clouds Services . Cloud Computing at Work: Cloud Service Development Tool - Management/Administrative Services. Tools and Technologies for Cloud - Parallel Computing -Cloud Computing Application Platform - Cloud Computing Platform - Tools for Building Cloud - Programming in Cloud. Cloud Tools: VMWare – Eucalyptus – CloudSim – OpenNebula – Nimbus - Microsoft Cloud Service: Windows Azure Platform - Google Cloud Applications - Amazon Cloud Services

Text Book:

1. Srinivasan.A, J. . Suresh , “Cloud Computing: A Practical Approach For Learning And Implementation”, Pearson Education India, 2014.
- Unit – 1 (Chapter 1, 2, 3, 4), Unit – 2 (Chapter 5, 6, 7) Unit – 3 (Chapter 8 , 9, 10), Unit – 4 (Chapter 11, 12, 18, 19), Unit – 5 (Chapter 16, 17, 24, 27, 28, 29, 30, 31)

Reference books:

1. Barrie Sosinsky, Cloud Computing Bible, New Delhi: Wiley India Pvt. Ltd, 2012.
2. Buyya, Vecciola and Selvi, Mastering Cloud Computing:Foundations and Applications Programming, Tata McGraw Hill,2013.

Course Outcomes:

CONo.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Illustrate the fundamental concepts of Cloud Computing.	1,2,5	Understanding
CO-2	Categorize the architecture, infrastructure and delivery models of Cloud Computing.	1,2,4,5	Analyzing
CO-3	Analyze the suitable concepts of Virtualization for Cloud Computing.	1,2,4,5	Analyzing
CO-4	Validate the core issues such as security, and privacy of Cloud Computing.	1,2,3,4,5	Creating
CO-5	Design Cloud Services.	1,2,3,4,5	Evaluating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
I	21PECS11A	Cloud Computing				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓			✓	✓	✓		✓	✓
CO-3	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 42 Relationship = High									

Semester – I

Course Title	SOCIAL COMPUTING
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS11B
Course Type	DSE-I-B
Credits	4
Marks	100

General Objective:

To learn and understand the important features of Social Computing and analyze the data in social media.

Course Objectives :

CONo.	The learners will be able to
CO-1	Classify the wide range of social technologies in Social Computing.
CO-2	Understand the basic theories of social forces and structures in the social context.
CO-3	Analyze the different ways to use Social Computing technologies.
CO-4	Analyze the appropriate filters among the users of Social Computing platform.
CO-5	Evaluate the analytical techniques to understand the user data for Social Computing platform.

UNIT I: BASIC CONCEPTS

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Socio metric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

UNIT II : SOCIAL LINK

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

UNIT III : SOCIAL MEDIA

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

UNIT IV : SOCIAL INFORMATION FILTERING

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

UNIT V : SOCIAL NETWORK STRATEGY

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities –Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

TEXTBOOK(S):

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect.Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.

REFERENCE BOOK(S):

1. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
2. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013
3. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
4. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.
5. Christina Prell, “Social Network Analysis: History, Theory andMethodology”, 1st Edition, SAGE Publications Ltd, 2012.

Course Outcomes:

CO. No.	Upon completion of the course, the students will be able to	PSO Mapped	Cognitive Level
CO-1	Discuss the concepts of Social Computing and its applications.	1,2 ,5	Understanding
CO-2	Use social links for Social Computing systems.	1,2,3,4,5	Applying
CO-3	Apply the ethical skills in Social Media for social relationship.	1,3,4,5	Applying
CO-4	Analyze the location-based Social Media.	1,2,3,4,5	Analyzing
CO-5	Assess the network strategies for lifelong use.	1,2,3,4,5	Evaluating

Relationship Matrix:

Semester	Course Code	Title of the Course				Hours	Credits			
I	21PECS11B	Social Computing				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓				✓	✓	✓			✓
CO-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-3	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓		✓	✓	✓	✓	✓	✓
	Number of Matches(✓)= 43 Relationship = High									

Semester – I

Course Title	DATA MINING
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS11C
Course Type	DSE-I-C
Credits	4
Marks	100

General Objective:

To Understand the algorithms commonly used in data mining tools and ability to apply data mining tools to real world problems.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the concept of Data mining and data warehouse architecture.
CO-2	Build good quality of data by doing Data Preprocessing.
CO-3	Analyze the data, identify the problems, and choose the relevant Models and Algorithms.
CO-4	Analyze clustering methods for grouping the data.
CO-5	Evaluate various applications and research prototypes of Data Mining

UNIT I INTRODUCTION

Data mining – Data mining functionalities – kinds of pattern can be mined – classification – major issues. Data warehouse –A multidimensional data model – Data warehouse architecture – Data warehouse implementation – From data warehouse to data mining.

UNIT II DATA PRE PROCESSING

Data preprocessing – Data cleaning – Data Integration and Transformation – Data Reduction –Discretization and concept hierarchy generation – Data mining primitives – Data mining Task

UNIT III ASSOCIATION AND CLASSIFICATION

Association Rule Mining – Mining single dimensional Boolean association rules from transactional databases –. Classification and prediction – Issues regarding classification and prediction – Bayesian classification - Classification by Back propagation – classification based on concepts from association rule mining.

UNIT IV CLUSTER ANALYSIS

Cluster Analysis-A categorization of Major clustering methods- Partitioning methods Hierarchical methods -Grid based methods - Model based clustering methods Density - based methods.

UNIT V APPLICATIONS

Applications and Trends in Data Mining – Data mining system Products and Research prototypes – Additional themes on Data mining – Social Impacts of Data Mining – Trends in Data mining - Mining Spatial Databases – Mining Timeseries and sequence data – Mining the World wide web.

TEXT BOOK(S):

1. Jiwei Han, Michelen Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann Publishers an Imprint Of Elsevier, 2001.(Chapters 1,2,3,4.1,6.1,6.2,7,8,9.2,9.4,9.6,10)

REFERENCE BOOK(S):

1. Arun K.Pujari, Data Mining Techniques, Universities Press(India) Limited, 2001.
2. George M. Marakas, Modern Data warehousing, Mining and Visualization: core concepts, Printice Hall, FirstEdition, 2002.
3. PangNing Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson,2008.
4. Soman K. P, ShyamDiwakar, V. Ajay, Data Mining, Prentice Hall, 2008.

Course Outcomes:

CO No.	Upon completion of the course, the students will be able to s	PSOs Addressed	Cognitive Level
CO-1	Summarize Data Mining concepts and Data Warehouse implementations.	1,2,5	Understanding
CO-2	Apply data preprocessing techniques to clean, integrate and transform data.	1,2,3,5	Applying
CO-3	Explain the analyzing techniques of various data.	1,2,3,5	Analyzing
CO-4	Discover distinct groups in a dataset using Clustering methods.	1,2,3,5	Analyzing
CO-5	Assess various trend and research of Data Mining	1,2,3,4,5	Evaluating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
I	21PECS11C	Data Mining				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓			✓	✓	✓	✓		✓
CO-3	✓	✓	✓		✓	✓	✓	✓		✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 40 Relationship = High									

Semester – I

Course Title	DESIGN AND ANALYSIS OF ALGORITHM PRACTICAL
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS1P1
Course Type	Practical-I
Credits	2
Marks	100/2

General Objective:

To analyze, design and implement efficient algorithms for a specified application.

Course Objectives:

CONo.	The learners will be able to
CO-1	Acquire skills in designing and implementing the concepts of Algorithm.
CO-2	Analyze the different Sorting techniques using C++.
CO-3	Experiment the Travelling Salesman Problem.
CO-4	Test 8-Queens Problem using the Backtracking.
CO-5	Solve the Knapsack Problem using Dynamic Programming.

Write following programs using C++

1. Implementation of Merge Sort.
2. Implementation of Quick Sort.
3. Implementation of Bubble Sort.
4. Implementation of Travelling Salesman Problem
5. Solve the Knapsack problem using Dynamic Programming
6. Implementation of Depth First Search.
7. Find the Shortest Path to other vertices using Dijkstra's Algorithm.
8. Prim's Algorithm-Greedy Method
9. Implement 8-Queens Problem using Backtracking.

Course Outcomes:

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Know about the various Sorting techniques in C++ to design algorithm.	1,2,3,5	Understanding
CO-2	Implement Travelling Salesman Problem.	1,2,3,4	Analyzing
CO-3	Execute the Knapsack Problem in Dynamic Programming.	1,2,3,4	Applying
CO-4	Construct Prim's Algorithm using Greedy Method.	1,2,3,4	Evaluating
CO-5	Design and implement 8-Queens Problem using the Backtracking.	1,2,3,4,5	Creating

Relationship Matrix:

Semester	Course Code	Title of the Course				Hours	Credits			
I	21PCCS1P1	Design and Analysis of Algorithm Practicals				60	2			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓			✓	✓	✓	✓		✓
CO-2	✓	✓			✓	✓	✓	✓	✓	
CO-3	✓	✓		✓	✓	✓	✓	✓	✓	
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 41 Relationship = High									

Semester – I

Course Title	ADVANCED WEB TECHNOLOGY PRACTICALS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS1P2
Course Type	Practical-II
Credits	2
Marks	100/2

General Objective:

To make the learners have a practical experience in the development of dynamic web applications for business logics using ASP.NET, PHP and Python.

Course Objectives:

CONo.	The learners will be able to
CO-1	Learn the components of ASP.NET to design Dynamic Applications.
CO-2	Understand the ways to use basic control statements and array in PHP.
CO-3	Apply their knowledge to design a dynamic web page along with validation and Data Controls in PHP.
CO-4	Experiment with the basics of Python Programming.
CO-5	Design and develop the different operations using Python program on Python Objects.

ASP.NET

1. Design a Registration form and validate all the controls using validation controls.
2. Design a form that accept employee details and display employee details in ascending order, using Data controls.

PHP

3. Write a program in PHP to display Multiplication Table using nested loop.
4. Write a program In PHP to create function to sort an array.

5. Write a program to create class in PHP.
6. Design the personal information form ,submit and retrieve the form data using PHP
7. Design Login Form and Validate that form using PHP Code
8. Write a PHP code to insert, delete, select the employee data from database.

PYTHON

9. Write a Python program to demonstrate arithmetic operations.
10. Write a Python function to check whether a number is in a given range.
11. Write a Python program to convert a tuple to a string
12. Write a Python program to convert a list to a tuple
13. Write a Python program to slice a tuple
14. Write Python program to create a list of tuples from given list having number and its cube in each tuple.

Course Outcomes:

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Demonstrate their ability to design simple interactive Web applications using ASP.NET.	1, 2, 3, 4	Understanding
CO-2	Examine the dynamic web pages using PHP with MYSQL Database.	1, 2, 3, 4,5	Analyzing
CO-3	Develop applications for any real time problems using PHP and ASP.NET.	1, 2, 3, 4	applying
CO-4	Assess Python data structure for real time applications.	1, 2, 3,5	Evaluating
CO-5	Create a program using the concepts of Python.	1, 2, 3, 4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
I	21PCCS1P2	Advanced Web Technology Practicals				60	2			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓	✓	✓		✓	✓	✓	✓	
CO-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-3	✓	✓	✓	✓		✓	✓	✓	✓	
CO-4	✓	✓	✓			✓	✓	✓		✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Numberof Matches(✓)= 43 Relationship : High									

Semester – I

Course Title	DIGITAL LITERACY
Total Hrs.	30
Hrs./Week	2
Sub.Code	21PICS11
Course Type	IDC-I
Credits	2
Marks	100/2

General Objective:

To gain the knowledge of the basic principles and applications underpinning the Digital Technology.

Course Objectives:

CO No.	The learners will be able to
CO-1	Extend their knowledge, skills and attitudes towards Digital India.
CO-2	Choose e-learning platforms for life time learning.
CO-3	Perform digital transactions over the Web.
CO-4	Check Digital Services of India.
CO-5	Make Digital Awareness among people.

UNIT I: DIGITAL INDIA

Digital India: Agencies Enabling Digital India - Digital India Services - Electronic Payment and Receipt (EPR) - The Government policy statement on EPR states as follows - Overview of Payments and Receipts in Government Departments - Digital Locker - Benefits of Digital Locker.

UNIT II: DIGITAL LEARNING

SWAYAM- SWAYAM PRABHA- e-PG Pathshala - ShodhGangotri - VIDWAN - E-CBSC - National Digital Library of India - Virtual Labs - e-Yantra - Talk to a Teacher Program - E-acharya - FOSEE (Free / Libre and Open Source Software in Education) -Spoken Tutorial.

UNIT III: DIGITAL TRANSACTION

SBI Pay app - SBI Pay - Download and install - one time registration process - Benefits of SBI Pay app - Adding bank accounts to the SBI Pay app - Create Virtual Payment Address - Set App Password - Set UPI pin - Create OTP and MPIN - Transfer money - Keep track of all our transactions - Validation of Payee.

Train Ticket Booking: Registration of an account for online train ticket booking - Activating user account and changing the password - Buy a train ticket - Manage a train ticket - check the status of tickets - print, cancel a ticket - cancellation and an automated Email of refund.

UNIT IV: DIGITAL SERVICES

PMJJBY: About Pradhan Mantri Jeevan Jyoti Bima Yojana - PMJJBY premium, benefits and claim amount - become a member of PMJJBY - Debit our Savings Bank account towards the payment of annual premium. PMSBY: About Pradhan Mantri Suraksha Bima Yojana - PMSBY premium, benefits and claim amount - become a member of PMSBY - Debit our Savings bank account towards the payment of annual premium

PAN Card: About PAN card - Structure and Validation of PAN card - Need for a PAN card and to know your PAN card - apply for PAN Card - Documents needed for proof of identity - Tracking the status of the application

UNIT V: DIGITAL AWARENESS

Privacy: Introduction - Data Privacy versus Data Protection - Involved parties in data protection - Functional Components of Data Protection - Data Privacy Principles - Data Security domains - Data Subject's rights - Strategy for Data Protection Implementation.

Responsible Social Media and Social Networking: Social Media Overview - Benefits of Social Media - Risks of Social Media - Social Media Best Practices - Social Media Principles - Applying Best Practices

TEXT BOOK:

1. Digital Literacy, PG AND RESEARCH DEPARTMENT OF COMPUTER SCIENCE

REFERENCE(S):

1. www.digitalindia.gov.in
2. www.swayam.gov.in
3. www.epgp.inflibnet.ac.in
4. www.digitaltransaction.net
5. www.cashlessindia.gov.in

Course Outcomes:

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the digital India concept	1,2,5	Understanding
CO-2	Carry out the learning through digital mode	1,2,3,5,	Applying
CO-3	Use digital transaction for money transfer	1,2,3,4,5	Applying
CO-4	Assess Government Schemes and Services	1,2,5	Evaluating
CO-5	Create Digital Awareness about Privacy and Social Media.	1,2,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
I	21PICS11	Digital Literacy				30	2			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓	✓		✓	✓	✓			✓
CO-2	✓	✓	✓		✓	✓	✓	✓		✓
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓		✓	✓	✓			✓
CO-5	✓	✓		✓	✓	✓	✓		✓	✓
	Number of matches (✓) = 40									
	Relationship = High									

Semester – II

Course Title	ADVANCED JAVA PROGRAMMING
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS21
Course Type	DSC-IV
Credits	4
Marks	100

General Objective:

To learn and understand the advanced Java Programming such as JDBC, Servlet and JSP.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the concepts of Applet and Event Handling.
CO-2	Apply database connections with JDBC process.
CO-3	Compare the access of TCP/IP and UDP networks.
CO-4	Develop dynamic Web applications using Servlet.
CO-5	Design the web applications using JSP.

UNIT I: APPLET AND EVENT HANDLING

The Applet Class : Two Types of Applets - Applet Basics - The Applet Class - Applet Architecture - An Applet Skeleton - Simple Applet Display Methods - Requesting Repainting - Using the Status Window The HTML APPLET Tag - Passing Parameters to Applets - The AudioClip Interface - The AppletStub Interface - Outputting to the Console

Event Handling: Two Event Handling Mechanisms - The Delegation Event Model - Event Classes - The KeyEvent Class - The MouseEvent Class - The MouseWheelEvent Class - The TextEvent Class - The WindowEvent Class - Sources of Events - Event Listener Interfaces - Using the Delegation Event Model - Adapter Classes - Inner Classes

UNIT II: AWT AND ITS CONTROLS

Introducing the AWT: AWT Classes - Window Fundamentals – Working with Frame Windows - Setting the Window's Dimensions - Hiding and Showing a Window - Creating a Frame Window in an AWT-Based Applet - Handling Events in a Frame Window - Creating a Windowed Program - Displaying Information Within a Window

Using AWT Controls, Layout Managers, and Menus: AWT Control Fundamentals - Labels - Using Buttons - Applying Check Boxes - CheckboxGroup - Choice Controls - Using Lists - Managing Scroll Bars - Handling Scroll Bars -Using a TextField - Using a TextArea - Understanding Layout Managers - Menu Bars and Menus - Dialog Boxes – FileDialog.

UNIT III: JDBC AND NETWORKING

Accessing Databases with JDBC: Introduction - Relational Databases -A books Database – SQL: Basic - Setting up a Java DB Database - Creating the Chapter's Databases on Windows - Manipulating Databases with JDBC - Connecting to and Querying a Database - Querying the books Database - RowSet Interface - PreparedStatement - Stored Procedures - Transaction Processing.

Networking : Networking Basics - The Networking Classes and Interfaces - InetAddress - Inet4Address and Inet6Address - TCP/IP Client Sockets - URL - URLConnection - HttpURLConnection - The URI Class - Cookies - TCP/IP Server Sockets - Datagrams – Remote Method Invocation (RMI).

UNIT IV: JAVA SERVLETS

Introduction: Servlets - Web Applications, Servlets and HTTP Servlets, Filters, Security, Internationalization - Servlet Life Cycle - Servlets for the World Wide Web -Requests, Responses, and Headers - GET and POST, HTTP Response Codes - Coding an HttpServlet - Deploying a Servlet, Web Application Deployment Descriptor Structure - Servlet Configuration - Limitations of Configuration: web.xml Additions, Client/Server Servlet Programming, HttpServletRequest and HttpServletResponse, HttpServletResponse - HttpServletRequest - ServletContext - Initial Web Application Parameters - Servlet Event Listeners.

UNIT V: JAVA SERVER PAGES

Java Server Pages: JSP 2.0 Specification - JSP Life Cycle - The Difference Between Servlets and JSP - JSP Syntax and Semantics - Elements and Template Data, Two Types of Syntax, Scripting Elements , Directives, JSP Configuration, Standard JSP Actions, Whitespace Preservation, Attributes, Comments, Quoting and Escape Characters. Implicit Objects - config, pageContext, out, page - JSP in XML Syntax - XML Rules - JSP Documents.

TEXTBOOKS:

1. Herbert Schildt, "Java the Complete Reference", Oracle Press, 9th edition, 2014. Unit I(Chapter 23, 24), Unit II(Chapter25,26), Unit III(Chapter 22).

2. Paul Deitel and Harvey Deitel, "Java: How to Program", Pearson Publication; 10th Edition, 2015. Unit III (Chapter 24)
3. Jayson Falkner, Kevin Jones, "Servlets and JavaServer Pages™: The J2EE™ Technology Web Tier", Addison-Wesley Professional, 2004. Unit IV (Chapter 2), Unit V (Chapter 3)

REFERENCE BOOKS:

1. Herbert Schildt, "Java: A Beginner Guide", Oracle Press, 8th Edition, 2018.
2. Murach's, "Java Servlets and JSP", Mike Murach & Associates Publishers, 2nd Edition, 2014.

Course Outcomes:

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the knowledge of Applet to design GUI based Applications.	1, 2, 3, 4	Understanding
CO-2	Apply JDBC Connectivity to access Database.	1, 2, 4	Applying
CO-3	Analyze basic concepts of IPV4 and IPV6 Networks.	1, 2, 3, 4, 5	Analyzing
CO-4	Create server side programming using Servlets.	1, 2, 3, 4, 5	Creating
CO-5	Propose Java Server Page to design and develop Dynamic Web Applications.	1, 2, 3, 4, 5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours			Credits	
II	21PCCS21	Advanced Java Programming				75			4	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes(PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓	✓	✓		✓	✓	✓	✓	
CO-2	✓	✓		✓		✓	✓		✓	
CO-3	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Numberof Matches(✓)= 43 Relationship = High									

Semester – II

Course Title	DIGITAL IMAGE PROCESSING
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS22
Course Type	DSC-V
Credits	4
Marks	100

General Objective:

To learn the digital image fundamentals and mathematical transforms in image processing, and develop skills in MATLAB.

Course Objectives:

CONo.	The learners will be able to
CO-1	Familiarize themselves in the fundamentals of Digital Image Processing.
CO-2	Demonstrate Spatial and Frequency Domain using various image transforms.
CO-3	Illustrate image enhancement techniques and Image Restoration techniques.
CO-4	Summarize Image Compression and Morphological Processing techniques.
CO-5	Perform Segmentation techniques in Digital Image Processing

UNIT I: INTRODUCTION TO IMAGE PROCESSING

Digital Image Processing – Mat Lab Working Environment – Image Representation – reading images – Displaying images – Writing images – Data classes – Image types – Converting between data classes and image types – Array indexing – M-Function Programming.

UNIT II: SPATIAL DOMAIN AND FREQUENCY DOMAIN PROCESSING

Intensity Transformation functions – Histogram processing and function plotting – spatial filtering – 2-D Discrete Fourier transformation – filtering in the frequency domain – generating and sharpening frequency domain filters.

UNIT III: IMAGE RESTORATION AND COLOR IMAGE PROCESSING

Model of the image degradation / restoration process – Noise models – Periodic Noise Reduction using frequency domain filtering – direct inverse

filtering – wiener filtering – constrained least square filtering – Lucy – Richardson algorithm – color image representation.

UNIT IV: IMAGE COMPRESSION AND MORPHOLOGICAL IMAGE PROCESSING

Coding redundancy - Spatial redundancy – psycho visual redundancy – JPEG compression - Morphological image processing – dilation and erosion – morphological reconstruction.

UNIT V: IMAGE SEGMENTATION AND REPRESENTATION

Point, Line, Edge Detection – Hough Transform – Thresholding – Region based Segmentation – Watershed Transform – Representation – Boundary Descriptors – Regional Descriptors.

TEXTBOOKS:

1. Rafael C.Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing using MATLAB”, McGraw Hill Education, 2010.
Unit I –(Chapter 1), Unit II - (Chapter 2, 3), Unit III -(Chapter 4, 6), Unit IV - (Chapter 8, 9), Unit V- (Chapter 10, 11).

REFERENCE BOOKS:

1. Rafael C.Gonzalez, Richard E. Woods, “Digital Image Processing”, Pearson publications, 4th Edition, 2018.
2. Chanda Bhabatosh, MajumderDwijesh Dutta. “Digigal Image Processing and Analysis”, Prentice Hall of India, New Delhi, 2nd Edition, 2011.
3. Scott E. Umbaugh, “Digital Image Processing and Analysis Applications with MATLAB and CVIPtools”, CRC Press, 2017.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the concepts and fundamental of Digital Image Processing.	1, 2, 3	Understanding
CO-2	Execute Mathematical Model of Spatial and Frequency Domain filters.	1, 2, 3, 4	Applying
CO-3	Select suitable Image Restoration technique for a real world applications	1, 2, 3, 4, 5	Analyzing
CO-4	Assess different Morphological and Image Compression techniques in Digital Image Processing.	1, 2, 3, 4, 5	Evaluating
CO-5	Design and Develop Application using image Segmentation Algorithms.	1, 2, 3, 4, 5	Creating

Relationship Matrix

Semester	Course Code	Titleof theCourse					Hours			Credits	
II	21PCCS22	Digital Image Processing					75			4	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)					
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO-1	✓	✓	✓			✓	✓	✓			
CO-2	✓	✓	✓			✓	✓	✓	✓		
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO-4	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Numberof Matches(✓)= 41 Relationship = High										

Semester – II

Course Title	DISTRIBUTED OPERATING SYSTEM
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS23
Course Type	DSC –VI
Credits	4
Marks	100

General Objective:

To understand the knowledge of Operating System in the distributed environment.

Course Objectives:

CONo.	The learners will be able to
CO-1	Recall the knowledge of process and Deadlocks.
CO-2	Compare the operating system and Distributed Operating System.
CO-3	Use Distributed File System in File Management Architecture.
CO-4	Distinguish the concept of Failure Recovery and Fault Tolerance.
CO-5	Practice the concepts of multiprocessor and the principles of Database Operating Systems.

UNIT I: PROCESS SYNCHRONIZATION

Introduction – Operating System Definition – Functions Of Operating System – Types Of Advanced Operating System – Design Approaches – Synchronization Mechanisms – Concepts Of A Process – Critical Section Problem – Process Deadlock – Models Of Deadlock – Conditions For Deadlock – System With Single-Unit Requests, Consumable Resources , Reusable Resources.

UNIT II: DISTRIBUTED OPERATING SYSTEMS

Distributed Operating Systems: Introduction- Issues – Communication Primitives – Inherent Limitations –Lamport’s Logical Clock, Vector Clock, Global State, Cuts – Termination Detection – Distributed Mutual Exclusion – Non Token Based Algorithms – Lamport’s Algorithm - Token Based Algorithms –Distributed Deadlock Detection – Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT III: DISTRIBUTED RESOURCE MANAGEMENT

Distributed Resource Management – Distributed File Systems – Architecture – Mechanisms – Design Issues – Distributed shared Memory – Architecture – Algorithm – Protocols – Design Issues – Distributed Scheduling – Issues – Components – Algorithms.

UNIT IV: FAILURE RECOVERY AND FAULT TOLERANCE

Failure Recovery And Fault Tolerance – Concepts – Failure Classifications – Approaches To Recovery – Recovery In Concurrent Systems – Synchronous And Asynchronous Check Pointing And Recovery – Check Pointing In Distributed Database Systems – Fault Tolerance Issues – Two-Phase And Nonblocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols.

UNIT V: MULTIPROCESSOR AND DATABASE OPERATING SYSTEMS

Multiprocessor And Database Operating Systems – Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory Management – Reliability/Fault Tolerance – Database Operating Systems – Concepts.

TEXTBOOKS:

1. Mukesh Singhal, Niranjana.G. Shivaratri, “Advanced Concepts in Operating Systems”, McGraw Hill 2001.
Unit I: (Chapters 1, 2, 3), Unit II: (Chapters 4, 5, 6, 7, 8)
Unit III: (Chapters 9, 10, 11), Unit IV: Chapters 12, 13)
Unit V: (Chapters 17, 18)

REFERENCE BOOKS:

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne, “Operating System Concepts”, 10th Edition, Wiley publications 2018.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, 2nd Edition Addison Wesley 2001.
3. Andrew S. Tanenbaum, “Distributed Operating System”, Pearson Education.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the concepts of process and Deadlocks	1,2,5	Understanding
CO-2	Apply the various distributed OS algorithms for Deadlock Detection.	1,2,4,5	Applying
CO-3	Analyze the scheduling algorithm for Distributed Resource Management.	1,2,3,4,5	Analyzing
CO-4	Evaluate Failure Recovery approaches and Fault Tolerance issues.	1,2,3,4,5	Evaluating
CO-5	Choose appropriate Synchronization techniques for Multiprocessor.	1,2,3,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
II	21PCCS23	Distributed Operating System				75	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓				✓	✓	✓			✓
CO-2	✓	✓			✓	✓	✓		✓	✓
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓		✓	✓	✓	✓		✓
	Number of matches (✓) = 40 Relationship = High									

Semester – II

Course Title	CRYPTOGRAPHY AND NETWORK SECURITY
Total Hrs.	60
Hrs./Week	4
Sub. Code	21PECS21A
Course Type	DSE-IIA
Credits	4
Marks	100

General Objective:

To practice the knowledge of cryptography and network security to maintain the privacy of computer data in network.

Course Objectives:

CONo.	The learners will be able to
CO-1	Illustrate the fundamental concepts of Computer and Network Security.
CO-2	Compare various Symmetric Key Algorithms with example.
CO-3	Select better Key Management Techniques for Network communication.
CO-4	Use necessary techniques to protect Wireless and Mobile Networks.
CO-5	Assess various threats and evaluate Security Tools like Firewall.

UNIT I: COMPUTER AND NETWORK SECURITY CONCEPTS

The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - Fundamental Security Design Principles - Attack Surfaces and Attack Trees - A Model for Network Security - Standards. Classical Encryption Techniques - Symmetric Cipher Model - Substitution Techniques - Transposition Techniques - Rotor Machines - Steganography.

UNIT II: BLOCK CIPHERS AND DES

Traditional Block Cipher Structure - The Data Encryption Standard - The Strength of DES - Block Cipher Design Principles. Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems - The RSA Algorithm.

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions - Secure Hash Algorithm (SHA) - Message Authentication Codes: Security of MACs - MACs Based on Hash Functions: HMAC - Digital Signatures.

UNIT III: KEY MANAGEMENT AND DISTRIBUTION

Distribution of Public Keys - X.509 Certificates - Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles – Kerberos. Electronic Mail Security : Internet Mail Architecture - Email Threats and Comprehensive Email Security - S/MIME - Pretty Good Privacy.

UNIT IV: NETWORK SECURITY

Transport-Level Security: Web Security Considerations - Transport Layer Security - HTTPS - Secure Shell (SSH). IP Security: IP Security Overview - IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange . Wireless Network Security: Wireless Security - Mobile Device Security

UNIT V: MALICIOUS SOFTWARE AND SECURITY

Advanced Persistent Threat – Viruses – Worms – Trojans – Zombie - Bots – Keyloggers- Phishing - Spyware - Distributed Denial of Service Attacks. Intruders: Intrusion Detection - Password Management. Firewalls: The Need for Firewalls - Firewall Characteristics and Access Policy - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

TEXTBOOKS:

1. Stallings William, “Cryptography and Network Security- Principles and Practice 2017. Unit I – (Chapter 1,3) , Unit II-(Chapter - 4, 9,11, 12,13), Unit III –(Chapter- 14,15, 19) , Unit IV- (Chapter - 17, 18, 20), Unit V (Chapter 21, 22,23)

REFERENCE BOOKS:

1. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 2007, Reprint 2015.
2. Man Young Rhee, “Internet Security: Cryptographic Principles”, “Algorithms And Protocols”, Wiley Publications, 2003.
3. [Http://Nptel.Ac.In/](http://Nptel.Ac.In/).

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Illustrate the fundamentals of Network Security and its standards.	1, 2, 4	Understanding
CO-2	Choose appropriate symmetric, Public key and Hash function algorithm for Cryptography.	1, 2, 3, 4	Applying
CO-3	Analyze the various Public Key and apply it for User Authentication Security.	1, 2, 3, 4	Analyzing
CO-4	Evaluate the security procedures for Wireless Network and Mobile Device.	1, 2, 4, 5	Evaluating
CO-5	Choose appropriate malicious software & Firewalls for Network Security.	1, 2, 3, 4, 5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
II	21PECS21A	Cryptography and Network Security				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes(PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓		✓		✓	✓		✓	
CO-2	✓	✓	✓	✓		✓	✓	✓	✓	
CO-3	✓	✓	✓	✓		✓	✓	✓	✓	
CO-4	✓	✓		✓	✓	✓	✓		✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Numberof Matches(✓)= 40 Relationship = High									

Semester – II

Course Title	COMPILER DESIGN
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS21B
Course Type	DSE-IIB
Credits	4
Marks	100

General Objective:

To understand the basic Principles, Algorithms, Data Structures and phases of Compiler Design.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the basic knowledge of various compilation steps.
CO-2	Apply the syntax for different type of Grammar
CO-3	Analyze the concept of semantic for Regular Expressions.
CO-4	Decide the structure of Intermediate Code Generation
CO-5	Compile the Intermediate Code Generation in the run-time environment

UNIT I: LEXICAL ANALYSIS

Language Processors, The Structure of a Compiler, Parameter passing mechanism – Symbol table - The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens – Finite automata - Regular expression to automata.

UNIT II: SYNTAX ANALYSIS

The role of the parser - Context-free grammars - Writing a grammar - Top down Parsing - Bottom-up Parsing - LR parsers- LALR parsers.

UNIT III: SEMANTIC ANALYSIS

Inherited and Synthesized attributes – Dependency graphs – Ordering the evaluation of attributes – S- attributed definitions – L-attributed definitions – Applications of Syntax Directed translation – Syntax Directed translations schemes - Storage organization – Stack allocation of space.

UNIT IV: INTERMEDIATE CODE GENERATION

Variants of Syntax trees – Three Address code – Types and Declarations - Translation of Expressions – Type checking - Control flow - Back patching - Switch Statements - Procedure calls.

UNIT V: CODE GENERATION AND CODE OPTIMIZATION

Issues in the design of a code generator - The target language – Address in the Target Code – Basic Block and Flow graphs – Optimization of Basic Blocks - A simple code generator – Peephole Optimization.

TEXT BOOK(S):

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman, “Compilers- Principles, Techniques and Tools”, Second Edition, Pearson Education Asia, 2009.
Unit 1 –(Chapter 1, 2, 3), Unit 2 –(Chapter 4), Unit 3 –(Chapter 5, 7)
Unit 4 – (Chapter 6, 8), Unit 5 –(Chapter 8)

REFERENCE(S):

1. A.V. Aho, Ravi Sethi, J.D. Ullman, Compilers-Principles, Techniques and Tools, Addison- Wesley, 2003.
2. Fischer Leblanc, Crafting Compiler, Benjamin Cummings, Menlo Park, 1988.
3. Kennath C.Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
4. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2001.
5. S.GodfreyWinster, S.Aruna Devi, R.Sujatha, “Compiler Design”, yesdee Publishers, Third Reprint 2019.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand fundamentals of Compiler and identify the relationships among different phases of the Compiler.	1,2,5	Understanding
CO-2	Use various types of parser and Grammar for Syntax Analysis.	1,2,3	Applying
CO-3	Analyze & implement the different attribute for directed translation.	1,2	Analyzing
CO-4	Evaluate Intermediate Code Generation for syntax and semantics	1,2,3,4,5	Evaluate
CO-5	Design a Code Optimization technique for compiler using modern tools and technologies.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
II	21PECS21B	Compiler Design				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes(PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓	✓		✓	✓	✓	✓		
CO-3	✓	✓	✓	✓	✓	✓	✓			
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Numberof Matches(✓)= 40 Relationship = High									

Semester – II

Course Title	WIRELESS NETWORKS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS21C
Course Type	DSE-IIC
Credits	4
Marks	100

General Objective:

Students have knowledge about Wireless Technologies and understand the need of 3G and 4G Technology

Course Objectives:

CONo.	The learners will be able to
CO-1	To introduce about Wireless Networks, Protocol Stack and Standards.
CO-2	Understand about Mobile IP and Routing
CO-3	Know about Congestion Control and Classical TCP
CO-4	Learn about Fundamentals of 3G Services, Its Protocols and Applications.
CO-5	Learn about Evolution of 4G Networks, its Architecture and Applications.

Unit I: WIRELESS LAN

Introduction-WLAN Technologies: Infrared, UHF Narrowband, Spread Spectrum -IEEE802.11: System Architecture, Protocol Architecture, Physical Layer, MAC Layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband Layer, Link Manager Protocol, Security – IEEE802.16-WIMAX: Physical Layer, MAC, Spectrum Allocation For WIMAX

Unit II: MOBILE NETWORK LAYER

Introduction – Mobile IP: IP Packet Delivery, Agent Discovery, Tunneling And Encapsulation, IPV6- Network Layer In The Internet- Mobile IP Session Initiation Protocol – Mobile Ad-Hoc Network: Routing, Destination Sequence Distance Vector, Dynamic Source Routing.

Unit III: MOBILE TRANSPORT LAYER

TCP Enhancements For Wireless Protocols – Traditional TCP: Congestion Control, Fast Retransmit/Fast Recovery, Implications Of Mobility – Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time Out Freezing, Selective Retransmission, Transaction Oriented TCP – TCP Over 3G Wireless Networks.

Unit IV: WIRELESS WIDE AREA NETWORK

Overview Of UMTS Terrestrial Radio Access Network-UMTS Core Network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IW MSC, Firewall, DNS/DHCP-High Speed Downlink Packet Access (HSDPA)- LTE Network Architecture And Protocol.

Unit V: 4G NETWORKS

Introduction – 4G Vision – 4G Features And Challenges – Applications Of 4G – 4G Technologies: Multicarrier Modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation And Coding With Time Slot Scheduler, Cognitive Radio.

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg , "Wireless Communications And Networking", First Edition, Elsevier 2014.(Unit IV,V)

REFERENCES:

1. Erik Dahlman, Stefan Parkvall, Johan Skold And Per Beming, "3G Evolution HSPA And LTE For Mobile Broadband", Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy Kuri, "Wireless Networking", First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013.
4. David G. Messerschmitt, "Understanding Networked Applications", Elsevier, 2010.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	State Wireless Network Environment for AnyApplication Using Latest Wireless Protocols And Standards.	1, 2, 3	Remembering
CO-2	Explain the Mobile IP Concepts.	1, 2, 3,5	Understanding
CO-3	Demonstrate various Classical TCP	1, 2, 3, 4,5	Applying
CO-4	Familiar with the Latest 3G/4G And WiMAX Networks AndIts Architecture	1, 2, 3,4,5	Understanding
CO-5	Contrast 4G Networks Applications	1,2,3,4,5	Analyzing

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
II	21PECS21C	WIRELESS NETWORKS				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓				✓	✓	✓	✓		
CO-2	✓	✓	✓		✓	✓	✓	✓		✓
CO-3	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 42 Relationship = High									

Semester – II

Course Title	ADVANCED JAVA PROGRAMMING PRACTICALS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS2P1
Course Type	Practical-III
Credits	2
Marks	100/2

General Objective:

To give practical experience of the concepts of Applet, Database connectivity using JDBC, Servlets and JSP, and apply them to write the solution for real world applications.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand and develop application with Applet programming and AWT Components.
CO-2	Implement JDBC connectivity to connect Database.
CO-3	Perform TCP communication in Network.
CO-4	Develop server side script using Servlet.
CO-5	Practice application development using JSP.

Program List:

1. Write a Program in Java to create a Banner using Applet.
2. Write a program in Java that displays the x and y position of the cursor movement using Applet.
3. Write a Program in Java to implement Arithmetic Calculator using AWT components and layouts.
4. Write a Program in Java to design Registration Form using AWT components.
5. Write a Program in Java to connect database to insert, update, delete and display Student's information.
6. Write a Program in Java for two way TCP communication for server and client. It should look like a simple chat application.
7. Write a Program in Java to create Servlet that Prints "Hello World".

8. Write a Program in Java to create Servlet for login page, if the username and password is correct then prints message "Hello username" else print a message "login failed"
9. Write a Program in Java to create JSP that prints current date and time.
10. Write a Program in Java to implementing the concept of cookies in JSP

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Demonstrate the web programming, using Java Applets	1, 2, 3	Understanding
CO-2	Prepare database connectivity using JDBC.	1, 2, 3, 4	Applying
CO-3	Experiment with TCP/IP communication to design Network applications.	1, 2, 3, 4	Applying
CO-4	Evaluate dynamic Web Pages, using Servlets.	1, 2, 3, 4, 5	Evaluating
CO-5	Create Dynamic Web Pages, using JSP.	1, 2, 3, 4, 5	Creating

Relationship Matrix:

Semester	Course Code	Title of the Course				Hours	Credits			
II	21PCCS2P1	Advanced Java Programming PRACTICALS				60	2			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes(PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓	✓			✓	✓	✓		
CO-2	✓	✓	✓	✓		✓	✓	✓	✓	
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Numberof Matches(✓)= 43 Relationship = High									

Semester – II

Course Title	DIGITAL IMAGE PROCESSING PRACTICALS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS2P2
Course Type	Practical-IV
Credits	2
Marks	100/2

General Objective:

To provide a practical experience to implement the methods and algorithm of Image Processing in real world application using MATLAB.

Course Objectives:

CONo.	The learners will be able to
CO-1	Familiarize with the concepts of Image Processing and basic analytical methods using MATLAB.
CO-2	Execute Image Enhancement and Restoration techniques using MATLAB.
CO-3	Compare different Image Compression techniques using MATLAB.
CO-4	Evaluate the various Edge Detection techniques using MATLAB.
CO-5	Design applications that apply Segmentation and Morphological Processing techniques using MATLAB.

1. Implement the following Point processing in spatial domain:

- a. Negation of an image
- b. Thresholding of an image
- c. Contrast Stretching of an image

2. Perform Bit Plane Slicing.

3. Perform Histogram Equalization.

4. Implement the Histogram Specification.

5. Perform Zooming by interpolation and replication.

6. Implement the following Filtering in spatial domain:

- a. Low Pass Filtering
- b. High Pass Filtering

- c. Median filtering
- 7. Implement the following Edge Detection using derivative filter mask:
 - a. Prewitt
 - b. Sobel
 - c. Laplacian
- 8. Perform Data compression using Huffman coding.
- 9. Implement the following Filtering in frequency domain:
 - a. Low pass filter
 - b. High pass filter
- 10. Perform Hadamard transform.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Demonstrate the Fundamental analytical methods in Image Processing using MatLab.	1, 2, 3, 4	Understanding
CO-2	Implement the Image Enhancement techniques to enhancing the quality of the image in Matlab.	1, 2, 3	Applying
CO-3	Examine the various Image Compression techniques.	1, 2, 3, 4, 5	Analyzing
CO-4	Test the Edge Detection techniques using Matlab.	1, 2, 3, 4, 5	Evaluating
CO-5	Develop real world application using Image Segmentation in Matlab.	1, 2, 3, 4, 5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
II	21PCCS2P2	Digital Image Processing Practicals				60	2			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓	✓	✓		✓	✓	✓	✓	
CO-2	✓	✓	✓		✓	✓	✓	✓		
CO-3	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Numberof Matches(✓)= 43, Relationship : High									

Semester – II

Course Title	SWAYAM - NPTEL ONLINE CERTIFICATION COURSES
Total Hrs.	30
Hrs./Week	2
Sub.Code	21PSCS21
Course Type	SEC
Credits	2
Marks	100/2

SWAYAM-NPTEL ONLINE CERTIFICATION COURSES

GUIDELINES AND INSTRUCTIONS

1. National Programme on Technology Enhanced Learning (NPTEL) provides e-learning through online web and video courses in Engineering, Science and Humanities streams through its portal
<https://swayam.gov.in/ncdetails/NPTEL>.
2. Enrollment to all the courses is FREE.
3. Enrollment to courses and Examination Registration can be done ONLINE only. The link is available on NPTEL Website <http://nptel.ac.in/>
4. SWAYAM– NPTEL Online Certification Courses are mandated for the students in the PG Programmes from the Academic year 2021-2022.
5. Candidates must have completed Examination Registration successfully within the prescribed time to receive hall tickets and to write examinations.
6. Any Eight – Week, Two-Credit Course in any discipline to offer for two hours a week be chosen by the respective Departments in the second semester of the Postgraduate Programmes.
7. The SWAYAM–NPTEL Online Certification Courses offered during the December – April Semester be chosen by the Departments. The courses may be handled by the Department Mentor or by any teacher in the respective Departments.
8. The allocation of marks for the online examination conducted by the respective IITs is 25:75 for each course.
9. A candidate should obtain a minimum of 40 marks on 100 marks (a minimum of 10 marks for Assignment and 30 marks in the final examination) to pass the Online Courses.
10. If a student fails in the Online Examination conducted by the respective IITs he/she would be permitted to write a Supplementary Examination for 75 marks by the Controller of Examinations of our College.

11. Those who registered for the Online Courses, obtained Assignment marks, appeared for the Online Examination and failed in the courses alone are eligible to apply for the Supplementary Examinations conducted by the College.
12. If a candidate fails in the Supplementary Examinations conducted by the College, the norms followed for taking an Arrear Examination will be adopted.
13. A provision is given to candidates to reappear for Supplementary/Arrear Examinations in the same semester to facilitate them to receive their Degrees.
14. The Question paper in Multiple Choice Question Pattern for 75 marks shall be framed by the respective faculty/ by an External Examiner for conducting the Supplementary Examinations.
15. The Supplementary Examinations would be conducted for three hours.
16. Course Completion Certificate will not be issued by the respective IITs for the candidates who clear the Online Courses through the Supplementary Examinations conducted by the College. The two credits the candidate earns, if passed, would be added in the Consolidated Statement of Marks issued by the Controller of Examinations.

Semester – III

Course Title	MACHINE LEARNING
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS31
Course Type	DSC –VII
Credits	4
Marks	100

General Objective:

To generalize the Concepts of Machine Learning and Deep learning.

Course Objectives:

CONo.	The learners will be able to
CO-1	Summarize Machine Learning algorithms using Python.
CO-2	Classify the various Regression techniques.
CO-3	Apply different Classification and Clustering Algorithms.
CO-4	Illustrate the Text Processing using Python.
CO-5	Understand the basics of learning algorithms in Deep Learning.

UNIT I: INTRODUCTION TO MACHINE LEARNING

Introduction – Machine Learning Process - Feature Engineering: Feature – Feature Engineering – Feature Extraction – Feature Selection – Feature Engineering Methods – Feature Engineering With Python. Data Visualization: Line Chart – Bar Chart – Pie Chart – Histograms – Scatter Plot – Box Plot – Plotting using Object Oriented Way – Seaborn.

UNIT II: REGRESSION

Introduction – Simple Regression – Multiple Regression : Polynomial Regression – Model Assessment – Training Error – Generalized Error – Testing Error – Irreducible Error – Bias – Variance Tradeoff. Ridge Regression – Lasso Regression: All Subset Algorithm – Greedy Algorithm For Feature Selection – Regularization For Feature Selection – Non-Parametric Regression: K-Nearest Neighbor Regression – Kernel Regression.

UNIT III: CLASSIFICATION

Linear Classifiers – Logistic Regression – Decision Tree: Tree Terminology – Decision Tree Learning – Decision Boundaries – Random Forest – Naïve Byes – Clustering – K Means Clustering: Problem With Random Assignment Of Cluster Centroid – Finding Value Of K – Hierarchical Clustering: Distance Metrics – Linkage.

UNIT IV: TEXT ANALYSIS

Basic Text Processing With Python: String Comparisons – String Conversions – String Manipulations – Regular Expression – Natural Language Processing: Stemming - Lemmatization –Tokenization – Text Classification – Topic Modeling.

UNIT V: DEEP LEARNING

Hyper Parameters – Deep Learning Architecture – Deep Belief Networks – Convolutional Neural Networks – Recurrent Neural Networks: Long Short – Term Memory – Deep Stacking Network – Deep Learning Framework – Recommendation System: Popularity Based Recommender Engines – Content based recommendation Engine – Collaborative Filtering.

TEXTBOOKS:

1. Abhishek Vijayvargia, “Machine Learning with Python-an approach to applied ML”, BPB Publications, 2018.
UNIT I, II, III, IV, V – Fully Covered

REFERENCE BOOKS:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.
2. EthemAlpaydin, “Introduction to Machine Learning (Adaptive Computation andMachine Learning Series)”, 4th Edition, MIT Press.
3. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Define the knowledge of Python in Machine Learning.	1,2,5	Remembering
CO-2	Distinguish the various Regression techniques using Machine Learning.	1,2,3,5	Understanding
CO-3	Choose better classification and clustering techniques to improve the model performance.	1,2,3,4,5	Applying
CO-4	Analyze operations on text processing using Python.	1,2,3,4,5	Analyzing
CO-5	Compare Machine Learning with deep Learning Algorithms in a range of real-world applications.	1,2,3,4,5	Evaluating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PCCS31	Machine Learning				75	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓				✓	✓	✓			✓
CO-2	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO-3	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 42 Relationship = High									

Semester – III

Course Title	MOBILE APPLICATION DEVELOPMENT
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS32
Course Type	DSC-VIII
Credits	4
Marks	100

General Objective:

To learn, design and develop the building blocks of Mobile Applications.

Course Objectives:

CONo.	The learners will be able to
CO-1	Familiarize with Mobile platform and Development Environment.
CO-2	Practice the activities, resources and event handling in Mobile Application.
CO-3	Experiment with various Android Services.
CO-4	Design drawable animation and implement Location Service in applications.
CO-5	Plan to test Mobile Application Development and Publish.

UNIT I: GETTING STARTED WITH MOBILITY

Introduction – Mobility panorama – Mobile Platforms – App Development Approaches - Android overview –Setting up Development Environment - Saying Hello to Android – Creating the first app step by step – Setting up an emulator – Behind the scenes – Traversing an android app project structure – Logical components of an android app – Android tool repository – Installing and running app devices.

UNIT II: BUILDING BLOCKS OF MOBILE APPS I

Introduction – Activity – Activity States – Life cycle methods – UI Resources – Layout resources – String resources – Image resources – UI Elements and Events – Event Handling Paradigm – UI elements – Interaction among activities – Navigation between activities – Exchanging data – Fragments – Building Fragments – Life cycle of fragments- Interaction between fragments – Action bar.

UNIT III: BUILDING BLOCKS OF MOBILE APPS II

Introduction – Threads – AsyncTask – Service – States and life cycle methods – Initiating a service – Intent Service – Bound Service – Notifications – Intents and intent Resolutions – Broadcast Receivers – Telephony and SMS.

UNIT IV: SPRUCING UP MOBILE APPS

Introduction – Android graphics – Supporting multiple screens – Drawables – Custom view and canvas – Android Animation – Drawable animation – View animation – Property animation – Google play services – Location services – Locating the user – Tracking user location – Retrieving location address – Maps – Setting up the path – Adding maps – Making maps interactive.

UNIT V: TESTING AND PUBLISHING MOBILE APPS

Testing Android Apps: Introduction – Testing android app components – Activity – Service – Content provider – App testing landscape overview – Publishing Apps: Introduction – Groundwork – Configuring – Packaging – Distributing.

TEXTBOOKS:

1. Anubhav Pradhan, Anil V Deshpande” Composing Mobile Apps
Learn|Explore|Apply using Andriod”, Wiley Publications 1st Edition
2014.

UNIT I – (Chapters 1, 2), UNIT II- (Chapters 4), UNIT III –(Chapters 5),
UNIT IV –(Chapters 7, 9), UNIT V-(Chapters 11, 12)

REFERENCE BOOKS:

1. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition,
Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, “Head First Android Development”,
2nd Edition, O’Reilly, 2017.
3. J F DiMarzio, “Beginning Android Programming with Android Studio”,
4th Edition, John Wiley & Sons, 2017.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Illustrate Android Architecture and various Mobile platforms.	1, 2	Understanding,
CO-2	Use appropriate Building Blocks of Mobile Apps, services in Android Application Development.	1, 2, 3, 4	Applying
CO-3	Integrate Android Services for Application Development.	1, 2, 3, 4, 5	Analyzing
CO-4	Determine the Graphics and Location services.	1, 2, 3, 4, 5	Evaluating
CO-5	Compose the developed app and publish.	1, 2, 3, 4, 5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PCCS32	Mobile Application Development				75	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes(PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓				✓	✓			
CO-2	✓	✓	✓			✓	✓	✓	✓	
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓		✓	✓	✓	✓	✓
	Numberof Matches(✓)= 40 Relationship = High									

Semester – III

Course Title	RESEARCH METHODOLOGY
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS33
Course Type	DSC-IX
Credits	4
Marks	100

General Objective:

To identify the problem and carry out the research individually in a perfect Scientific method.

Course Objectives:

CO No.	The learners will be able to
CO-1	Identify the Research and Scientific methods
CO-2	Determine the different Sampling techniques.
CO-3	Categorize the various Scaling techniques.
CO-4	Examine the analysis techniques for Data Processing.
CO-5	Write Research Report.

UNIT – I INTRODUCTION TO RESEARCH

Research Methodology: Introduction -- Objectives of Research – Types of Research - Research approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific method – Research process – Criteria of good Research – Problems encountered by Researchers in India. Defining the Research problem: What is a Research problem - Selecting the Problem – Techniques involved in defining a problem.

UNIT – II RESEARCH AND SAMPLE DESIGN

Research design: Meaning of research design – Need for Research Design – Features of Good Design – Important concepts relating to Research design – Different Research designs – Basic Principles of Experimental Designs – Important Experimental designs . Design of sample surveys: Introduction - Sample design - Types of sampling designs – Non probability sampling – Probability sampling.

UNIT – III SCALING, DATA COLLECTION

Measurements and scaling: Quantitative and qualitative data – Classifications of measurement scales – Goodness of measurement scales – Sources of error in measurement – Scaling – Scale classification bases – Scaling techniques – Comparative Scaling Techniques – Non- Comparative Scaling Techniques. Data Collection : Collection of Primary Data — Observation Method – Interview method – Collection of data through Questionnaires – Collection of data through Schedules – Difference between Questionnaire and schedule – Guidelines for constructing Questionnaire/schedule – Some other methods of data collection – Collection of secondary data – Selection of Appropriate method for data collection.

UNIT – IV ANOVA

Data Preparation : Data preparation process – Questionnaire checking – Editing – coding – classification – tabulation – Graphical representation – Data cleaning – Data adjusting – Some problems in preparation process – Types of analysis – Statistics in research. Analysis of variance: The ANOVA technique – One way ANOVA – Two way ANOVA

UNIT – V REPORT WRITING, ALGORITHMIC RESEARCH

Interpretation and Report Writing : Meaning of interpretation –Technique of interpretation – Precaution in Interpretation – Significance of Report Writing – Different Steps in Writing Report – Layout of the Research Report – Types of Reports – Mechanics of Writing a Research Report. Algorithmic Research: Algorithmic Research Problems – Types of Solution Procedure/ Algorithm – Steps of Development of Algorithm – Comparison of Algorithms.

TEXT BOOK (S)

1. C.R.Kothari, “Research Methodology, Methods and Techniques”, Fourth edition, New Age International Publishers, 2019. Unit I (Chapter 1 and 2.1, 2.2, 2.3, 2.4), Unit II (Chapter 3 and 4.1, 4.2, 4.5),Unit III (Chapter 5 and 6), Unit IV (Chapter 7 and 12.1 to 12.4),
2. R.Panneerselvam, “Research Methodology”, PHI, 2009. Unit V-(Chapter 13)

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Select Research problem and techniques.	1,2,3,4,5	Understanding
CO-2	Choose suitable sample designs for Research problem.	1,2,3,4	Applying
CO-3	Select appropriate method for data collection.	1,2,3,4,5	Analyzing
CO-4	Characterize the Data using ANOVA techniques.	1,2,3,4,5	Analyzing
CO-5	Prepare Report writing.	1,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PCCS33	Research Methodology				75	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-2	✓		✓	✓	✓	✓	✓	✓	✓	
CO-3	✓			✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓		✓	✓	✓	✓		✓	✓	✓
	Number of matches (✓) = 44 Relationship = High									

Semester – III

Course Title	ARTIFICIAL INTELLIGENCE
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS31A
Course Type	DSE-IIIA
Credits	4
Marks	100

General Objective:

To provide a strong foundation of fundamental concepts in Artificial Intelligence, Natural Language Processing and fuzzy sets.

Course Objectives:

CONo.	The learners will be able to
CO-1	Discuss the concepts of Artificial Intelligence.
CO-2	Examine the methods of solving problems using Artificial Intelligence.
CO-3	Describe the concepts of Predicate Logic
CO-4	Outline the leading trends and systems in NLP
CO-5	Relate the basic concepts of modelling in systems using Fuzzy Sets

UNIT I: APPROACHES TO AI

What is Artificial Intelligence? : – The AI Problems – What is an AI Techniques? – Problems, Problems spaces and search: Defining the Problems as a State Space Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the Design of Search Programs

UNIT II: KNOWLEDGE REPRESENTATION

Heuristic Search Techniques: Generate and Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction – Means Ends Analysis - Representation and Mappings – Approaches to Knowledge Representation – Issues in Knowledge Representation.

UNIT III: PREDICATE LOGIC

Representing Simple facts in Logic – Representing Instance and Is a relationships – Computable functions and Predicates – Resolutions – Natural Deductions - Representing Knowledge Using Rules: Procedural versus Declarative Knowledge – Forward versus Backward Reasoning – Matching – Control Knowledge.

UNIT IV: PLANNING AND NATURAL LANGUAGE PROCESSING

The Minimax Search Procedure – Adding Alpha-beta Cutoffs – Iterative Deepening – Planning: Components of a Planning System – Goal Stack Planning – Nonlinear Planning Using Constraint Posting – Hierarchical Planning – Natural Language Processing.

UNIT V: FUZZY SETS

Introduction to Fuzzy logic – Classical Sets - Fuzzy Sets – Classical Relations - Fuzzy Relations - Membership Functions – Fuzzification – Methods of Membership Value Assignments –Defuzzification Methods – Fuzzy Inference Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems

TEXT BOOK(S):

1. Elaine Rich, Kevin Knight, “Artificial Intelligence”, 3/e, TataMcGraw Hill Publishing Ltd., - New Delhi, 1991. Unit I – (Chapter 1,2), Unit II- (Chapter 3, 4), Unit III- (Chapter 5, 6), Unit IV –(Chapter 12, 13, 15),
2. S.N Sivanandam S.N Deepa “Principles of Soft Computing”, 3/e Wiley – India, 2007. Unit V- (Chapter 10, 11, 12, 13, 15.8, 16, 17)

REFERENCE(S):

1. Introduction to Artificial Intelligence and Expert Systems, Dan W.Patterson, Prentice Hall of India, New Delhi, 1992
2. Artificial Intelligence, A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson Education, reprint 2003.
3. Introduction to Expert Systems, 3/e, Peter Jackson, Pearson Education, Reprint 2003
4. Artificial Intelligence, A New Synthesis, Nils J. Nilsson Harcourt Asia Pvt. Ltd., 1998

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.	1,2,3,5	Understanding
CO-2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.	1,2,3,5	Analyzing
CO-3	Identify appropriate AI methods to solve a given problem.	1,2,3,4,5	Applying
CO-4	Evaluate the concept, Natural Language processing to problems leading to understanding of Cognitive Computing.	1,4,5	Evaluating
CO-5	Create the capability to represent various real life problem domains using Fuzzy Logic based techniques.	1,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PECS31A	Artificial Intelligence				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓	✓		✓	✓	✓	✓		✓
CO-2	✓	✓	✓		✓	✓	✓	✓		✓
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓			✓	✓
CO-5	✓	✓	✓	✓	✓	✓			✓	✓
	Number of matches (✓) = 42 Relationship = Medium									

Semester – III

Course Title	HUMAN COMPUTER INTERACTION
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS31B
Course Type	DSE-IIIB
Credits	4
Marks	100

General Objective:

To gain knowledge on the fundamental principles, evaluation methodologies and cognitive aspects of interactions between Human and Computer.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the fundamentals of Graphical Computer Interfaces in the field of HCI.
CO-2	Illustrate the software process of interaction between Human and Computer.
CO-3	Implement the HCI models and methodologies using HCI tools.
CO-4	Analyze the Cognitive Architecture for Socio Organizational issues.
CO-5	Assess the Communication and collaboration models which is interact between Human and Computer.

UNIT I: FOUNDATIONS

Human: Human memory – Emotion – Individual differences – Psychology and the design of interactive systems – Computer: Devices used for Text entry, display, virtual reality and 3D interactions – Positioning & pointing – physical controls, sensors and special devices – memory – processing and networks.

UNIT II: INTERACTION DESIGN BASICS

Paradigms of interactions – process of design – HCI in software process – software life cycle – usability engineering – interactive design and prototyping – design rules: principles to support usability – standards – guidelines and rules for heuristics – HCI patterns – implantation support – evaluation technique – user support.

UNIT III: IMPLEMENTATION AND EVALUATION

Elements of windowing systems – Toolkits – User interface systems – Goals of evaluation – evaluation through expert system - user participation – choosing evaluation method – universal design principles – multi-modal interaction – design focus – user support.

UNIT IV: MODELS AND THEORIES-1

Cognitive models: Goals and task hierarchies – linguistic models – challenge of display based systems- physical and device models – cognitive architecture – socio organizational issues and stakeholder requirements: organizational issues – capturing requirements.

UNIT V: MODELS AND THEORIES-2

Communication and collaboration models: face to face communication – conversion – text based communication – group working – task analysis: task decomposition – knowledge based analysis – dialog notations and design – models of systems – models of rich interactions.

REFERENCE(S) :

1. Julie A. Jacko, “Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications”, 3rd edition, CRC Press, ISBN 9781439829431, 2012.
2. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human computer Interaction”, 3rd edition, Wiley, ISBN-10: 0470665769, 2011.
3. Dix A, Human – Computer Interaction. Harlow, England: Prentice Hall, ISBN- 10:0130461091, 2004.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the human memory, emotion, psychology and apply in to Interactive System.	1,2,5	Understanding
CO-2	Design the HCI prototype using standard technique, guidelines, and patterns.	1,2,3,4	Applying
CO-3	Analyze selected design methods and evaluation methods at a basic level of competence.	1,2,4	Analyzing
CO-4	Evaluate the Cognitive Architecture based on the stakeholder requirements.	1,2,3,4,5	Evaluating
CO-5	Design and develop the prototype with HCI techniques that are usable by people.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PECS31B	Human Computer Interaction				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓		✓	✓	✓	✓			✓
CO-2	✓	✓		✓	✓	✓	✓	✓	✓	
CO-3	✓	✓	✓	✓	✓	✓	✓		✓	
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 43 Relationship = Medium									

Semester – III

Course Title	SOFT COMPUTING
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS31C
Course Type	DSE-IIIC
Credits	4
Marks	100

General Objective:

To expose the students of soft computing, various types of Soft computing techniques and applications of Soft Computing.

Course Objectives :

CONo.	The learners will be able to
CO-1	Understand the concepts of Neural Networks.
CO-2	Choose better learning network for an application.
CO-3	Simplify the Fuzzy Set and Relations.
CO-4	Analyze the Fuzzy Rules.
CO-5	Implement the application of Genetic Algorithms.

UNIT I INTRODUCTION

Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics - Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope – Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch-Pitts Model – Hebb Network – Linear Separability.

UNIT II SUPERVISED LEARNING NETWORKS

Perceptron Networks – Adaline and Madaline Networks – Back Propagation Network – Radial Basis Function Network. Associative Memory Networks – BAM - Hopfield Network - Boltzmann Machine. Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network.

UNIT III FUZZY SETS

Basic Concept – Crisp Set Vs Fuzzy Set - Operations on Fuzzy Set – Properties of Fuzzy Sets – Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation - Membership Functions: Features – Fuzzification – Methods of Membership value assignments – Defuzzification – Methods.

UNIT IV FUZZY ARITHMETIC

Fuzzy Arithmetic – Extension Principle – Fuzzy Measures – Fuzzy Rules and Fuzzy Reasoning: Fuzzy Propositions – Formation of Rules –Decomposition of Rules – Aggregation of Rules – Approximate Reasoning – Fuzzy Inference and Expert Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT V GENETIC ALGORITHM

Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

TEXT BOOK(S):

1. S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, Wiley India, 2007.

REFERENCE(S):

1. S. Rajasekaran, G.A.V. Pai, “Neural Networks, Fuzzy Logic, Genetic Algorithms”, Prentice Hall India, 2004.

Course Outcomes

CO No.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Demonstrate the fundamental theory and concepts of Neural Networks	1,2,3,5	Understanding
CO-2	Select appropriate Learning Network Architectures as per need.	1,2,3,5	Applying
CO-3	Examine the concepts of fuzziness involved in various systems and fuzzy set theory	1,2,3,5	Analyzing
CO-4	Determine the Fuzzy Rules to solve Fuzzy Reasoning.	1,4,5	Evaluating
CO-5	Choose better Genetic Algorithms for and needed applications.	1,4,5	Applying

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PECS31C	Soft Computing				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓			✓	✓	✓	✓		✓
CO-2	✓	✓			✓	✓	✓	✓		✓
CO-3	✓	✓	✓		✓	✓	✓	✓		✓
CO-4	✓	✓	✓	✓	✓	✓			✓	✓
CO-5	✓	✓	✓	✓	✓	✓			✓	✓
	Number of matches (✓) = 38 Relationship = High									

Semester – III

Course Title	MACHINE LEARNING PRACTICALS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS3P1
Course Type	Practical –V
Credits	2
Marks	100/2

General Objective:

To apply machine learning techniques for real-world problems.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the basic concepts and techniques of Machine Learning.
CO-2	Utilize with regression methods, classification methods and Clustering methods.
CO-3	Implement Dimensionality Reduction Techniques.
CO-4	Make use of Data sets in implementing the Machine Learning Algorithms
CO-5	Develop the Machine Learning Applications.

1. Implement Factors and Vector Manipulation.
2. Implement Matrix Arithmetic Operations.
3. Implement the concepts of Lists and Data Frames.
4. Implement Functions and String Construction.
5. Reading and Writing Files.
6. Implement Classification using Nearest Neighbors.
7. Implement Classification using Naive Bayes.
8. Implement Classification using Decision Trees.
9. Implement Linear Regression.
10. Implement Support Vector Machines.
11. Implement Market Basket Analysis using Association Rules.
12. Implement K-means Clustering Algorithm.
13. Implement Hierarchical Clustering Algorithm.
14. Write a program to measure the performance of classification.
15. Write a program to improve the performance of random forest model.

Course Outcomes

CONo.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Demonstrate the concepts of Machine Learning.	1,2,5	Understanding
CO-2	Use classification and clustering that is suitable for a given problem.	1,2,5	Applying
CO-3	Implement the problems using various Machine Learning techniques.	1,2,3,5	Applying
CO-4	Design Dimensionality reduction techniques.	1,2,3,4,5	Creating
CO-5	Develop application using Machine Learning techniques to solve real life problems.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours			Credits	
III	21PCCS3P1	Machine Learning Practical				60			2	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓			✓	✓	✓			✓
CO-3	✓	✓	✓		✓	✓	✓	✓		✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 40 Relationship = High									

Semester – III

Course Title	MOBILE APPLICATION DEVELOPMENT PRACTICALS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS3P2
Course Type	Practical –VI
Credits	2
Marks	100/2

General Objective:

To provide practical experience in the art of Android programming and publish Mobile applications.

Course Objectives:

CONo.	The learners will be able to
CO-1	Demonstrate the components and structure of Mobile Application Development Frameworks for Android based mobiles.
CO-2	Choose better layout for Android Applications.
CO-3	Illustrate Menus in the development of Android Applications.
CO-4	Determine appropriate sensors presents in Mobile Devices and understand the capabilities and limitations.
CO-5	Compose and publish Android Mobile Application.

Program List:

1. Setting up android and android emulator and develop a program to display “Hello World” on screen.
2. Develop a program to create a Unlock Slide-Bar in Android.
3. Develop a program to change the Screen Orientation a Button in Android.
4. Develop a program to implement linear layout and absolute layout.
5. Develop a program to implement frame layout, table layout and relative layout.
6. Develop a program to implement Button, Image Button and Toggle Button.
7. Develop a program to implement Menu and sub menu and option menu.
8. Develop a program to implements Multi Threading.

9. Create a program to demonstrating Services in Android.
10. Create Canvas animations: Simple Circle Progress View on Android.
11. Display the List of Sensors Present in an Android Device.
12. Create .apk file and publishing.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Explain Configuration of Android environment and components of Android.	1, 2, 5	Understanding
CO-2	Construct rich user Interfaces by using Layouts and Controls.	1, 2, 3, 4	Applying
CO-3	Inspect Android Services for Mobile Application Development.	1, 2, 3, 4	Analyzing
CO-4	Select appropriate sensors presents in mobile Devices to develop applications.	1, 2, 3, 5	Evaluating
CO-5	Develop application on Mobile platform and Publish it.	1, 2, 3, 4, 5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PCCS3P2	Mobile Application Development Practicals				60	2			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes(PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓	✓	✓		✓	✓	✓	✓	
CO-3	✓	✓	✓	✓		✓	✓	✓	✓	
CO-4	✓	✓	✓	✓		✓	✓	✓		✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of Matches(✓)= 40, Relationship =High									

Semester – III

Course Title	DIGITAL TECHNOLOGY
Total Hrs.	30
Hrs./Week	2
Sub.Code	21PICS31
Course Type	IDC – II
Credits	2
Marks	100/2

General Objective:

To provide a better understanding of the orientation in the current development of the modern network technologies which are used in E-Commerce.

Course Objectives:

CO No.	The learners will be able to
CO-1	Discuss fundamentals of e-commerce, types and applications.
CO-2	Choose better Internet and web features and services that support e-Commerce.
CO-3	Summarize issues involved in choosing the most appropriate hardware and software for an e-Commerce site.
CO-4	Assess security in E-Commerce Payment System
CO-5	Express the various challenges in protection of intellectual Property and Online Privacy.

UNIT I: INTRODUCTION

Introduction to E-commerce – Features of E-commerce Technology - Types of E-commerce: Business-to-Consumer (B2C) E-commerce - Business-to-Business (B2B) E-commerce - Consumer-to-Consumer (C2C) E-commerce - Mobile E-commerce (M-commerce) - E-commerce: A Brief History - Understanding E-commerce: Organizing Themes

UNIT II: E-COMMERCE INFRASTRUCTURE

The Internet: Technology Background: Packet Switching, TCP/IP, IP Addresses, Domain Names and URLs, Client/Server Computing - The Web: Markup Languages, Web Servers and Clients, Web Browsers - The Internet and the Web: Features and Services: Communication Tools, Search Engines, Web 2.0 Applications and Services - Mobile Apps.

UNIT III: BUILDING AN E-COMMERCE PRESENCE

Building an E-commerce Presence: A Systematic Approach - Choosing Software - Choosing Hardware - Other E-commerce Site Tools: Website Design: Basic Business Considerations, Tools for Interactivity and Active Content,

Personalization Tools - Developing a Mobile Website and Building Mobile Applications.

UNIT IV:E-COMMERCE SECURITY AND PAYMENT SYSTEMS

The E-commerce Security Environment - Security Threats in the E-commerce Environment - Technology Solutions - Management Policies, Business Procedures, and Public Laws - E-commerce Payment Systems.

UNIT V: ETHICAL, SOCIAL, AND POLITICAL ISSUES IN E-COMMERCE

Understanding Ethical, Social, and Political Issues in E-commerce: Basic Ethical Concepts - Responsibility, Accountability, and Liability- Analyzing Ethical Dilemmas, Candidate Ethical Principles - Intellectual Property Rights: Types of Intellectual Property Protection, Copyright: the Problem of Perfect Copies and Encryption.

TEXT BOOK(S):

1. "Digital Technology ", PG AND RESEARCH DEPARTMENT OF COMPUTER SCIENCE

REFERENCE(S):

1. Kenneth C.Laudon, Carlo Guercio Traver, "E- Commerce-business, Technology, Society," Pearson Education 2017. Unit I -(Chapter 1), Unit II -(Chapter 3), Unit III -(Chapter 4), Unit IV -(Chapter 5), Unit V -(Chapter 8)
2. Mike Papazologn, "E-Business, Organizational and Technical Foundations," Wiley India Pvt Ltd, 2008.
3. Elias M. Awad, "Electronic Commerce", Prentice-Hall of India, 2008.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the concept of e-Commerce.	1,2,5	Understanding
CO-2	Carry out the business through online technology.	1,2,3,5	Applying
CO-3	Select tools to build an e-Commerce Website.	1,2,3,4,5	Analyzing
CO-4	Predict the key security threats in the e-commerce environment and identify the Secure Payment System.	1,2,3,5	Evaluating
CO-5	Solve the problem of Intellectual Property Rights and Online Privacy.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
III	21PICS31	Digital Technology				30	2			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓				✓	✓	✓			✓
CO-2	✓	✓	✓		✓	✓	✓	✓		✓
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓		✓	✓	✓	✓		✓
CO-5	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 40 Relationship = High									

Semester – IV

Course Title	INTERNET OF THINGS
Total Hrs.	75
Hrs./Week	5
Sub. Code	21PCCS41
Course Type	DSC-X
Credits	4
Marks	100

General Objective:

To understand the concept of Internet of Things to develop IoT Devices for the real-time applications.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand the fundamentals of Internet of Things
CO-2	Illustrate the various types of IoT architecture
CO-3	Organize the different types of IoT protocols to maintain IoT standards.
CO-4	Differentiate between the Web of Things and IoT.
CO-5	Produce the IoT devices for Industry applications.

UNIT I: INTRODUCTION To IoT

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels and Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

UNIT II: IoT ARCHITECTURE

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III: IoT PROTOCOLS

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security.

UNIT IV: WEB OF THINGS

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT V: APPLICATIONS

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

TEXT BOOK(S):

1. ArshdeepBahga, Vijay Madiseti, “Internet of Things – A hands- on approach”, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
3. Jan Ho“ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
6. The Internet of Things in the Cloud - A Middleware Perspective By Honbo Zhou Copyright Year 2013

Unit I Chapter 1 to 5 (Text Book 1)

Unit II Chapter 14 (Text Book 5)

Unit III (Text Book 5)

Unit IV (Text Book 6)

Unit V Chapter 7 & 8 (Text Book 2) Chapter 15 & 16 (Text Book 5)

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Exemplify the knowledge of IoT.	1,2,3	Understanding
CO-2	Apply the IoT models in IoT Architecture.	1,2,3,4,5	Applying
CO-3	Relate IoT protocols in networking platform.	1,2,3,4,5	Analyzing
CO-4	Evaluate WoT and IoT in multi layer architecture.	1,2,3,4,5	Evaluating
CO-5	Create smart applications to the real-time scenario.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
IV	21PCCS41	Internet of Things				75	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓				✓	✓	✓		
CO-2	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO-3	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 43 Relationship = High									

Semester – IV

Course Title	DATA SCIENCE WITH R
Total Hrs.	75
Hrs./Week	5
Sub.Code	21PCCS42
Course Type	DSC –XI
Credits	4
Marks	100

General Objective:

To study the complete data analysis process, familiarize with R programming and apply them in solving real time scientific problems.

Course Objectives:

CONo.	The learners will be able to
CO-1	Understand Data Science and its process.
CO-2	Examine the exploratory Data Analysis and Data Distribution
CO-3	Explain basic Statistical Analysis and Testing.
CO-4	Utilize R programming for data findings.
CO-5	Choose Learning Algorithms for analyze data to solve real world problems.

UNIT I: DATA SCIENCE INTRODUCTION

Data science in a big data world: Benefits and uses of data science and big data - Facets of data: Structured data - Unstructured data - Natural language - Machine-generated data - Graph-based or network data - Audio, image, and video - Streaming data. The data science process: Overview of the data science process - Defining research goals and creating a project charter - Retrieving data - Cleansing, integrating, and transforming data - Exploratory data analysis - Build the models - Presenting findings and building applications on top of them.

UNIT II: EXPLORATORY DATA ANALYSIS

Elements of Structured Data: Rectangular Data - Data Frames and Indexes - Nonrectangular Data Structures - Estimates of Location: Mean - Median and Robust Estimates. Estimates of Variability: Standard Deviation and Related Estimates - Estimates Based on Percentiles. Exploring the Data Distribution: Percentiles and Boxplots - Frequency Table and Histograms - Density Estimates. Exploring Binary and Categorical Data: Mode - Expected Value. Correlation: Scatterplots - Exploring Two or More Variables: Hexagonal Binning and Contours (Plotting Numeric versus Numeric Data) - Two Categorical Variables - Categorical and Numeric Data - Visualizing Multiple Variables.

UNIT III: STATISTICAL EXPERIMENTS AND SIGNIFICANCE TESTING

A/B Testing - Hypothesis Tests: The Null Hypothesis - Alternative Hypothesis - One-Way, Two-Way Hypothesis Test – Resampling: Permutation Test - Exhaustive and Bootstrap Permutation Test - Permutation Tests: The Bottom Line for Data Science. Statistical Significance and P-Values: P-Value – Alpha - Type 1 and Type 2 Errors - Data Science and P-Values – t-Tests - Multiple Testing - Degrees of Freedom. ANOVA: F-Statistic - Two-Way ANOVA. Chi-Square Test: A Resampling Approach- Statistical Theory - Fisher’s Exact Test - Relevance for Data Science - Multi-Arm Bandit Algorithm - Power and Sample Size.

UNIT IV: WORKING WITH R

Data Manipulation: Data Already in R - Quickly Reviewing Data → Reading Data -Manipulating Data with dplyr - Tidying Data with tidyr. Visualizing Data: Basic Graphics - The Grammar of Graphics and the ggplot2 Package - Figures with Multiple Plots. Working with Large Datasets: Subsample Your Data Before You Analyze the Full Dataset - Running Out of Memory during Analysis - Too Large to Plot - Too Slow to Analyze - Too Large to Load.

UNIT V: SUPERVISED AND UNSUPERVISED LEARNING

Supervised Learning: Machine Learning - Supervised Learning: Regression versus Classification, Inference versus Prediction - Specifying Models: Linear Regression, Logistic Regression, Model Matrices and Formula - Validating Models: Evaluating Regression Models , Evaluating Classification Models, Random Permutations of Your Data, Cross-Validation, Selecting Random Training and Testing Data - Supervised Learning Packages: Decision Trees, Random Forests, Neural Networks, Support Vector Machines - Naive Bayes. Unsupervised Learning: Dimensionality Reduction: Principal Component Analysis, Multidimensional Scaling - Clustering: k-Means Clustering, Hierarchical Clustering - Association Rules - Fitting Models.

Textbooks:

1. Davy Cielen, Arno Meysman, Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
Unit I-(Chapters 1.1, 1.2, 2)
2. Peter Bruce, Andrew Bruce “Practical Statistics for Data Scientists”, O'Reilly Media, Inc., 2017. Unit II Chapter 1, Unit III Chapter 3
3. Thomas Mailund, Aarhus, Denmark, “Beginning Data Science in R Data Analysis, Visualization, and Modelling for the Data Scientist”, 2017.
Unit IV-(Chapters 3, 4, 5)
Unit V-(Chapters 6, 7)

Reference Books:

1. Rafael A. Irizarry, “Introduction to Data Science: Data Analysis and Prediction Algorithms with R”, Chapman and Hall/CRC, 2019.
2. Norman Matloff, “The Art of R Programming A Tour of Statistical Software Design”, No Starch Press, 2011.

Course Outcomes

CONo.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Outline the concepts of Data Science.	1,2,5	Understanding
CO-2	Analyze with exploratory analysis of data.	1,2,5	Analyzing
CO-3	Interpret statistical experiments and testing.	1,2,3,5	Applying
CO-4	Apply data analysis using R programming.	1,2,3,4,5	Evaluating
CO-5	Plan supervised, unsupervised learning and identify its applicability in real life problems.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
IV	21PCCS42	Data Science with R				75	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓			✓	✓	✓			✓
CO-3	✓	✓	✓		✓	✓	✓	✓		✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 40 Relationship = High									

Semester – IV

Course Title	Project
Total Hrs.	120
Hrs./Week	8
Sub.Code	21PPCS41
Course Type	Project
Credits	8
Marks	100

The following are the guidelines to be adhered to by the Postgraduate students :

- Individual Projects should be taken.
- The Project should be written in English only.
- The Minimum number of pages should be 60.
- Project observations, suggestions and summation/conclusion shall form part of the Project Report.
- The Projects will be evaluated by the Internal Examiner and the External Examiner for 150 marks. The distribution of mark should be 90 marks for the Project Report and 60 marks for the Viva-Voce Examination. The Division of marks for the Project Report is as follows:

Particulars	Internal Examiner	External Examiner
Wording of Title	5	5
Objectives / Formulation including Hypothesis	10	10
Review of Literature	15	15
Relevance of the Project to Social Needs	10	10
Methodology / Technique / Procedure Adopted	30	30
Summary / Findings / Conclusion / Summation	10	10
Bibliography / Annexure / Foot notes / Works Cited / Works Consulted	10	10
Total	90	90

- ❖ The Internal Examiner and the External Examiner will award the marks for each candidate. The average mark obtained by the candidate is considered marks for the Project Report.

Semester – IV

Course Title	PROFESSIONAL ETHICS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS41A
Course Type	DSE-IVA
Credits	4
Marks	100

General Objective:

To learn the moral values or ethics that ought to guide the profession.

Course Objectives:

CONo.	The learners will be able to
CO-1	Relate the awareness on Ethics and Human Values in professional environment.
CO-2	Identify the important treaties and conventions relating to Intellectual Property Rights.
CO-3	Analyze the software issues and Computer Crimes.
CO-4	Inspect the threat of Cyber Bullying.
CO-5	Value the social, moral and ethical challenges arising from online Social Networks.

UNIT I: HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality.

UNIT II: INTELLECTUAL PROPERTY RIGHTS AND COMPUTER TECHNOLOGY

Foundations of Intellectual Property – Ownership - Intellectual Property Crimes - Protection of Ownership Rights - Protecting Computer Software under the IP - Transnational Issues and Intellectual Property. Social Context of Computing: The Digital Divide - Obstacles to Overcoming the Digital Divide - ICT in the Workplace - Employee Monitoring - Employee Health and Productivity in the Workplace.

UNIT III: SOFTWARE ISSUES: RISKS AND LIABILITIES

Definitions - Causes of Software Failures – Risk - Consumer Protection - Improving Software Quality - Producer Protection. Computer Crimes: History of Computer Crimes - Types of Computer Systems Attacks - Motives of Computer

Crimes - Costs and Social Consequences - Computer Crime Prevention Strategies.

UNIT IV: CYBER BULLYING

Definition - Types of Cyber bullying - Areas of Society Most Affected by Cyber bullying: Schools – Cyber bullying in the Workplace - Legislation Against Cyber bullying: Federal Laws – State Laws – International Laws - Effects of Cyber bullying - Dealing with Cyber bullying: Awareness – Legislation – Community Support – Resources.

UNIT V: NEW FRONTIERS FOR COMPUTER ETHICS

Artificial Intelligence – Virtualization - Cyberspace and the Concept of Tele presence. Ethical, Privacy, and Security Issues in the Online Social Network Ecosystems: Introduction to Computer Networks - Social Networks (SNs) - Online Social Networks (OSNs) - Ethical and Privacy Issues in Online Social Networks - Security and Crimes in Online Social Networks - Proven Security Protocols and Best Practices in Online Social Networks.

TEXTBOOKS:

1. Joseph Migga Kizza, “Ethics in Computing A Concise Module”, Springer, 2016, DOI 10.1007/978-3-319-29106-2.
UNIT II: (Chapters 5, 6)
UNIT III: (Chapters 7, 8)
UNIT IV: (Chapters 9)
UNIT V: (Chapters 10, 11)
2. UNIT I : [https://www.siet.ac.in/downloads/Handbook on Professional Ethics & Human Values.pdf](https://www.siet.ac.in/downloads/Handbook%20on%20Professional%20Ethics%20&%20Human%20Values.pdf) (**WEBLINK**)

REFERENCE BOOKS:

Kenneth Einar Himma and Herman T. Tavani, “The Handbook of Information and Computer Ethics”, Wiley, 2008.

ONLINE RESOURCE(S) :

1. <http://jgustilo.pbworks.com/f/the-handbook-of-information-and-computer-ethics.pdf>

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand the importance of moral issues and human values.	1,5	Understanding
CO-2	Make use of the Intellectual Property Rights in Computer technology.	1,3,4,5	Applying
CO-3	Examine the ethical concerns in software issues and crimes.	1,2,3,4,5	Analyzing
CO-4	Examine about Cyber Bullying and its laws.	1,4,5	Analyzing
CO-5	Evaluate the ethical values in Artificial Intelligence and online Social Network.	1,2,3,4,5	Evaluating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours			Credits	
IV	21PECS41A	Professional Ethics				60			4	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓			✓	✓	✓				✓
CO-2	✓		✓	✓	✓	✓		✓	✓	✓
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓		✓	✓	✓			✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 40 Relationship = High									

Semester – IV

Course Title	GREEN COMPUTING
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS41B
Course Type	DSE-IVB
Credits	4
Marks	100

General Objective:

To know about the basic energy management option in individual Hardware and Software components.

Course Objectives:

CONo.	The learners will be able to
CO-1	Express the concept of green IT
CO-2	Choose hardware and software that can facilitate a more sustainable operation
CO-3	Plan and organize Green Enterprise
CO-4	Assess Strategizing and Implementation of Green IT
CO-5	Create awareness about laws, standards, protocols and certifications related to Green IT

UNIT I: GREEN IT : AN OVERVIEW

Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing Environmental sustainability, Green IT Standards and Eco-Labeling of IT, Enterprise Green IT strategy, Green IT: Burden or Opportunity?

UNIT II: GREEN DEVICES AND HARDWARE WITH GREEN SOFTWARE

Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and Measuring software Impact to platform power.

UNIT III: GREEN ENTERPRISES AND THE ROLE OF IT

Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.

UNIT IV: MANAGING GREEN IT

Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media.

UNIT V: REGULATING THE GREEN IT: LAWS, STANDARDS AND PROTOCOLS

Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies, Green building standards, Green data centers, Social movements and Greenpeace.

TEXT BOOK(S):

1. Harnessing Green IT Principles and Practices , San Murugesan, G.R. Gangadharan Wiley Publication, ISBN:9788126539680
Unit I – Chapter 1, Unit II- (Chapter 2, 3), Unit III – (Chapter 12)
Unit IV – (Chapter 14), Unit V – (Chapter 15)

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO1	Understand the concepts of technologies that conform to low-power computation	1, 2, 4	Understanding
CO2	Determine green (power-efficient) technologies for hardware components.	1, 2, 4	Applying
CO3	Analyze IT usage and issues in Green Enterprises	1, 2,3, 4	Analyzing
CO4	Select tools to help monitor and design Green Systems	1, 2, 3,4,5	Evaluating
CO5	Adapt various laws, standards and protocols for regulating Green IT	1, 2, 3, 4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits				
IV	21PECS41B	Green Computing				60	4				
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5	
	CO-1	✓	✓		✓		✓	✓		✓	
	CO-2	✓	✓		✓		✓	✓		✓	
	CO-3	✓	✓	✓	✓		✓	✓	✓	✓	
	CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 40 Relationship = High										

Semester – IV

Course Title	EMBEDDED SYSTEMS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PECS41C
Course Type	DSE-IVC
Credits	4
Marks	100

General Objective:

Students have knowledge about the basic functions, structure, concepts and applications of Embedded Systems.

Course Objectives:

CONo.	The learners will be able to
CO-1	To introduce the Building Blocks of Embedded System
CO-2	Understand the basic hardware components and their selection method based on the characteristics and attributes of an Embedded System.
CO-3	Describe the hardware software co-design and Firmware Design approaches
CO-4	Know the RTOS internals, multitasking, task scheduling, task communication and synchronization
CO-5	Learn the development life cycle of Embedded System

Unit I Introduction

Introduction to Embedded system - Embedded system vs General computing systems - History - Classification - Major Application Areas - Purpose of Embedded systems - Smart running shoes: The innovative bonding of lifestyle with embedded technology. Characteristics and Quality Attributes of Embedded systems

Unit II Elements of an Embedded system

Elements of an Embedded system - core of the embedded system: General purpose and domain specific processors, ASICs, PLDs, COTS Memory - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces - Embedded Firmware - Reset circuit, Brown-out protection circuit, Oscillator unit, Real-time clock, and Watchdog timer - PCB and Passive Components.

Unit III Embedded Systems

Embedded Systems - Washing machine: Application-specific - Automotive: Domain specific. Hardware Software Co-Design - Computational Models - Embedded Firmware Design Approaches - Embedded Firmware Development Languages - Integration and testing of Embedded Hardware and firmware.

Unit IV RTOS based Embedded System Design

Operating System Basics - Types of operating Systems - Tasks, process and Threads - Multiprocessing and Multitasking - Task Scheduling- Task Communication - Task Synchronisation - Device Drivers - choosing an RTOS.

Unit V Components in embedded system

Components in embedded system development environment, Files generated during compilation, simulators, emulators and debugging - Objectives of Embedded product Development Life Cycle – Different Phases of EDLC - EDLC Approaches - Trends in Embedded Industry - Case Study: Digital Clock.

TEXT BOOK(S):

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

REFERENCE(S):

1. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", TMH. Second Edition 2009
2. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley. Third Edition 2006
3. Cliff Young, Faraboschi Paolo, and Joseph A. Fisher, "Embedded Computing: A VLIW Approach to Architecture, Compilers and Tools", Morgan Kaufmann Publishers, An imprint of Elsevier, 2005.
4. David E. Simon, "An Embedded Software Primer" Pearson Education, 1999

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Understand a basic knowledge about fundamentals of Embedded System.	1, 2, 3	Understand
CO-2	Describe the differences between the general computing system and the Embedded system, also recognize the classification of Embedded Systems.	1, 2, 3,5	Remember
CO-3	Analyze and develop embedded hardware and software development cycles and tools.	1, 2, 3, 4,5	Analysis
CO-4	Design real time embedded systems using the concepts of RTOS.	1, 2, 3,4,5	Create
CO-5	Apply different phases of EDLC	1,2,3,4,5	Apply

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits			
IV	21PECS41C	Embedded Systems				60	4			
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓			✓	✓	✓	✓		
CO-2	✓	✓			✓	✓	✓	✓		✓
CO-3	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 42 Relationship = High									

Semester – IV

Course Title	INTERNET OF THINGS PRACTICALS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS4P1
Course Type	Practical-VII
Credits	2
Marks	100/2

General Objective:

To train students in the field of IoT based application development.

Course Objectives

CONo.	The learners will be able to
CO-1	Develop IoT based system.
CO-2	Relate the need of IoT in the Research Community and Software industry.
CO-3	Build capable talent, start-up community for Entrepreneurial Ecosystem.
CO-4	Experiment with innovative application's needs for the real-time scenario.
CO-5	Construct IoT based Applications.

1. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
2. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
3. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
4. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
5. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
6. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.

9. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak cloud.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO1	Choose the concepts of Internet of Things to solve real-time problems.	1,2,5	Remembering
CO2	Demonstrate the basic IoT applications on Embedded Platform	1,2,3,5	Understanding
CO3	Analyze the performance of IoT applications in different Domains.	1,2,3,4,5	Analyzing
CO4	Assess IOT applications using Arduino / Raspberry Pi	1,2,4,5	Evaluating
CO5	Design effective techniques to create IoT based Applications	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours			Credits	
IV	21PCCS4P1	Internet of Things Practicals				75			4	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓			✓	✓	✓	✓		✓
CO-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-4	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 42 Relationship = High									

Semester – IV

Course Title	DATA SCIENCE WITH R PRACTICALS
Total Hrs.	60
Hrs./Week	4
Sub.Code	21PCCS4P2
Course Type	Practical –VIII
Credits	2
Marks	100/2

General Objective:

To learn and apply the Data Science concepts with R Programming Language to solve real world problems.

Course Objectives:

CONo.	The learners will be able to
CO-1	Illustrate the Data Science with R Programming Language.
CO-2	Develop applications with statistical analysis of data.
CO-3	Apply Data Visualization and Optimization.
CO-4	Analyze algorithms to build Machine Intelligence.
CO-5	Build the data model for Classification, Clustering and Regression.

1. Descriptive Statistics In R

- Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.
- Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

2. Reading And Writing Different Types Of Datasets

- Reading different types of data sets (.txt, .csv) from Web and disk and writing the file in specific disk location.
- Reading Excel data sheet in R.

3. Visualizations

- Find the data distributions using box and scatter plot.
- Plot the histogram, bar chart and pie chart on sample data.

4. Correlation And Covariance

- Find the correlation matrix.

- b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.

5. Regression Model

Import a data from web storage. Do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).

6. Multiple Regression Model

Apply multiple regressions, if data have a continuous Independent variable. Apply on above dataset.

7. Regression Model For Prediction

Apply regression Model techniques to predict the data on above dataset.

8. Classification Model

- a. Choose classifier for classification problem.
- b. Evaluate the performance of classifier.

9. Clustering Model

- a. Clustering algorithms for unsupervised classification.
- b. Plot the cluster data using R visualizations.

Course Outcomes

CONo.	Upon completion of the course, the students will be able to	PSOs Addressed	Cognitive Level
CO-1	Demonstrate to use R in any Operating System.	1,2,5	Understanding
CO-2	Choose and apply the methodology to solve data science tasks.	1,2,3,5	Applying
CO-3	Identify Data Science capabilities for real world scenario.	1,2,3,5	Applying
CO-4	Assess the model used to solve Data Science tasks.	1,2,3,4,5	Evaluating
CO-5	Develop R program for Statistical Analysis.	1,2,3,4,5	Creating

Relationship Matrix

Semester	Course Code	Title of the Course				Hours			Credits	
IV	21PCCS4P2	Data Science with R Practicals				60			2	
Course Outcomes (COs)	Programme Learning Outcomes (PLOs)					Programme Specific Outcomes (PSOs)				
	PLO1	PLO2	PLO3	PLO4	PLO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO-1	✓	✓			✓	✓	✓			✓
CO-2	✓	✓	✓		✓	✓	✓	✓		✓
CO-3	✓	✓			✓	✓	✓	✓		✓
CO-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Number of matches (✓) = 41 Relationship = High									

INTERDISCIPLINARY COURSES (2021 – 2024)							
SEM	TITLE OF THE COURSE	COURSE CODE	H/W	C	MARKS		
					I	E	T
DEPT. OF ENGLISH							
II	SOFT SKILLS	21PIEN11	2	2	40	60	100/2
III	ENGLISH FOR BUSINESS COMMUNICATION	21PIEN31	2	2	40	60	100/2
DEPT. OF HISTORY							
II	INDIAN HISTORY FOR COMPETITIVE EXAMINATIONS UPTO 1707A.D	21PIHS11	2	2	40	60	100/2
III	INDIAN HISTORY FOR COMPETITIVE EXAMINATIONS FROM (1707-1947 A.D)	21PIHS31	2	2	40	60	100/2
DEPT. OF COMMERCE							
II	ENTREPRENEURIAL DEVELOPMENT	21PICO11	2	2	40	60	100/2
III	HUMAN RESOURCE MANAGEMENT	21PICO31	2	2	40	60	100/2
DEPT. OF MATHEMATICS							
II	DISCRETE STRUCTURE – I	21PIMA11	2	2	40	60	100/2
III	DISCRETE STRUCTURE – II	21PIMA31	2	2	40	60	100/2
DEPT. OF CHEMISTRY							
II	ANALYTICAL BIOCHEMISTRY	21PICH11	2	2	40	60	100/2
III	INDUSTRIAL CHEMISTRY	21PICH31	2	2	40	60	100/2
DEPT. OF COMPUTER SCIENCE							
II	DIGITAL LITERACY	21PICS11	2	2	40	60	100/2
III	DIGITAL TECHNOLOGY	21PICS31	2	2	40	60	100/2
DEPT. OF MICROBIOLOGY							
II	MICROBIOLOGY AND HUMAN HEALTH	21PIMB11	2	2	40	60	100/2
III	ENTREPRENEURSHIP IN MICROBIOLOGY	21PIMB31	2	2	40	60	100/2
DEPT. OF PHYSICS							
II	THE BASICS OF DIGITAL ELECTRONICS	21PIPH11	2	2	40	60	100/2
III	ENERGY PHYSICS	21PIPH31	2	2	40	60	100/2
DEPT. OF ZOOLOGY							
II	ORNAMENTAL FISH CULTURE	21PIZO11	2	2	40	60	100/2
III	APPLIED ZOOLOGY	21PIZO31	2	2	40	60	100/2
DEPT. OF NUTRITION AND DIETETICS							
II	DIET THERAPY-I	21PIND11	2	2	40	60	100/2
III	DIET THERAPY-II	21PIND31	2	2	40	60	100/2

THE SCHEME OF EXAMINATIONS UNDER CHOICE BASED CREDIT SYSTEM

- The medium of instruction in all the UG and PG Programmes is English and Students shall write the CIA Tests and the Semester Examinations in English. Three CIA Tests for one hour each will be conducted. For the calculation of CIA Tests marks the average of the best two tests will be taken. The portion for each test can be 1.5 units of the unitized syllabi.
- Two assignments for the Undergraduate Programmes and one assignment and one seminar for the Postgraduate Programmes are compulsory.
- Two Practical Examinations will be conducted for CIA at the end of the semester and the average will be taken.

Distribution of Marks for the Students admitted into the UG and PG Programmes from the academic year 2021-2022 CIA Tests and Semester Examinations

Undergraduate, Certificate, Diploma and Advanced Diploma Programmes						
Course Type	TOTAL MARKS	CIA TESTS MAX.MARKS	SEMESTER EXAMINATION Max. Marks	PASSING MINIMUM		
				CIA	SEM. EXAM	OVERALL
Theory	100	25	75	Nil	30	40
Practical (2Hrs.)	50	20	30	Nil	12	20
Practical (4Hrs.)	100	40	60	Nil	24	40
Project	100	Nil	Report- 60 Marks Viva-Voce- 40 Marks	Nil	Nil	100

Postgraduate Programmes						
Course Type	TOTAL MARKS	CIA MARKS	SEMESTER EXAM	PASSING MINIMUM		
				CIA	SEM. EXAM	OVERALL
Theory	100	40	60	Nil	30	50
Practical	50	20	30	Nil	15	25
Practical (for PG Maths only)	100	40	60	Nil	30	50
Project Report	150	Nil	Project Report- 90 Marks Viva-Voce Examination - 60 Marks	Nil	Nil	150

CIA TESTS
Distribution of Marks

Components	Tests (A)			Assignment (B)	Seminar (C)	Record Note (D)	Total (A+B+C+D)
	I	II	III				
UG-Theory	20	20	20	5	-	-	25
	The Average of the Best Two Tests:20						
PG-Theory	30	30	30	5	5	-	40
	The Average of the Best Two Tests:30						
UG- Practical (2 hrs)	15	15		-	-	5	20
	The Average of the Tests: 15						
UG- Practical (4 hrs)	30		30	-	-	10	40
	The Average of the Tests: 30						
PG-Practical	15	15		-	-	5	20
	The Average of the Tests: 15						
PG-Practical (Maths only)	30	30		-	-	10	40
	The Average of the Tests: 30						

Question Pattern for CIA Test (Theory)

Programme	Question Paper Pattern			Total (A+B+C)
	Part-A	Part-B	Part-C	
UG	MCQs- 8x0.5=4 marks	Internal Choice (Either or type). 2x4=8 marks Answer should not exceed 250 words	Internal Choice (Either or type) 1x8=8 marks Answer should not exceed 500 words	20
PG	MCQs- 20x0.5=10 marks	Internal Choice (Either or type) 3x4=12 marks Answer should not exceed 250 words	Internal Choice (Either or type) 1x8=8 marks Answer should not exceed 500 words	30

End Semester Examination (ESE)

The students who have put in the required number of days of attendance are eligible to appear for the End Semester Examinations irrespective of whether they have passed in the CIA Tests or not. They have to pay the examination fees for all the current courses and the arrear courses, if any, and submit the

application form before the due date specified for the purpose. For any reason, the dates will not be extended. Hall tickets will be issued only for those who have paid the fees. The question papers for the End Semester Examinations for all the theory courses of the UG and the PG Programmes will be set for 75 marks.

Question Pattern for End Semester Examinations (Theory)

Programme	Question Paper Pattern			Total (A+B+C)
	Part-A	Part-B	Part-C	
UG	MCQs- 30x0.5=15 marks	Internal Choice (Either or type) 5x4=20 marks Answer should not exceed 250 words	Internal Choice (Either or type) 5x8=40 marks Answer should not exceed 500 words	75
PG	MCQs- 30x0.5=15 marks	Internal Choice (Either or type) 5x4=20 marks Answer should not exceed 250 words	Internal Choice (Either or type) 5x8=40 marks Answer should not exceed 500 words	$(\frac{x}{75} \times 60)$ 60

The Question Paper Pattern for the End Semester Examinations (Practical)

The Question Paper Pattern is designed by the respective departments.