MARUDHAR KESARI JAIN COLLEGE FOR WOMEN (AUTONOMOUS)

Vaniyambadi – 635 751

PG Department of Computer Applications

for

Postgraduate Programme

Master of Computer Applications

From the Academic Year 2024-25

CONTENT

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION

1. Preamble

The Department of Computer Applications was established in 2002, with the objective of imparting quality education in the domain of Computer Applications. With rapidly evolving technology and the continuous need for innovation, the department has always produced quality professionals, holding important positions in Information Technology industries in India and abroad. The Department updates its syllabi frequently to attract young talents from all over the country. The academic activities of the department, during the last four years, were centered on teaching programmes in computer Applications with a view to train postgraduates who can contribute significantly to the requirements of professional organizations in the field.

PROGRAMME OUTCOMES (PO)

Programme	**MCA**
Programme Code	**PS02**
Duration	**2 Years**
Programme Outcomes	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that forma part of an undergraduate Programme of study. **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself / himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3:Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extra polate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate there liability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing view points. **PO6:Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation. **PO7:Cooperation/ Teamwork :** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team. **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence, and experiences from an open-minded and reasoned perspective.

Programme Specific Outcomes:	**PSO1– Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO2-Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skills that will facilitate startups and high potential organizations. **PSO3 –Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards Growth and development.

Eligibility for Admission:

- Candidates must have a Bachelor's degree with Mathematics as a subject.
- A minimum of 50% of marks are required in a Bachelor degree.
- Candidates must have completed 10+2 i.e. senior secondary Education with science as a major.

Methods of Evaluation and Assessment

Methods of Evaluation		
Internal Evaluation		25 Marks
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand / Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or overview	
Application (K3)	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, finish a procedure in many steps, Differentiate Between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Semester - I						
Course Code	Course Title	Hours Distribution				C
		L	T	P	S	
24PCAC11	CC – Data Structure and Algorithm	3	1	2	0	5
24PCAC12	CC – Python Programming	3	1	2	0	5
24PCAC13P	CC – Data Structure using Python Programming Lab	0	0	4	0	3
24PCAE11	EC – Discrete Mathematics	3	1	1	0	3
24PCAE12	EC – Relational Database Management System	3	1	1	0	3
24PCAA11P	AECC – Hands on Training in RDBMS Lab	1	1	0	0	2
24PCHR11	VE - 1 Human Rights	1	1	0	0	2
					30	**23**

Semester - II						
Course Code	Course Title	Hours Distribution				C
		L	T	P	S	
24PCAC21	CC – Data Analytics and Visualization	3	1	2	0	5
24PCAC22	CC – Java Programming	3	1	2	0	5
24PCAC23P	CC – Data Analytics and Visualization Lab	0	0	4	0	3
24PCAC24P	CC – Java Programming Lab	0	0	4	0	3
24PCAE21	EC –Cloud Computing	2	1	1	0	3
24PCAE22	EC – Social Media Analytics	2	1	1	0	3
24PCAS21	SEC – 1 Internet and Web Development	1	1	0	0	2
					30	**24**

Semester - III						
24PCAC31	CC – Machine Learning	2	1	2	0	5
24PCAC32	CC – Digital Forensics	2	1	2	0	5
24PCAC33	CC – Advanced Web Technology	2	1	1	0	3
24PCAC34P	CC – Machine Learning Lab	0	0	4	0	3
24PCAC35P	CC – Internet of Things Lab	0	0	4	0	3
24PCAE31	EC – Algorithm of Design and Analysis	2	1	1	0	3
24PCAS31	SEC – Full Stack Development	1	1	0	0	2
24PCAIN31	Internship	0	0	0	2	2
					30	**26**

Semester - IV						
24PCAC41	CC – Digital Image Processing	3	1	2	0	5
24PCAC42P	CC - 14 Project	0	2	4	6	5
24PCAE41	EC – High Performances Computing	4	1	1	0	3
24PCAP41	PEC – 1 Digital Marketing	1	1	0	0	2
24PCAL41	SLC – 1 Ecommerce & its applications	0	0	1	3	2
					30	**17**
	Total Credit	**90+2***				

Students must complete at least one online course (MOOC) from platforms like SWAYAM, NPTEL, or Nanmudalvan within the fifth semester. Additionally, engaging in a specified Self-learning Course is mandatory to qualify for the degree, and successful participation will be acknowledged with an extra credit of 2*.

L- Learning T-Tutorial P-Practical S-Seminar C-Credit

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC11	**DATA STRUCTURE AND ALGORITHM**	Core	3	1	2		5	6	25	75	100

Learning Objectives	
LO1	To get a clear understanding of various ADT structures.
LO2	To understand how to implement different ADT structures with real-time scenarios.
LO3	To analyze the various data structures with their different implementations.
LO4	To get an idea of applying the right models based on the problem domain.
LO5	To realize and understand how and where to implement modern data structures with Python language.

Unit	Content	Hours
1	Abstract Data Types: Introduction-Date Abstract Data Type-Bags-Iterators. Arrays: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. Sets, Maps: Sets-Maps- Multi-Dimensional Arrays.	**14**
2	Algorithm Analysis: Experimental Studies-Seven Functions-Asymptotic Analysis. Recursion: Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.	**14**
3	Stacks, Queues, and De queues: Stacks- Queues- Double-Ended Queues Linked. Lists: Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. Trees: General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.	**14**
4	Priority Queues: Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. Maps, Hash Tables, and Skip Lists: Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multi sets, and Multi maps.	**14**
5	Search Trees: Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. Sorting and Selection: Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. Graph Algorithms: Graphs-Data Structures for Graphs-Graph Traversals-ShortestPaths-Minimum Spanning Trees.	**14**

CO	Course Outcomes
CO1	Understand various ADT concepts
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems
CO3	Apply with proper ADT models with problem understanding
CO4	Apply and analyze right models based on the problem domain
CO5	Evaluate modern data structures with Python language

Text books:	
1	Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011.
2	Michael T. Goodrich, Roberto Tamassia, Michael H. Gold wasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013.
3	Data Structures and Algorithmic Thinking with Python by Narasimha Karumanchi
4	Data structures and algorithms in python by Michael T. Goodrich
5	Data Structures and Algorithms with Python by Kent D. Lee and SteveHubbard.
Reference Books:	
1	Problem Solving with Algorithms and Data Structures Using Python by Bradley NMiller and David L. Ranum.
2	Hands-On Data Structures and Algorithms with Python: Write complex and powerful codeusing the latest features of Python 3.7, 2nd Edition by Dr. BasantAgarwal, Benjamin Baka.
3	Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms inthe Python Language", Apress, 2014.
4	Core Python Programming -Second Edition,R. NageswaraRao, Dreamtech Press
5	Data Structures and Algorithms in Python. Michael T. Goodrich , Roberto Tamassia , Michael H. Goldwasser, Wiley, 2013.
Web resources:	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html/
3	https://www.w3schools.com/python/python_intro.asp
4	https://www.geeksforgeeks.org/python-programming-language/
5	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO 2	PSO3
CO1	3	3	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	3	3	3	2	3	2	2
CO3	3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	12	15	12	12
Average	3	3	3	3	3	3	3	2	3	2	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC12	**PYTHON PROGRAMMING**	Core	3	1	2		5	6	25	75	100

Learning Objectives	
LO1	To acquire programming skills in core Python.
LO2	To learn Strings and function
LO3	To develop object oriented skills in Python
LO4	To comprehend various Python Packages
LO5	To develop web applications using Django

Unit	Content	Hours
1	Introduction : Fundamental ideas of Computer Science - Strings, Assignment and Comments - Numeric Data types and Character sets - Expressions - Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop	**14**
2	Strings and Text Files: Accessing Characters and substrings in strings - Data encryption-Strings and Number systems- String methods - Text - Lists and Dictionaries: Lists - Dictionaries - Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program's namespace - Higher-Order Functions	**14**
3	Design with Classes: Getting inside Objects and Classes - Data-Modeling Examples - Building a New Data Structure - The Two - Dimensional Grid - Structuring Classes with Inheritance and Polymorphism-Graphical User Interfaces-The Behavior of terminal-Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events	**14**
4	Working with Python Packages: NumPy Library-Ndarray- Basic Operations - Indexing, Slicing and Iteration - Array manipulation - Pandas - The Series - The Data Frame - The Index Objects - Data Visualization with Matplotlib-	**14**

	The Matplotlib Architecture -Pyplot- The Plotting Window - Adding Elements to the Chart - Line Charts - Bar Charts - Pie charts	
5	Django: Installing Django- Building an Application - Project Creation - Designing the Data Schema - Creating an administration site for models - Working with Query Sets and Managers - Retrieving Objects - Building List and Detail Views	**14**

CO	**Course Outcomes**
CO1	Comprehend the programming skills in python and develop applications usingconditional branches and loop
CO2	Create python applications with strings and functions
CO3	Understand and implement the Object Oriented Programming paradigm with the conceptof objects and classes, Inheritance and polymorphism
CO4	Evaluate the use of Python packages to perform numerical computations and datavisualization
CO5	Design interactive web applications using Django

Text books:	
1	K.A. Lambert, " Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 (Unit - I, II and III)
2	Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018 (Unit - IV)
3	Antonio Mele, "Django 3 By Example", Third Edition, 2020 (Unit - V)
4	Introduction to Python Programming by Udayan Das, et al. Publisher: OpenStax
5	Python Basics: A Practical Introduction to Python 3 Revised and Updated 4th Edition David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler Copyright © Real Python (realpython.com), 2012–2020
Reference Books:	
1	Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: Anintroduction to Computer Science Using Python, second edition, The Pragmatic Bookshelf, 2013.
2	Allen Downey, Jeffrey Elkner, 2Learning with Python: How to Think Like a Computer Scientist Paperback –2015.
3	Hans Fango hr, Introduction to Python for Computational Science and Engineering(A beginner's guide), 2015.
4	Timothy A. Budd, Exploring Python, McGraw Hill Education, 2009.
5	Mark Lutz, Learning Python, Fourth Edition, O'Reilly publication, 2009.

Web resources:	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html
3	https://www.w3schools.com/python/python_intro.asp
4	https://www.geeksforgeeks.org/python-programming-language/
5	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	3	3	3	2	3
CO2	3	3	3	3	2	3	2	3	3	3	3
CO3	3	2	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	2
Total	15	14	14	14	14	15	14	14	15	15	14
Average	3	2	2	2	2	3	2	2	3	3	2

3 – Strong, 2- Medium, 1- Low

1. DISCRETE MATHEMATICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
24PCAE11	3	1	0	0	3	4	25	75	100

Learning Objectives	
LO1	To know the concepts of relations
LO2	To know the concepts of functions
LO3	To know and solve matrices, rank of matrix
LO4	To gain knowledge on mathematical logics
LO5	To study the graphs and its types

Unit	Contents	No. of Hours
I	**Relations:** Relation Introduction- Cartesian Product of Two Sets- Relation Definition with Examples- Domain and Range of a Relation- Representation of Relation- Matrix of a Relation- Digraph of a Relation- Operations on Relations- Compositions of Relation- Equivalence Relations	10
II	**Functions:** Functions and Operators- Range of a Function- One to One & Onto Functions- Special Types of Functions- Many to One Mapping- The Identity Function- Invertible Functions- Composition of Functions	10
III	**Matrices:** Matrix Algebra- Equality of Matrix- Matrix Operations- Transpose of a Matrix- The Inverse of a Square Matrix- Elementary Operations and Rank of a Matrix- Simultaneous Linear Equations	10
IV	**Mathematical logics:** Proposition- TF Statement- Connectives- Conjunction & Disjunction - Negation - Conditional & Bi conditional Statement- The Truth Table of a Formula- Tautalogy- Tautological Implications and Equivalence of Formulae	10
V	**Graph Theory:** Basic Concepts- Incidence and Degree- Subgraph- Graph Isomorphism- Some Special Classes of Graphs- Path, Cycles and Connectedness Definitions only- Matrix Representation of Graph- The Adjacency of and Undirected Graph.	10
	Total	50

COURSE OUTCOMES	
CO1	To understand the concepts of relations distinguish among normal forms
CO2	To understand the concepts of functions distinguish among normal forms
CO3	To solve and know various types of matrices
CO4	To distinguish the various logic operators
CO5	To evaluate and solve various types of graphs

TEXT BOOKS	
1	Discrete Mathematics – Dr. M. K. Venkataraman, Dr. N. Sridharan, N. Chandrasekaran-The National Publishing Company
2	N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.
3	Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Indian Reprint, Springer Verlag, NewYork, 2006.
4	Discrete Mathematics- Susanna. S.Epp -Metric Version
5	Discrete Mathematics-Schaum's Outlines-Seymour Lipschutz, Marc Lars Lipson 3rd Edition

REFERENCE BOOKS	
1	Kimmo Eriksson &Hillevi Gavel, Discrete Mathematics & Discrete Models, Student litteratur AB, 2015.
2	Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill,2012
3	A.Gill, Applied Algebra for Computer Science, Prentice Hall Inc., New Jersey.
4	J.L.Gersting, Mathematical Structures for Computer Science, 3 rdEdn., ComputerScience Press, New York.
5	S.Wiitala,Discrete Mathematics - AUnified Approach, McGraw Hill Book Co.

Web Resources
https://nptel.ac.in/courses/106106094 https://nptel.ac.in/courses/111107058

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	2	2	3	2	2	3	3	2
CO3	3	2	3	3	3	3	3	3	3	2	2
CO4	2	2	3	2	2	3	2	2	3	3	3
CO5	2	3	2	3	3	2	3	3	3	2	3
Total	13	13	14	13	12	14	13	13	15	13	13
Average	2.6	2.6	2.8	2.6	2.4	2.8	2.6	2.6	3	2.6	2.6

3 – Strong, 2- Medium, 1- Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC13P	**DATA STRUCTURE USING PYTHON LAB**	**Practical**	**0**	**0**	**4**	**0**	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand basic data structures in python like Lists, Tuples, Dictionaries, Sets and Maps.
LO2	Design and analyze simple linear data structures
LO3	Identify and apply the suitable data structure for the given real world problem
LO4	Design and analyze non linear data structures
LO5	Gain knowledge in practical applications of data structures

Unit	Content	Hours
1	Program using elementary data items, lists, dictionaries and tuples	5
2	Program using conditional branches, loop	5
3	Program for creating dynamic and interactive web pages using forms	5
4	Write a Python program to illustrate the following comprehensions: a) List Comprehensions b) Dictionary Comprehensions c) Set Comprehensions d) Generator Comprehensions	5
5	Write a Python program to generate the combinations of n distinct objects taken from the elements of a given list. Example: Original list: [1, 2, 3, 4, 5, 6, 7, 8, 9] Combinations of 2 distinct objects: [1, 2] [1, 3] [1, 4] [1, 5] ..... [7, 8] [7, 9] [8, 9].	5
6	Write a program for Linear Search and Binary search.	5
7	Write a program to implement Bubble Sort and Selection Sort.	5
8	Write a program to implement Merge sort and Quick sort.	5

9	Write a program to implement Stacks and Queues.	5
10	Write a program to implement Singly Linked List.	5
11	Write a program to implement Doubly Linked list.	5
12	Write a program to implement Binary Search Tree.	5

CO	Course Outcomes
CO1	Understand various data representation techniques in the real world
CO2	Implement linear and non-linear data structures.
CO3	Analyze various algorithms based on their time and space complexity.
CO4	Develop real-time applications using suitable data structure
CO5	Identify suitable data structure to solve various computing problems

Text books:	
1	Data Structures and Algorithmic Thinking with Python by Narasimha Karumanchi
2	Data structures and algorithms in python by Michael T. Goodrich
3	K.A. Lambert, " Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018
4	Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018
5	Antonio Mele, "Django 3 By Example", Third Edition, 2020
Reference Books:	
1	Problem Solving with Algorithms and Data Structures Using Python by Bradley NMiller and David L. Ranum.
2	Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition by Dr. Basant Agarwal, Benjamin Baka.
3	Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.
4	Core Python Programming -Second Edition,R. Nageswara Rao, Dream tech Press
5	Data Structures and Algorithms in Python. Michael T. Goodrich , Roberto Tamassia , Michael H. Goldwasser, Wiley, 2013.

Web resources:	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html
3	https://www.w3schools.com/python/python_intro.asp
4	https://www.geeksforgeeks.org/python-programming-language/
5	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	3	3	3	2	3
CO2	3	3	3	3	2	3	2	3	3	3	3
CO3	3	2	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	2
Total	15	14	14	14	14	15	14	14	15	15	14
Average	3	2	2	2	2	3	2	2	3	3	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE12	**RELATIONAL DATABASE MANAGEMENT SYSTEM**	**Core**	**3**	**1**	**1**	**0**	**3**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	Master the basics of SQL and construct queries using SQL.
LO2	Understand the relational database design principles.
LO3	Familiar with the basic issues of transaction processing and concurrency control.
LO4	Familiar with database storage structures and access techniques.
LO5	Understand the relational database design principles.

Unit	Content	Hours
1	Database & Database Users. Characteristics of the Database Approach advantages of using DBMS. Data Models, Schemas & Instances. DBMS Architecture & Data Independence. System Architecture for DBMS and Data Dictionary, Database Users Data Base languages & Interfaces. Data Modeling using the Entity-Relationship Model -Entity types, Entity Sets, Attributes and Keys, Relationship, Relationship Types, Week Entity Types, Structural Constraints, Enhanced ER Model- Specialization Generalization, Constraints on Specialization Generalization.	**12**
2	Relational Data Model Concepts and Constraints. Relational Algebra - select, project, set theoretic, join operations. Overview of Relational Calculus. SQL - A Relational Database Language. Data Definition commands, View and Queries , transaction commands, Specifying Constraints & Indexes in SQL.	**12**
3	Function Dependencies & Normalization for Relational Databases. Informal design guidelines for relation schemas, Functional Dependencies. Normal forms based on primary keys (INF, 2NF, 3NF& BCNF). Lossless join & Dependency preserving decomposition. Multivalued dependencies, join dependencies (4NF & 5NF), Denormalization.	**12**

4	Basic concept; ACID properties; transaction state; implementation of atomicity and durability; concurrent executions; basic idea of serializability; view and conflict serializabllity Recovery Techniques Failure Classification , Storage Structure, Recovery and Atomicity Log Based Recovery, Shadow Paging ,stable storage implementation, data access; recovery and atomicity - log based recovery, deferred database modification, immediate database modification, checkpoints.	**12**
5	Distributed databases; Basic idea; distributed data storage; data replication; data fragmentation horizontal, vertical and mixed fragmentation. Concepts of Multimedia databases, Object oriented data base management systems. Data Warehousing & mining.	**12**

CO	Course Outcomes
1	Describe the fundamental elements of relational database management systems
CO2	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
CO3	Design ER-models to represent simple database application scenarios
CO4	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
CO5	Improve the database design by normalization.

Text books:	
1	Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.(All UNITS except III th)
2	Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition.
3	Henry F.Korth, and Abraham Silberschatz , Sudarshan “Database Concepts”, McGraw Hill, 4th Edition, 2002 system
4	Singh. S. K., “Database Systems – Concepts, Design and Applications”, Pearson Education Publications, New Delhi, 2006.
5	Pipin C. Desai, “An Introduction to data base systems”, Galgotia Publications Private Limited, 1991.
Reference Books:	
1	Fundamentals of Database Systems, Elmasri Navathe Pearson Education
2	An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition for UNIT III.
3	Ramez Elamassri and Shankant B-Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education Delhi, 2010.
4	Raghu Ramakrishnan, Johannes Gehrke , “Database management systems” McGrawHill, 2003.
5	C.J. Date, “An Introduction to Database Systems”, 3rd Edition, Addison Wesley 1983.

Web resources:	
1	http://www.cs.helsinki.fi/u/laine/tikape/k03/material03.html
2	http://infolab.stanford.edu/~ullman/dscb.html
3	http://cs.nyu.edu/courses/spring06/G22.2433-001/
4	https://www.w3schools.com/mysql/mysql_rdbms.asp
5	https://www.w3resource.com/sql/tutorials.php

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	2	3	3	3	2	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3
CO4	2	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	2
Total	14	15	14	14	15	15	14	14	15	15	14
Average	2	3	2	2	3	3	2	2	3	3	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE11P	**Hands on Training in RDBMS Lab**	**Core**	**0**	**0**	**2**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the data definition and data manipulation commands
LO2	To learn the use of nested and join queries
LO3	To understand function, procedures and procedural extension of database
LO4	To be familiar with the use of a front end tool
LO5	To understand design and implementation of typical database applications

Unit	Content	Hours
1	Use of DDL for creating objects (Table, Database).	3
2	Use of DML for performing retrieval operations.	3
3	Use of DCL for specifying constraints and authorities on table.	3
4	Use of Aggregate functions.	3
5	Use of String functions.	3
6	Creating and Performing various operations on Views	3
7	Performing queries for Union, Intersection, Difference, Cartesian Product and Division.	3
8	Performing queries on varies joins and nested queries	3
9	Writing Programs in PL/SQL	3
10	Understanding and Creating Cursors	3

CO	Course Outcomes
CO1	Use typical data definition and manipulation commands
CO2	Design applications to test Nested and Join Queries
CO3	Implementing simple applications that use Views
CO4	Implementing applications that required a Front-end tool
CO5	Critically analyses the use of Tables, Views, Functions and Procedures.

Text books:	
1	Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.(All UNITS except III th)
2	Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATAMcGraw Hill 3rd Edition.
3	Henry F.Korth, and Abraham Silberschatz , Sudarshan "Database Concepts", McGraw Hill, 4th Edition, 2002 system
4	Singh. S. K., "Database Systems – Concepts, Design and Applications", Pearson Education Publications, New Delhi, 2006.
5	Pipin C. Desai, "An Introduction to data base systems", Galgotia Publications Private Limited, 1991.
Reference Books:	
1	Fundamentals of Database Systems, Elmasri Navathe Pearson Education
2	An Introduction to Database systems, C.J. Date, A.Kannan, S.SwamiNadhan, Pearson, Eight Edition for UNIT III.
3	Ramez Elamassri and Shankant B-Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education Delhi, 2010.
4	Raghu Ramakrishnan, Johannes Gehrke , "Database management systems" McGraw Hill, 2003.
5	C.J. Date, "An Introduction to Database Systems", 3rd Edition, Addison Wesley1983.
Web resources:	
1	http://www.cs.helsinki.fi/u/laine/tikape/k03/material03.html
2	http://infolab.stanford.edu/~ullman/dscb.html
3	http://cs.nyu.edu/courses/spring06/G22.2433-001/
4	https://www.w3schools.com/mysql/mysql_rdbms.asp
5	https://www.w3resource.com/sql/tutorials.php

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	2	3	2	3	3	2
Total	15	15	15	15	15	14	14	14	15	15	14
Average	3	3	3	5	5	2	2	2	3	3	2

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC21	DATA ANALYTICS AND VISUALIZATION	Core	3	2	0	1	5	6	25	75	100

Learning Objectives

LO1	To understand the basics in R programming in terms of constructs, control statements, string functions
LO2	To learn about the getting data In and Out of R
LO3	To learn the principles and methods of statistical analysis
LO4	To learn the Data Mining concepts using R
LO5	To understand the basic concepts of data visualization using R.

Unit	Content	Hours
1	**Introduction To R** : Overview -Evolution Of R -Features Of R -Identifiers– Data Types-Data Structure: Vectors -Lists -Matrices –Arrays Factors -Data Frames - Variables -Operators– Functions- Decision Making - Loops. **Chapter 4: Section -4.1, 4.2, 4.3** **Chapter 5: Section -5.1, 5.2, 5.3, 5.4** **Chapter 9: Section- 9.1,9.2,9.3** **Chapter 10: Section – 10.1,10.2,10.3**	14
2	**R Programming** Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files. Working with R Charts and Graphs: Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts. **Chapter 6:Section - 6.1, 6.2, 6.3, 6.4, 6.7,6.8** **Chapter 7: Section - 7.1, 7.2,**	14
3	**Data Analytics**: Introduction to Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of Data and variables, Data Modelling Techniques, Missing Imputation set. Need for Business Modelling. **Chapter 3 : Section 3.1,3.2** **Chapter 4 : Section 4.2,4.3,4.4**	14
4	**Data Mining :** Association -Classification & Prediction: -Classification by Decision Tree Induction - Bayes' Theorem Naïve Bayesian Classification – Bayesian Belief Networks The k-Nearest Neighbour Algorithm-Decision Trees - k-Means Clustering- Hierarchical Clustering. **Chapter 5 :Section5.3** **Chapter 6.3 : Section 6.3.1, 6.3.2, 6.3.3,6.4.1,6.4.2, 6.4.3** **Chapter 6.9 : Section 6.9.1**	14

5	**Data visualization with R** : Introduction to ggplot2 - A worked example, Placing the data and mapping options, Graphs as objects, Univariate Graphs: Categorical, Quantitative. Bivariate Graphs- Categorical vs. Categorical, Quantitative vs Quantitative, Categorical vs. Quantitative, Multivariate Graphs : Grouping, Faceting **Chapter 3 : Section 3.1, 3.2, 3.3** **Chapter 4 : Section 4.1, 4.2** **Chapter 5: Section 5.1, 5.2, 5.3** **Chapter 6: 6.1, 6.2**	14

CO	Course Outcomes
CO1	Gain the knowledge about basic R programming.
CO2	To understand the getting data In and Out of R
CO3	To understand the principles and methods of statistical analysis
CO4	To understand the Data Mining concepts using R
CO5	To Gain the knowledge about the basics of data visualization.
Textbooks:	
1	R for Everyone: Advanced Analytics and Graphics By Jared P. Lander
2	Student's Handbook for Associate Analytics – III.
3	Data Mining : Concepts and Techniques : Concepts and Techniques (3rd Edition) Jiawei Han, Micheline Kambar, Jian Pie
4	Hands-On Programming with R- Garrett Grolemund Foreword by Hadley Wickham -Oreilly
5	https://rkabacoff.github.io/datavis/Univariate.html#categorical
Reference Books:	
1	Beginning Data Science in R-Data Analysis, Visualization, and Modelling for the Data Scientist - Thomas Mailund –Apress -2017.
2	Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006
3	Data Warehousing Fundament's, Pualraj Ponnaiah, Wiley Student Edition.
4	Practical Data Science with R, Nina Zumel & John Mount, Manning Publications NY, 2014.
5	R Programming for Data Science -Roger D. Peng, 2015 , Lean Publishing.
Web resources:	
1	https://sves.org.in/ecap/Resources/_53.pdf
2	https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	3	3	2
CO2	2	1	2	1	3	2	2	3	3	3	3
CO3	3	2	2	2	2	3	1	3	2	3	3
CO4	2	2	2	2	2	2	2	2	3	3	2
CO5	3	1	2	2	3	3	3	2	3	2	3
Total	13	8	10	9	12	12	10	12	14	14	13
Average	2	1	2	1	2	2	2	2	3	3	2

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC22	JAVA PROGRAMMING	Core	3	1	2	0	5	6	25	75	100

Learning Objectives	
LO1	To understand the basics of Object Oriented Programming concepts, Character Set, tokens, variables, data types, operators and control structure.
LO2	To understand the fundamental concept of Java like class and object, array, methods, constructors and inheritance.
LO3	To understand the concept of package, Exception Handling and Threading.
LO4	To understand the concepts of Applets and AWT.
LO5	To understand the concepts of JDBC connectivity.

Unit	Content	Hours
1	**OOP** and Java Objects and Classes, Encapsulation, Inheritance, Polymorphism, Java Language, The Primaries– Character Set, Tokens, Constants, Variables, Operators and Expressions, Library Methods, Strings, I/O Streams, Formatting the Output values, Control Statements–If, Switch, While, Do-While-for.	14
2	**Arrays**: One, Two dimensional Arrays, Methods – General form, invoking, method overloading, recursion, Classes and objects – General form, creation, constructors, constructor overloading, copy constructor, ‗this ‘ keyword, Static members, finalize method, Inner class and anonymous classes, Inheritance– inheriting, abstract classes and final classes, Interfaces – structure, implementation, interface inheritance.	14
3	**Packages–** Package Hierarchy, Import Statement, Hiding the Classes, Access Control Modifiers, Exception Handling – Default Exception – User Defined Exception Handling, Exception and Error Classes, Throw and Throws. Threading– Life Cycle, Creating and Running, Methods in Thread Class, Priority Thread, Synchronization, Dead Lock, Inter Thread Communication.	14
4	**Applets**–Life Cycle, Applet Class, Syntax of Applet Tag, Methods in Graphics Class, Events, Listeners, Event Handling Methods, Inheritance of Control Classes, Labels, Button Control, Check Box Control, Radio Button, Choice Control, List Control, Scroll Bars, Layouts and Panel, Windows and Frames, Menus and Dialogs, Mouse Events and Listeners, Adapter Class and Inner Class.	14
5	**JDBC**– Establishing Connection, Creating Tables, Enter Data, Table Updating Obtaining Metadata, Using Transactions.	14

CO	Course Outcomes
CO1	The student will be able to understand the basics of Object Oriented Programming concepts, Character Set, tokens, variables, datatypes, operators and control structure
CO2	The student will be able to understand the fundamental concept of Java like class and object, array, methods, constructors and inheritance
CO3	The student will be able to understand the concept of package, Exception Handling and Threading
CO4	The student will be able to understand the concepts of Applets and AWT
CO5	The student will be able to understand the concepts of JDBC connectivity
Textbooks:	
1	Muthu C,—Programming in Java ǁ, 2nd Edition, Tata Mcgraw Hill Education Private Limited, 2009. Unit–I : Ch.1,2,3 Unit-II : Ch.4,5,6 Unit-III : Ch.7,12,13 Unit–IV : Ch.8,9,10 Unit–V : Ch.18
2	Core Java for beginners, RASHMI Kanta Das, Vikas pub.
3	Java Server Programming Java EE 7 (J2EE 1.7) - Black Book, Kogent, Dreamtech PressSenn, LA., "Analysis and Design of Information Systems". Tata McGraw Hill Book Company, 1986.
4	Java Programming – A Practical Approach – C Xavier, Tata McGraw-Hill Edition
5	K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000
Reference Books:	
1	Herbert Schildt,—The Complete Reference–Java2 ǁ, 4th Edition,Tata Mc Graw Hill, 2001
2	Balaguruswamy,— ProgrammingwithJAVAǁ,2ndEdition,Tata Mc Graw Hill,1999.
3	Java Programming by Hari Mohan Pandey, Pearson Education, 2012.
4	Java 6 Programming, Black Book, KoGenT, Dreamtech Press, 2012.
5	Java 2 Essentials, Cay Hortsmann, second edition, Wiley
Web resources:	
1	http://www.tutorialspoint.com/java/
2	http://javabeginnerstutorial.com/core-java/

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	3	1	3	2	3	2
CO2	3	3	3	2	2	3	1	3	2	3	2
CO3	3	3	3	2	2	3	1	3	2	3	2
CO4	3	3	3	2	2	3	1	3	2	3	2
CO5	3	3	3	2	2	3	1	3	2	3	2
Total	15	15	15	10	10	15	5	15	10	15	10
Average	3	3	3	2	2	3	1	3	2	3	2

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC23P	**DATA ANALYTICS AND VISUALIZATION LAB**	Practical	0	0	4	0	3	4	25	75	100

Learning Objectives	
LO1	To Learn the basic concepts of R
LO2	To learn the usage of different R Data Structures.
LO3	Develop programming logic using R Packages. C
LO4	Analyze the datasets using R programming capabilities
LO5	Apply R programming for reading, cleaning, visualizing and analyzing data

Unit	Content	Hours
1	Download and install R-Programming environment and install basic packages using install. Packages () command in R.	4
2	Learn all the basics of R-Programming (Data types ,Variables , Operators ,Control statements	4
3	Write a R program to create a two-dimensional 5x3 array of sequence of even integers greater than 50.	4
4	a) Create a Scatter plot from CSV in R b) Create a Json Files	4
5	Implement data frames in R. Write a program to join columns and rows in a data frame using c bind () and r bind () in R.	4
6	a) Write a R program to find factorial of a number using recursion b) Write a R program to mean, variance, standard deviation for the given probability distribution	4
7	Implement A priori algorithm to extract association rule of data mining.	4
8	Implement k-means clustering technique.	4
9	Implement Classification algorithm.	4
10	Create pie charts and bar charts using R.	4
	Total	40

CO	Course Outcomes
CO1	Utilize and R Data types for developing programs.
CO2	Make use of different R Data Structures.
CO3	Develop programming logic using R Packages. C
CO4	Analyze the datasets using R programming capabilities
CO5	Apply R programming for reading, cleaning, visualizing and analyzing data
Text Books:	
1	R for Everyone: Advanced Analytics and Graphics By Jared P. Lander
2	Student's Handbook for Associate Analytics – III.
3	Data Mining : Concepts and Techniques : Concepts and Techniques (3rd Edition) Jiawei Han, Micheline Kambar, Jian Pie
4	Hands-On Programming with R- Garrett Grolemund Foreword by Hadley Wickham -Oreilly
5	https://rkabacoff.github.io/datavis/Univariate.html#categorical
Reference Books:	
1	Beginning Data Science in R-Data Analysis, Visualization, and Modelling for the Data Scientist - Thomas Mailund –Apress -2017.
2	Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006
3	Data Warehousing Fundament's, Pualraj Ponnaiah, Wiley Student Edition.
4	Practical Data Science with R, Nina Zumel & John Mount , Manning Publications NY, 2014.
5	R Programming for Data Science -Roger D. Peng, 2015 , Lean Publishing.
Web resources:	
1	https://sves.org.in/ecap/Resources/_53.pdf
2	https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	3	3	2
CO2	2	1	2	1	3	2	2	3	3	3	3
CO3	3	2	2	2	2	3	1	3	2	3	3
CO4	2	2	2	2	2	2	2	2	3	3	2
CO5	3	1	2	2	3	3	3	2	3	2	3
Total	13	8	10	9	12	12	10	12	14	14	13
Average	2	1	2	1	2	2	2	2	3	3	2

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC24P	**JAVA PROGRAMMING LAB**	Practical	0	0	4	0	3	4	25	75	100

Learning Objectives

LO1	To understand the basics of Object Oriented Programming concepts, Character Set, tokens, variables, data types, operators and control structure.
LO2	To understand the fundamental concept of Java like class and object, array, methods, constructors and inheritance.
LO3	To understand the concept of package, Exception Handling and Threading.
LO4	To understand the concepts of Applets and AWT.
LO5	To understand the concepts of JDBC connectivity.

Unit	Content	Hours
1	Class and Objects	4
2	String and String Buffer Class	4
3	Inheritance and Interface	4
4	Packages	4
5	Exception Handling	4
6	Threads	4
7	Applet	4
8	Shapes	4
9	AWT	4
10	JDBC	4
	Total	40

CO	Course Outcomes
CO1	The student will be able to understand the basics of Object Oriented Programming concepts, Character Set, tokens, variables, data types, operators and control structure
CO2	The student will be able to understand the fundamental concept of Java like class and object, array, methods, constructors and inheritance
CO3	The student will be able to understand the concept of package, Exception Handling and Threading
CO4	The student will be able to understand the concepts of Applets and AWT
CO5	The student will be able to understand the concepts of JDBC connectivity
Textbooks:	
1	Muthu C,—Programming in Java ǁ, 2nd Edition, Tata Mcgraw Hill Education Private Limited, 2009. Unit–I : Ch.1,2,3 Unit-II : Ch.4,5,6 Unit-III : Ch.7,12,13 Unit–IV : Ch.8,9,10 Unit–V : Ch.18
2	Core Java for beginners, RASHMI Kanta Das, Vikas pub.
3	Java Server Programming Java EE 7 (J2EE 1.7) - Black Book, Kogent, Dreamtech PressSenn, LA., "Analysis and Design of Information Systems". Tata McGraw Hill Book Company, 1986.
4	Java Programming – A Practical Approach – C Xavier, Tata McGraw-Hill Edition
5	K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000
Reference Books:	
1	Herbert Schildt,—The Complete Reference–Java2 ǁ, 4th Edition,Tata Mc Graw Hill, 2001
2	Balaguruswamy,— ProgrammingwithJAVAǁ,2ndEdition,Tata Mc Graw Hill,1999.
3	Java Programming by Hari Mohan Pandey, Pearson Education, 2012.
4	Java 6 Programming, Black Book, KoGenT, Dreamtech Press, 2012.
5	Java 2 Essentials, Cay Hortsmann, second edition, Wiley
Web resources:	
1	http://www.tutorialspoint.com/java/
2	http://javabeginnerstutorial.com/core-java/

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	3	1	3	2	3	2
CO2	3	3	3	2	2	3	1	3	2	3	2
CO3	3	3	3	2	2	3	1	3	2	3	2
CO4	3	3	3	2	2	3	1	3	2	3	2
CO5	3	3	3	2	2	3	1	3	2	3	2
Total	15	15	15	10	10	15	5	15	10	15	10
Average	3	3	3	2	2	3	1	3	2	3	2

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE21	**CLOUD COMPUTING**	**Elective**	**2**	**1**	**1**	**0**	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand the basic ideas and motivation for cloud computing
LO2	Elaborate the deployments models based on properties
LO3	To identify the various of cloud computing paradigm
LO4	Know about different companies that support cloud computing
LO5	Understand the features supported by tools

Unit	Content	Hours
1	**CLOUD COMPUTING FUNDAMENTALS** Motivation for Cloud Computing- Defining Cloud computing – Principles Cloud Computing - Cloud Ecosystem - Requirements for Cloud Services - Cloud Application and Benefits and Drawbacks - Introduction Cloud Computing Architecture and Management -Cloud Architecture – Anatomy of the cloud - Network Connectivity in Cloud Computing - Applications on the Cloud and Managing the Cloud - Migrating Application to Cloud.	12
2	**CLOUD DEPLOYMENT MODELS** Introduction - Private Cloud – Public Cloud-Community Clod-Hybrid Cloud-Public vs Private Cloud - Introduction to Cloud Service Models -Software as a Service- Platform as a Service – Infrastructure as a Services — Other Cloud Service Models.	12
3	**TECHNOLOGICAL DRIVERS FOR CLOUD COMPUTING** Introduction- Virtualization- Multi Core Technology- Memory and Storage Technologies- Networking Technologies- Programming Models- Pervasive Computing-Operating System- Application Environment.	12
4	**CLOUD SERVICE PROVIDERS** Introduction - EMC: EMC IT- Captiva cloud toolkit-Google: Cloud Platform and Cloud storage- Google cloud content and Google cloud print- Google App Engine- Amazon Web Services- Amazon Elastic Compute Cloud- Amazon Simple Storage Service- Microsoft: Windows Azure- Microsoft Assessment- Microsoft Planning Toolkit- IBM: Cloud Models- IBM Smart Cloud	12

5	**OPEN SOURCE SUPPORT FOR CLOUD** Introduction - Open Source Tools for IaaS- Open Nebula – Eucalyptus- Open Stack and Apache Cloud Stack-Open Source Tools for PaaS: Paasmaker- Red Hat Open Shift Origin- Open Source Tools for SaaS: Apache VCL- Google Drive - Google Docs – Drop box- Open Source Tools for Research: CloudSim- Sim MapReduce, Cloud Analyst and Green Cloud- Distributed Computing Tools for Management of Distributed Systems: Cassandra- Hadoop and MongoDB- NGrid and Ganglia.	12

CO	Course Outcomes
CO1	Understand the concepts of cloud computing and their models
CO2	Apply cloud computing techniques for various cloud architecture and its services
CO3	Analyze the best technologies for cloud computing in terms of network, storage and other services
CO4	Evaluate the various virtualization and cloud deployment models in cloud computing.
CO5	Develop real time applications by using various cloud service providers and open source tools.
Textbooks:	
1	K. Chandrasekaran (2015), Essentials of Cloud Computing , CRC Press Taylor & Francis Group, LLC (Unit I to V).
2	"Cloud Computing: Concepts, Technology & Architecture" Authors: Thomas Erl, Ricardo Puttini, and Zaigham Mahmood
3	"Mastering Cloud Computing: Foundations and Applications Programming" Authors: Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi
4	"Cloud Native Patterns: Designing Change-Tolerant Software" Author: Cornelia Davis
5	"Cloud Native Java: Designing Resilient Systems with Spring Boot, Spring Cloud, and Cloud Foundry" Authors: Josh Long and Kenny Bastani
Reference Books:	
1	Rishabh Sharma (2014), Cloud Computing: Fundamentals, Industry Approach and Trends, WileyIndia Edition.
2	Dr. Kumar Saurabh (2011), Cloud Computing : Insights into New Era Infrastructure, Wiley India
3	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi (2013), Mastering Cloud Computing
4	Foundations and Applications Programming, Morgan Kaufmann is an imprint of Elsevier.
5	A.Srinivasan, J.Suresh,(2014), Cloud Computing A Practical Approach for Learning and Implementation, Pearson Education.

Web resources:	
1	https://aws.amazon.com/Free/CloudComputing
2	https://www.w3schools.com/aws/aws_cloudessentials_cloudcomputing.php

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	2	3	3	3	2	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3
CO4	2	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	2
Total	14	15	14	14	15	15	14	14	15	15	14
Average	2.8	3	2.8	2.8	3	3	2.8	2.8	3	3	2.8

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE22	**SOCIAL MEDIA ANALYTICS**	Elective	2	1	1	0	3	4	25	75	100

Learning Objectives

LO1	Familiarize the learners with the concept of social media.
LO2	Familiarize the learners with the concept of social media analytics and understand its significance
LO3	Enable the learners to develop skills required for analyzing the effectiveness of Social media.
LO4	Familiarize the learners with different tools of social media analytics.
LO5	Familiarize the learner with different visualization techniques for Social media analytics.

Unit	Content	Hours
1	**Social Media Analytics :An Overview** Core Characteristics of Social Media, Types of Social Media, Social media landscape, Need for Social Media Analytics (SMA), SMA in small & large organizations. Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Social Media Analytics Tools.	12
2	**Social Network Structure, Measures & Visualization** Basics of Social Network Structure - Nodes, Edges & Tie Describing the Networks Measures –Degree Distribution, Density, Connectivity, Centralization, Graph Layout, Scale Issues. Social Media Network Analytics-Common Network Terms, Common Social Media Network Types, Types of Networks, Common Network Terminologies, Network Analytics Tools.	12
3	**Social Media Text, Action &Hyperlink Analytics** Social Media Text Analytics-Types of Social Media Text, Steps in Text Analytics, Social Media Text Analysis Tools, Social Media Action Analytics-What Is Actions Analytics? Actions Analytics Tools , Social Media Hyperlink Analytics: Types of Hyperlinks, Types of Hyperlink Analytics, Hyperlink Analytics Tools.	12
4	**Social Media Location & Search Engine Analytics** Location Analytics - Sources of Location Data, Categories of Location Analytics, Location Analytics Tools, Search Engine Analytics-Types of Search Engines, Search Engine Analytics, Search Engine Analytics Tools	12

5	**Social Information Filtering - Social Sharing and filtering** Automated Recommendation systems, Traditional Vs social Recommendation Systems, Understanding Social media and Business Alignment, Social media KPI, formulating a Social Media Strategy, Managing Social Media Risks.	12

CO	Course Outcomes
CO1	Understand the concept of Social media
CO2	Understand the concept of social media Analytics and its significance
CO3	Learners will be able to analyze the effectiveness of social media.
CO4	Learners will be able to use different Social media analytics tools effectively and efficiently.
CO5	Learners will be able to use different effective Visualization technique store present Social media analytics
Textbooks:	
1	Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
2	Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6
3	"Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics" Author: Matthew Ganis and Avinash Kohirkar
4	"Social Media Data Mining and Analytics" Authors: Gabor Szabo and G. L. Ciampaglia
5	"Social Media Metrics: How to Measure and Optimize Your Marketing Investment" Author: Jim Sterne
Reference Books:	
1	Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0.
2	Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615.
3	Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6.
4	Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2 nd Edition, ISBN: 978-3-642-19459-7.
5	"Social Media Mining: An Introduction" Authors: Reza Zafarani, Mohammad Ali Abbasi, and Huan Liu
Web resources:	
1	https://www.bing.com/videos/riverview/relatedvideo?q=social+Media+analytics+web+resources+link&mid=05D562A78D17FE262CCA05D562A78D17FE262CCA&FORM=VIRE

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	2	1	3	3	3
CO2	3	3	3	2	2	1	2	1	3	3	3
CO3	3	2	2	2	2	1	3	2	3	2	2
CO4	3	3	2	3	3	3	2	2	3	2	2
CO5	3	3	3	2	1	2	1	3	2	2	1
Total	15	14	13	11	10	8	10	9	14	12	11
Average	3	2.8	2.6	2.2	2	1.6	2	3	2.8	2.4	2.2

3 – Strong, 2- Medium, 1- Low

1st YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAS21	INTERNET AND WEB DEVELOPMENT	NME	1	1	0	0	2	2	25	75	100

Learning Objectives	
LO1	To understand the basic concepts of web and internet.
LO2	To learn about Client-Side Processing and Scripting
LO3	To Learn and implement the concepts of Web Designing.
LO4	To Learn and implement the concepts of CSS in the Program.
LO5	To understand the need of My SQL and its usage in web development.

Unit	Content	Hours
1	**Introduction To Internet** Concept of Internet-Evolution of internet-Basic concepts-Communication on the Internet-Internet Domains-Internet Server Identities-Establishing Connectivity on Internet-Client IP Address-TCP/IP and its Services-Web Server-Web Client-Domain Registration	6
2	**Client-Side Processing and Scripting** JavaScript Introduction – Data Types – Variables – Operators - Control Statements – Functions – Arrays – DOM, Built-in Objects, Regular Expression, Exceptions, Event handling - Windows and Frames - Forms and Validation.	6
3	**Web Designing** Introduction to HTML- HTML tags-Commonly used HTML commands - Title and footers - Text formatting - Text Style - Lists - Forms - Adding Graphics to HTML documents -Tables - Linking Documents - Frames	6
4	**Introduction to Cascading Style Sheet** CSS, CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface Markup tags for inserting URL, Images, Tables, Frames - Dynamic HTML.	6
5	**Introduction to MY SQL** The Show Databases and Table - The USE command – Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement – Some Administrative detail -Loading and Dumping a Database.	6

CO	Course Outcomes
CO1	Gain a comprehensive understanding of how the internet works.
CO2	Implement client-side Processing and Script.
CO3	Implement the concepts of HTML in Web Design.
CO4	Implement the concepts of CSS in Web Design.
CO5	Develop application using My SQL as a backend Connectivity in web Design.
Text books:	
1	"Internet & World Wide Web" 5th Edition, Paul Deitel, Harvey Dietel, Abbey Dietel.
2	The Internet Book : Everything You Need to Know About Computer Networking and How the Internet Works, Douglas E Comer Fifth Edition
3	Achyut S Godbole and Atul Kahate, "Web Technologies", 2nd Edition, Tata McGraw Hill, 2012.
4	Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", 3rd Edition, Tata McGraw Hill, 2013.
5	Mike Mcgrath, "PHP & MySQL in easy Steps", Tata McGraw Hill, 2012.
Reference Books:	
1	Web Development with JavaServer Pagesby Duane K. Fields and Mark A. Kolb (Manning Publications, 2000)
2	Internet Working with TCP/IP Volume 2, Douglas E Comer, Second Edition.
3	https://stucor.in
4	https://www.techtarget.com/searchnetworking/definition/TCP-IP
5	Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How to Program", 5th Edition, Pearson Education, 2011.

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	3	3	3	2	3	2	2
CO3	3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	12	15	12	12
Average	3	3	3	3	3	3	3	2	3	2	2

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC31	Machine Learning	Core	2	1	2	0	5	5	25	75	100

Learning Objectives	
LO1	To understand the concepts of Machine Learning.
LO2	To understand the theoretical and practical aspects of types of machine learning.
LO3	To teach and get familiarized with supervised learning and their applications.
LO4	To teach and get familiarized with the concepts and algorithms of unsupervised learning. .
LO5	To appreciate the concepts and algorithms of deep learning.

Unit	Content	Hours
1	**Introduction** Introducing Machine Learning: The Origins of Machine Learning, Uses and Abuses of Machine Learning _ Basics of Machine Learning Algorithm Model Works Steps to apply Machine Learning Choosing a Machine Learning Algorithm Using Machine Learning concepts. **Chapter 1: Page No: 1 - 24** **Chapter 2: Page No: 28-61**	14
2	**Lazy Learning** – Classification Using Nearest Neighbors: The kNN Algorithm Diagnosing Breast Cancer with the kNN Algorithm **Probabilistic Learning** – Classification Using Naive Bayes: Basic concepts of Bayesian Methods The Naïve Bayes Algorithm. **Chapter 3: Page 66 – 86** **Chapter 4: Page 90 -124** **Chapter 5: Page 126-158**	14
3	**Forecasting Numeric Data – Regression Methods**: Understanding Regression Example – Predicting Medical Expenses using Linear Regression Understanding Regression Trees and Model Trees. **Black Box Methods – Neural Networks:** Understanding Neural Networks, from Biological to Artificial Neurons. **Chapter 6:172-200** **Chapter 7:220-229**	14

4	**Finding Groups of Data**: Clustering with KMeans: Understanding Clustering -The kmeans Algorithm for clustering Finding teen market segments using kmeans Clustering.	14
5	**Introduction to Deep Learning:** Introduction to Deep Learning, Single Layer Perceptron Model (SLP), Multilayer Perceptron Model (MLP), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs)	14

CO	Course Outcomes
CO1	To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data
CO2	To comprehend, apply and evaluate the classification techniques for real world applications
CO3	To understand, use and perform evaluation of Regression methods
CO4	To recognize, implement and analyse the unsupervised techniques for real world applications
CO5	To understand, identify, implement and review the deep learning techniques for real time applications
Text books:	
1	Brett Lantz, "Machine Learning with R", Addison Wesley Packt Publishing, 2013**. (Unit 1 to 4)**
2	Taweh Beysolow, "Introduction to Deep Learning Using R: A Step by Step Guide to Learning and Implementing Deep Learning Models Using R", San Francisco, California, USA, 2017. **(Unit 5)**
3	Hands-On Machine Learning With Scikit-Learn Keras, and TensorFlow by Aurélien Géron's
4	Foundations of Machine Learning Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar
5	R in a Nutshell: A Desktop Quick Reference 2nd Edition by Joseph Adler
Reference Books:	
1	Daniel T. Larose, Chantal D. Larose, "Data mining and Predictive analytics", Second Ed., Wiley Publication, 2015.
2	Bertt Lantz, "Machine Learning with R: Expert techniques for predictive modeling", 3rd Edition, April 15,2019.
3	Jason Bell, "Machine Learning: HandsOn for Developers and Technical Professionals", Wiley Publication,2015.
4	R for Data Analysis in easy steps 2nd Edition by Mike McGrath
5	Practice datascience with R- Nine Zumel,John Mount.
Web resources:	
1	https://www.coursera.org/learn/machine-learning
2	https://www.techtarget.com/searchenterpriseai/definition/machine-learning-ML

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	2	3	2	2
CO2	3	3	3	2	3	2	2	2	3	3	2
CO3	3	2	2	2	3	1	1	2	3	3	2
CO4	3	3	3	3	3	2	1	3	3	3	3
CO5	3	2	3	2	3	2	1	2	3	3	2
Total	15	13	13	11	14	9	6	11	15	14	11
Average	3	3	3	2	3	2	1	2	3	3	2

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC32	Digital Forensics	Core	2	1	2	0	5	5	25	75	100

Learning Objectives	
LO1	To understand the fundamentals of digital forensics and its techniques.
LO2	To comprehend digital crimes and the methodologies of investigation.
LO3	To prepare for digital forensic readiness in various scenarios.
LO4	To learn and utilize forensic tools specific to iOS devices.
LO5	To learn and utilize forensic tools specific to Android devices.

Unit	Content	Hours
1	Introduction to Digital Forensics: Forensic Science and its relevance to digital forensics-Digital Evidence: Types and characteristics-Digital Forensics Process: Identification, Collection, Examination, Analysis, and Presentation phases	14
2	Digital Crime and Investigation: Understanding Digital Crime and Substantive Criminal Law-General Conditions and Offenses in the digital realm-Investigation Methods for Collecting Digital Evidence-International Cooperation in Digital Evidence Collection	14
3	Digital Forensic Readiness-Concept of Digital Forensic Readiness -Law Enforcement vs. Enterprise Digital Forensic Readiness-Frameworks, Standards, and Methodologies-Challenges in Digital Forensics	14
4	iOS Forensics-Overview of Mobile Hardware and Operating Systems-iOS Fundamentals and Jail breaking-File System and Hardware Analysis-iPhone Security and Forensic Procedure	14
5	Android Forensics -Android Architecture and Rooting Techniques-File System and Hardware Analysis-Android Security and Forensic Procedures-Tools for Android Forensics: Oxygen Forensics, Mobil Edit, Android App Decompiling	14

CO	Course Outcomes
CO1	Understand the principles and practices of digital forensics.
CO2	Identify and investigate various forms of digital crimes.
CO3	Prepare and implement strategies for digital forensic readiness.
CO4	Apply forensic techniques to extract and analyze data from iOS devices.
CO5	Apply forensic techniques to extract and analyze data from Android devices.
Textbooks:	
1	André Årnes, "Digital Forensics", Wiley, 2017.
2	Nelson, B, Phillips, A, Enfinger, F, Stuart, C., —Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
3	Chuck Easttom, "An In-Depth Guide to Mobile Device Forensics", 2nd Edition, CRC Press, 2019.
4	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
Reference Books:	
1	John Sammons, The Basics of Digital Forensics The Primer for Getting Started in Digital Forensics, Second Edition, Syngress, 2015.
2	Bill Nelson,Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, 1st Edition, Cengage Learning, 2014
3	Cory Altheide and Harlan Carvey, —Digital Forensics with Open Source Tools, 1st Edition, Elsevier publication, April 2011.
4	Nihad A. Hassan, Digital Forensics Basics: A Practical Guide Using Windows OS, 1st Edition,APress, 2019
5	Thomas J. Holt, Adam M.Bossler, K.C.Seigfried – Spellar, Cybercrime and Digital Forensics An Introduction, 1st Edition, Taylor and Francis,New York, 2015.
Web resources:	
1	https://www.simplilearn.com/what-is-digital-forensics-article
2	https://nyayags.org/digital-forensics-and-legal-aspects
3	https://www.mailxaminer.com/blog/digital-evidence-collection,https://infosavvy.com/evidence-collection/
4	https://www.ibm.com/think/topics/computer-forensics
5	https://www.eccouncil.org/cybersecurity-exchange/computer-forensics/mobile-device-forensics/

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	3	3	2	3
CO2	3	3	3	3	2	3	2	3	3	2	3
CO3	3	3	2	2	3	2	2	3	3	3	3
CO4	3	3	3	3	3	2	1	2	3	3	3
CO5	3	3	3	3	3	2	1	2	3	3	3
Total	15	15	13	13	13	11	7	13	15	13	15
Average	3	3	3	3	3	2	1	2	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC34P	**Machine Learning Lab**	**Practical- V**	**0**	**0**	**4**	**0**	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To formulate machine learning problems corresponding to different applications.
LO2	To understand a range of machine learning algorithms along with their strengths and weaknesses.
LO3	To apply machine learning algorithms to solve problems of moderate complexity.
LO4	To apply CNN to solve problems of moderate complexity.
LO5	To apply LSTM and RNN to solve problems.

Unit	**Content**	**Hours**
1	Write a python program to compute the Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, Standard Deviation.	6
2	Implement a Linear Regression and Multiple Linear Regression with a Real Dataset.	6
3	Implementation of Logistic Regression using sklearn.	6
4	Implement a binary classification model.	6
5	Classification with Nearest Neighbours and NavieBaye Algorithm	6
6	Implementation Decision tree for classification using sklearn and its parameter tuning.	6
7	Implement the k-means algorithm.	6
8	Implement an Image Classifier using CNN in TensorFlow/Keras.	6
9	Implement an Autoencoder in TensorFlow/Keras.	6
10	Implement a Simple LSTM using Tensor Flow/Keras.	6
	Total	60

CO	Course Outcomes
CO1	To understand and implement the mathematical and statistical prospective of machine learning algorithms through python programming
CO2	To recognize and develop the machine learning models through python in built functions
CO3	To understand, impart and develop the machine learning models for real-time dataset
CO4	To comprehend, impart and implement the deep learning models for real-time applications
CO5	To identify and evaluate the performance machine learning models for real-time dataset
Text Books:	
1	Brett Lantz, "Machine Learning with R", AddisonWesley Packt Publishing, 2013**. (Unit 1 to 4)**
2	TawehBeysolow, "Introduction to Deep Learning Using R: A Stepby Step Guide to Learning and Implementing Deep Learning Models Using R", San Francisco, California, USA, 2017. **(Unit 5)**
3	Hands-On Machine Learning With Scikit-Learn Keras, and TensorFlow by Aurélien Géron's
4	Foundations of Machine Learning Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar
5	R in a Nutshell: A Desktop Quick Reference 2nd Edition by Joseph Adler
Reference Books:	
1	Daniel T. Larose, Chantal D. Larose, "Data mining and Predictive analytics", Second Ed., Wiley Publication, 2015.
2	Bertt Lantz, "Machine Learning with R: Expert techniques for predictive modeling", 3rd Edition, April 15,2019.
3	Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals", Wiley Publication,2015.
4	R for Data Analysis in easy steps 2nd Edition by Mike McGrath
5	Practice datascience with R- Nine Zumel,John Mount.
Web resources:	
1	https://www.coursera.org/learn/machine-learning
2	https://www.techtarget.com/searchenterpriseai/definition/machine-learning-ML

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1	1	2	3	3	2
CO2	3	3	3	3	3	2	1	2	3	3	3
CO3	3	2	2	2	3	1	2	2	3	3	2
CO4	3	2	3	2	3	1	-	2	3	3	2
CO5	3	3	3	3	3	2	2	3	3	3	3
Total	15	13	13	12	15	7	6	11	15	15	12
Average	3	3	3	2	3	1	1	2	3	3	2

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC35P	**Internet of Things Lab**	**Practical-VI**	**0**	**0**	**4**	**0**	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To implement the concepts of IoT.
LO2	To interface different platforms like Arduino and Raspberry pi
LO3	To design and implement the related applications.
LO4	To learn how to analysis the data in IoT.
LO5	To learn IoT system involving prototyping, programming and data analysis.

Unit	Content	Hours
1	Controlling the Light Emitting Diode (LED) with a push button.	4
2	Interfacing Arduino to Zigbee module	4
3	Interfacing the RGB LED with the Arduino	4
4	Controlling the LED blink rate with the potentiometer interfacing with Arduino	4
5	Detection of the light using photo resistor	4
6	Interfacing of temperature sensor LM35 with Arduino	4
7	Interfacing Servo Motor with the Arduino	4
8	Interfacing of the Active Buzzer with Arduino.	4
9	Interfacing of the Relay with Arduino.	4
10	Directional Control of the DC motor using Arduino	4
	Total	40

CO	Course Outcomes
CO1	On this completion of this course the students will be able to the basics of the Raspberry Pi platform and Python programming for embedded applications.
CO2	On this completion of this course the students will be able to Interface Arduino with Zigbee, GSM, and Bluetooth modules for wireless communication.
CO3	On this completion of this course the students will be able to Interface various sensors (temperature, humidity, motion, etc.) with Raspberry Pi.
CO4	On this completion of this course the students will be able to Establish wireless data exchange between Arduino and Raspberry Pi using Zigbee, Bluetooth, Wi-Fi, or RF communication.
CO5	On this completion of this course the students will be able to Apply acquired knowledge to create real-world IoT applications in domains like home automation, smart agriculture, or industrial monitoring.
Textbooks:	
1	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2	Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
3	Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
4	"Springer Handbook of Internet of Things" edited by Reza Malekian, Álvaro Rocha, and Nuno M. Garcia Publisher: Springer ,2023
5	"Internet of Things: Technology, Applications, and Standardization" edited by Jaydip Sen et al. ArXiv, 2018
Reference Books:	
1	The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit2).
2	“From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”,Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3	Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer,2011.
4	Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition,Michael Margolis, Arduino Cookbook and O‟Reilly Media,2011.
5	"Learning Internet of Things" by Peter Waher , Packt Publishing , 2015
Web resources:	
1	Learn Internet of Things (IoT) | .NET
2	IoT Hub - Connecting YOU to the Internet of Things

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	2	1	2	3	3	2
CO2	3	3	3	2	3	2	2	2	3	3	2
CO3	3	3	3	2	3	2	2	3	3	3	3
CO4	3	3	3	2	3	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	14	14	11	15	11	11	12	15	15	13
Average	3	3	3	2	3	2	2	2	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC33	Advanced Web Technology	Core	2	1	1	0	3	4	25	75	100

Learning Objectives	
LO1	Understand the fundamentals of the web development and design.
LO2	Provide basic knowledge HTML, CSS and JavaScript.
LO3	Learn Client-side Scripting and Server-side Scripting programming languages.
LO4	Learn database management using SQL and NoSQL databases.
LO5	Understand Web development frameworks and Libraries.

Unit	Content	Hours
1	**Introduction to Web Development:** Overview of Web Development. Web Development Process. Web Development tools and technologies. Introduction to HTML, CSS, and JavaScript. Web Development frameworks and libraries.	12
2	**HTML and CSS and JavaScript:** HTML-Basic HTML Elements, Forms, Tables and Frames, HTML5 Features. CSS-Basics, Selectors, Properties, CSS box Model, Layouts. JavaScript- Basics, Variables, Control Structures, Functions. JavaScript Basics: Variables, Data types and Operators, Control Structures. JavaScript Libraries and Frameworks.	12
3	**Client-Side Scripting and Server-Side Scripting** Client-Side Scripting**:** DOM Manipulation, Events and Event Handling. Introduction to Server –Side Scripting. PHP-Basics, Variables, Control Structures, Functions and Function Expressions. Other Server-Side Technologies(Python, Ruby, Etc)	12
4	**Database Management:** Introduction to databases: Overview of database Management Systems, Types of databases. Relational Databases-Database Design, SQL Queries, Database Security. NoSQL databases:(MongoDB,Etc)-Introduction to NoSQL Databases, Data Modeling and Schema design, Querying NoSQL databases.	12

5	**Web Frameworks and Libraries:** Introduction to Web Frameworks. Front-End Frameworks (React, Angular, Vue.js, etc).Overview of Popular front-end frameworks, Building Applications with Front-End Frameworks. Back-End Frameworks(Laravel, Django, Ruby on Rails, etc), Overview of Popular back-end frameworks. Building Applications with back-end Frameworks.	12

CO	Course Outcomes
CO1	Design and develop dynamic web applications
CO2	On the Completion of this course the student will be to learned about the basics of HTML, CSS and JavaScript.
CO3	Apply client-side and Side scripting techniques.
CO4	Implement database –driven web applications.
CO5	Apply web development frameworks and libraries
Textbooks:	
1	Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. UNITS: 1,2,3,4
2	Dayley Brad, Dayley Brendan ,"AngularJS, JavaScript, and jQuery All in One", Sams Teach Yourself 1st Edition, Kindle Edition, 2015.UNIT: 5.
Reference Books:	
1	M. Srinivasan: Web Programming Building Internet Applications, 3 rdEdition, Wiley India, 2009.
2	Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7thImpression,2012.
3	Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4	Raj Kamal: Internet and Web Technologies, McGraw Hill Education.
Web resources:	
1	https://www.w3schools.com/html/
2	https://www.tpointtech.com/what-is-xhtml
3	https://javascript.info/first-steps
4	https://www.geeksforgeeks.org/how-to-create-xml-dynamically-using-javascript/
5	https://www.geeksforgeeks.org/introduction-to-angularjs/

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	1	2	2	2	2
CO2	3	3	3	2	3	2	1	2	3	3	2
CO3	3	2	3	2	3	2	1	2	3	2	3
CO4	3	3	2	3	3	2	1	2	3	3	3
CO5	3	2	3	2	3	1	1	2	3	3	3
Total	15	12	13	11	14	9	5	10	14	13	13
Average	3	2	3	2	3	2	1	2	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE31	Algorithm of Design and Analysis	Elective	2	1	1	0	3	4	25	75	100

Learning Objectives

LO1	Learn the fundamentals of algorithm efficiency, including time and space complexity.
LO2	Learn the fundamental principles of the Greedy Method and how it differs from other problem-solving techniques like Divide and Conquer and Dynamic Programming.
LO3	Learn how overlapping sub problems and optimal substructure help solve problems efficiently and Compare Dynamic Programming (DP) with Divide and Conquer and Greedy methods.
LO4	Learn how backtracking systematically explores all possible solutions to a problem.
LO5	Learn how Branch and Bound systematically explores the solution space for optimization problems.

Unit	Content	Hours
1	Introduction – Performance Analysis – Asymptotic Notation- Divide and conquer Method: Binary Search, Finding Maximum and Minimum, Merge Sort and Quick Sort.	12
2	Greedy Methods: Knapsack Problem, Minimum Cost Spanning Trees, Optimal Storage on Tapes and Single Source Shortest Path Problem.	12
3	Dynamic Programming: Multistage Graphs, 0/1 knapsack and Traveling Salesman Problem. Basic Traversal and Search Techniques: Techniques for Binary Tree, Techniques for Graphs: Depth First Search and Breadth First Search - Connected Components and Spanning Tree - Biconnected Components and DFS.	12
4	Backtracking: 8 Queens Problems, Sum of Subsets, Graph Colouring, Hamiltonian Cycle and Knapsack Problem.	12
5	Branch and Bound: Least Cost Search. Bounding: FIFO Branch and Bound and LC Branch and Bound. 0/1 Knapsack Problem, Travelling Salesman Problem.	12

CO	Course Outcomes
CO1	On the completion of this course the students will able to understand and apply asymptotic notations (Big-O, Ω, Θ) for time and space complexity analysis.
CO2	On the completion of this course the students will able to apply Divide and Conquer for efficient searching and sorting (Binary Search, Merge Sort, Quick Sort)
CO3	On the completion of this course the students will able to implement Depth-First Search (DFS) and Breadth-First Search (BFS) for graph-based problems.
CO4	On the completion of this course the students will able to implement Backtracking algorithms for 8 Queens, Graph Coloring, Hamiltonian Cycle, and Knapsack.
CO5	On the completion of this course the students will able to apply FIFO and Least Cost (LC) Branch and Bound techniques.
Textbooks:	
1	E.Horowitz, S.Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms , Second edition, Universities Press.
2	S. K. Basu, Design Methods and Analysis of Algorithms , PHI, 2005.
3	Goodman and S. T. Hedetniem, Introduction to the Design and Analysis of Algorithms , MGH, 1977
4	A.V. Aho, J.D. Ullman and J.E.Hospcraft, The Design and Analysis of Computer Algorithms Pearson Education.
Reference Books:	
1	Introduction to Algorithms – Cormen, Leiserson, Rivest, and Stein (MIT Press)
2	Algorithm Design – Jon Kleinberg, Eva Tardos (Pearson)
3	The Design and Analysis of Computer Algorithms – Aho, Hopcroft, Ullman (Pearson)
4	Algorithms – Robert Sedgewick and Kevin Wayne (Addison-Wesley)
5	Data Structures and Algorithm Analysis in C++ – Mark Allen Weiss (Pears
Web resources:	
1	https://onlinecourses.nptel.ac.in/noc19_cs47/preview

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	2	1	3	3	2
CO2	3	3	3	3	2	2	1	1	3	3	2
CO3	3	3	3	2	2	1	2	1	3	3	3
CO4	3	3	3	3	2	1	2	1	3	3	3
CO5	3	3	2	2	2	1	2	2	3	3	3
Total	15	15	13	12	10	6	9	6	15	15	13
Average	3	3	3	2	2	1	2	1	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE32	Object Oriented Analysis and Design	Elective	2	1	1	0	3	4	25	75	100

Learning Objectives

LO1	To provide a brief, hands-on overview of object-oriented concepts and its life cycle for software development.
LO2	To learn for modelling the software and to design them using UML diagrams
LO3	To understand the problem domain and to identify the objects from the problem specification.
LO4	To understand, how to apply design axioms and corollaries for the classes and object relational systems.
LO5	To gain knowledge about open source tools for Computer Aided Software Engineering

Unit	Content	Hours
1	**INTRODUCTION** : An overview – Object basics – Object state and properties – Behaviour – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Meta classes – Object oriented system development life cycle.	12
2	**METHODOLOGY AND UML** Introduction – Survey – Rumbaugh, Booch, Jacobson methods – Unified modelling language – Static and Dynamic models – Rational Rose Suite - UML diagrams – Static diagram : Class diagram – Use case diagrams – Behaviour Diagram : Interaction diagram – State chart diagram – Activity diagram - Implementation diagram: Component diagram – Deployment diagram – example - Design of online railway reservation system using UML diagrams - Dynamic modelling – Model organization – Extensibility.	12
3	**OBJECT ORIENTED ANALYSIS** Identifying Use case – Business object analysis – Use case driven object oriented analysis – Use case model – Documentation – Classification – Identifying object, relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility – construction of class diagram for generalization, aggregation – example – vehicle class.	12
4	**OBJECT ORIENTED DESIGN** Design process and benchmarking – Axioms – Corollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability – Databases – Object relational systems – Designing interface objects – Macro and Micro level processes – The purpose of a view layer interface-OOUI - MVC Architectural Pattern and Design – Designing the system.	12
5	**CASE TOOLS** Railway domain : Platform assignment system for the trains in a railway station - Academic domain : Student Marks Analysing System - ATM system - Stock maintenance - Quiz System - E-mail Client system - Cryptanalysis – Health Care Systems. Use Open source CASE Tools: StarUML/ UML Graph for the above case studies.	12

CO	Course Outcomes
CO1	Able to understand the object oriented concepts and to apply object oriented life cycle model for a project.
CO2	Able to design static and dynamic models using UML diagrams.
CO3	Able to perform object oriented analysis to identify the objects from the problem specification.
CO4	Able to identify and refine the attributes and methods for designing the object oriented system.
CO5	Able learn the open source CASE tools and to apply them in various domains.
Textbooks:	
1	Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, 2008
2	Brahma Dathan, Sarnath Ramnath, "Object-Oriented Analysis, Design and Implementation", Universities Press, 2010
3	Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Patterns and Java, Pearson 2004
Reference Books:	
1	Craig Larman, Applying UML and Patterns – An Introduction to Object-Oriented Analysis and Design and Iterative Development" , 3rd Edition, Pearson Education, 2005
2	Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Addison Wesley Long man, 1999
3	Martin Fowler, "UML Distilled A Brief Guide to Standard Object Modeling Language", 3rd Edition, Addison Wesley, 2003
4	Russ Miles, Kim Hamilton, "Learning UML 2.0", O'Reilly, 2008
Web resources:	
. http://www.spinellis.gr/umlgraph/doc/index.html	

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	1	2	3	3	2
CO2	3	3	3	2	2	2	1	2	3	3	2
CO3	3	3	3	2	3	2	1	2	3	3	3
CO4	3	3	3	3	3	2	1	2	3	3	3
CO5	3	2	3	2	3	3	1	3	3	3	3
Total	15	13	14	10	13	11	5	11	15	15	13
Average	3	3	3	2	3	2	1	2	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAS31	**Full Stack Development**	**SEC**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To become knowledgeable about the most recent web development technologies.
LO2	Idea for creating two tier and three tier architectural web applications.
LO3	Design and Analyze real time web applications.
LO4	Constructing suitable client and server side applications
LO5	To learn core concept of both front end and back end programming.

Unit	Content	Hours
1	Web Development Basics: Web development Basics - HTML & Web servers Shell - UNIX CLI Version control - Git &Github HTML, CSS	6
2	Frontend Development: Javascript basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format.	6
3	REACT JS: Introduction to React React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication	6
4	Java Web Development: JAVA PROGRAMMING BASICS, Model View Controller (MVC) Pattern MVC Architecture using Spring RESTful API using Spring Framework Building an application using Maven	6
5	Databases & Deployment: Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles and deploying application in Cloud	6

CO	Course Outcomes
CO1	Develop a fully functioning website and deploy on a web server.
CO2	Gain Knowledge about the front end and back end Tools
CO3	Find and use code packages based on their documentation to produce working results in a project.
CO4	Create web pages that function using external data.
CO5	Implementation of web application employing efficient database access.
Textbooks:	
1	Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2	Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-byStep Guide to Creating Dynamic Websites by Robin Nixon
3	Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015 BYAZAT MARDAN
Reference Books:	
1	Full-Stack JavaScript Development by Eric Bush.
2	Mastering Full Stack React Web Development Paperback – April 28, 2017 by TomaszDyl , Kamil Przeorski , Maciej Czarnecki

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	1	1	2	2	3	2
CO2	3	3	3	2	3	1	1	2	3	3	3
CO3	3	3	3	2	3	2	1	3	3	3	3
CO4	3	3	3	2	3	2	2	3	3	3	3
CO5	3	2	3	2	3	2	1	3	3	3	3
Total	15	13	14	9	15	8	6	13	14	15	14
Average	3	3	3	2	3	1	1	3	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAC41	Digital Image Processing	Core	3	1	2	0	5	6	25	75	100

Learning Objectives	
LO1	Understand the **basic concepts of digital images**, including image formation, sampling, and quantization.
LO2	Apply **point operations**, including gray-level transformations and histogram manipulation, to enhance images.
LO3	Implement **inverse filtering** and **least mean square (LMS) filtering**.
LO4	Identify and analyze **image discontinuities** using edge detection techniques.
LO5	Use **transform-based compression techniques**, including those based on DCT and wavelets.

Unit	Content	Hours
1	Digital image fundamentals & Image Transforms:- Digital Image fundamentals, Sampling and quantization, Relationship between pixels. Image Transforms: 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Discrete Wavelet Transform.	14
2	Image enhancement (spatial domain) : Introduction, Image Enhancement in Spatial Domain, Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation, gray level Transformation, local or neighborhood operation, median filter, spatial domain high- pass filtering.	12
3	Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration.	13
4	Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation Morphological Image Processing :Dilation and Erosion, Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, The Hit or Miss Transformation.	12
5	Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.	11

CO	Course Outcomes -The Students will be able to
CO1	Understand appreciation of the fundamentals of Digital Image Processing including the topics of filtering, transforms and morphology, and image analysis and compression
CO2	Implement basic image processing algorithms in MATLAB.
CO3	The skill base necessary to further explore advanced topics of Digital Image Processing.
CO4	A position to make a positive professional contribution in the field of Digital Image Processing.
CO5	A clear impression of the breadth and practical scope of Digital Image Processing.
Textbooks:	
1	Digital Image Processing- S Jayaraman, S. Essakkirajan, T. Veerakumar-TMH,2010
2	Digital Image Processing- Rafeal C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008
3	Digital Image Processing and analysis-human and computer vision application with using CVIP Tools – Scotte Umbaugh,2nd Ed, CRC Press,2011
4	Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
5	Digital Image Processing with MATLAB & Labview - Vipula Singh Elsevier
Reference Books:	
1	Digital Image Processing using Matlab, Rafeal C. Gonzalez, Richard E. Woods, Steven L. Eddins, Pearson Education.
2	Digital Image Processing and computer Vision-Somka, Halavac, Boyle - Cengage learning (Indian edition)2008.
3	Introduction to Image Processing & Analysis-John C. Russ, J. Christian Russ, CRC Press, 2010
4	Fundamentals of Digital Image Processing-A.K. Jain, PHI,1989
Web resources:	
1	https://nptel.ac.in/courses/117105079
2	https://www.coursera.org/learn/digital
3	https://www.udemy.com/course/digital-image-processing-operations-and-applications/
4	https://www.edx.org/course/fundamentals-of-digital-image-and-video-processing
5	https://www.classcentral.com/subject/digital-image-processing

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	2	3	2	2
CO2	3	3	3	2	3	2	2	2	3	3	2
CO3	3	2	2	2	3	1	1	2	3	3	2
CO4	3	3	3	3	3	2	1	3	3	3	3
CO5	3	2	3	2	3	2	1	2	3	3	2
Total	15	13	13	11	14	9	6	11	15	14	11
Average	3	3	3	2	3	2	1	2	3	3	2

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									Review	External	Total
24PCAC42P	Project Work	Core	0	2	4	6	5	12	80	120	200

Learning Objectives	
LO1	Expose to the various phases of Software Development Life Cycle.
LO2	Learn to apply the Skills and Knowledge in Design, Coding and Testing with appropriate Technological Tools and Procedures.
LO3	Learn to Develop Applications with Personal, Societal and Professional Ethical Standards.

Unit	Content	Hours
	1. The Candidates have to undergo a Minimum of 150 Hours of Project Work during the Course of Study either in an IT Industry / Public or Private Sector Organization / Research Institutes / Institution itself. 2. The Candidates need to identify and analyze real world problems on the selected project domain. 3. During the course of study, the Candidates need to Develop, Design, Test, etc., the Applications as per the directions by the Guide. 4. Then the Candidates have to prepare and submit the manuscript of the Project Work as a Report as per the requirements of the Institution / Department for Evaluation. 5. The submission of the Project Report will be done at the end of the Semester for Presentation and VivaVoce during the Practical Examinations of the Semester. 6. The Passing Minimum for Project Work is 50%. 7. If the Candidate fails to score 50% in the Project Work, the Candidate has to improve it during the next attempt. 8. A Faculty Member from the Department will act as a Guide to Supervise and Monitor the progress of the Candidates during the course of Project Work. 9. The Faculty Member will act as the Internal Examiner during the course of Project Work as well as at the time of conducting the VivaVoce Examination. 10. The Internal Marks for the Project Work will be awarded by the concerned Guide / Internal Examiner. 11. The Internal and External Examiners shall both evaluate the Project Report, Presentation and conduct the VivaVoce Examination.	

	INTERNAL MARKS AWARDED FOR THE PROJECT WORK – 80 Marks 1. Plan of the Project – 15 Marks 2. Execution of the Plan – 15 Marks 3. Individual Initiative – 10 Marks 4. Review 1 – 20 Marks 5. Review 2 – 20 Marks	
	EXTERNAL MARKS AWARDED FOR THE PROJECT WORK – 120 Marks 1. Evaluation of the Project Report 50 Marks 2. Presentation – 30 Marks 3. VivaVoce Examination – 40 Marks	

CO	**Course Outcomes -The Students will be able to**
CO1	Show leadership skills and learn time management
CO2	Identify various tools to be applied to a specific problem
CO3	Evaluate the reports
CO4	Involve in the Team and Manage it to deliver the excellent outcomes
CO5	Assess and Develop the individual skills to present and organize the projects

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAE41	**High Performances Computing**	**Core**	**4**	**1**	**1**	**0**	**3**	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	To get a clear idea of High Performance Computing concept.
LO2	To get brief knowledge about how to function the HPC systems.
LO3	To get idea of what techniques used in HPC models.
LO4	To understand a Parallel computing concepts.
LO5	To get familiar with OpenMP technology that is widely used in HPC technology.

Unit	Content	Hours
1	**Modern processors:** Stored-program computer architecture-General purpose cache-based microprocessor architecture-Memory Hierarchies- Multicore processors-Multithreaded processors-Vector processors. **Basic optimization techniques for serial code:** Scalar Profiling-Common sense optimizations-Simple measures, large impact-The role of compilers-C++ optimizations.	14
2	**Data access optimization:** Balance analysis and light speed estimates- Storage order-Algorithm classification and access optimizations-The Jacobi algorithm-Algorithm classification and access optimizations-Sparse matrix- vector multiply. **Parallel computers:** Taxonomy of parallel computing paradigms-Shared-memory computers-Distributed memory computers- Hierarchical systems-Networks.	14
3	**Basics of parallelization:** Introduction to Parallelism -Parallel scalability. **Shared memory parallel programming with OpenMP:** Short introduction to OpenMP-OpenMP-parallel Jacobi algorithm.	14
4	**Efficient OpenMP programming:** Profiling OpenMP programs-Performance pitfalls-Parallel sparse matrix-vector multiply. **Locality optimizations on ccNUMA architectures:** Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls-ccNUMA issues with C++.	14
5	**Distributed-memory parallel programming with MPI:** Message passing- A short introduction to MPI-MPI parallelization of a Jacobi solver. **Efficient MPI programming:** MPI performance tools-Communication parameters-Synchronization, serialization, contention-Reducing communication overhead-Understanding intranode point-to-point communication.	14

CO	Course Outcomes
CO1	Understand of the HPC and ccNUMA concepts
CO2	Design and develop a parallel programming with modern C, C++ and new version of FORTRAN
CO3	Apply with parallel computing
CO4	Develop an efficient OpenMP programming
CO5	Evaluate an efficient MPI programming
Textbooks:	
1	Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011.Chapters: 1 to 10.
2	Introduction to High Performance Computing for Scientists and Engineers ,Georg Hager and Gerhard Wellein, Publisher: CRC Press.
3	High Performance Computing: Modern Systems and Practices, Thomas Sterling, Matthew Anderson, Maciej Brodowicz, Morgan Kaufmann Edition/Year: 1st Edition, 2017
4	High Performance Computing, Charles Severance Kevin Dowd
5	High Performance Computing: Modern Systems and Practices, Maciej Brodowicz, Matthew Anderson
Reference Books:	
1	Michael W. Berry, Kyle A. Gallivan, Efstratios Gallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "Highperformance scientific computing: algorithms and applications", Springer, 2012.
2	Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.
3	Using OpenMP: Portable Shared Memory Parallel Programming, Barbara Chapman, Gabriele Jost, Ruud van der Pas, MIT Press, Edition/Year: 2007
4	Parallel Programming. Techniques and Applications Using Networked Workstations and Parallel Computers by Barry Wilkinson and Michael Allen, Pearson Prentice Hall, second edition, 2005.
5	Vipin Kumar, Ananth Grama , Anshul Gupta , George Karypis. Introduction to Parallel Computing (2nd ed.) Pearson India, 2003.
Web resources:	
1	https://researchcomputing.princeton.edu/education/external-online-resources/hpc-overview
2	https://www.redhat.com/en/blog/high-performance-computing-101
3	https://ubuntu.com/engage/a-guide-to-high-performance-computing
4	https://www.nvidia.com/en-us/training/

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	3	3	2	3
CO2	3	3	3	3	2	3	2	3	3	2	3
CO3	3	3	2	2	3	2	2	3	3	3	3
CO4	3	3	3	3	3	2	1	2	3	3	3
CO5	3	3	3	3	3	2	1	2	3	3	3
Total	15	15	13	13	13	11	7	13	15	13	15
Average	3	3	3	3	3	2	1	2	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAP41	**Digital Marketing**	PEC	1	1	0	0	2	2	25	75	100

Learning Objectives	
LO1	To provide basic knowledge about digital marketing.
LO2	To understand and develop various digital marketing.
LO3	To know the digital analytics and measurement tools used for business.
LO4	To familiarize online and Social Media Marketing.
LO5	To understand various data a analytics and measurement tools in digital marketing.

Unit	Content	Hours
1	Introduction to Digital Marketing-Origin and Development of Digital Marketing-Traditional vs Digital Marketing-Opportunities, Fundamentals of Digital Marketing: Changing Media Consumption and Buyer‘s Behaviour, Brand and Ad exposure, Internet Marketing .	6
2	Content Marketing -Content creation process -Content pillar -Types-Display Advertising -Search Engine Marketing-Search Engine Optimization (On page and Off page optimization)-Email Marketing -Mobile Marketing, Affiliate Marketing.	6
3	Social Media Marketing: Building successful social media digital strategy-Piggy bank theory -Personal branding in social media -Lead generation and sales in social media, Introduction to Blogging, Content Planning and writing Introduction to Face book, Twitter, Google +, LinkedIn, YouTube, Instagram and Pinterest, their channel advertising and campaigns.	6
4	Online Reputation Management: Social commerce: Ratings and Reviews-Word of Mouth- Co-Marketing -Influencer Marketing, Digital Innovation and Trends: The contemporary digital revolution, Frame work of digital transformation. Issues in Security and privatization towards digital marketing.	6
5	Digital Analytics & Measurement -Importance of Analytics in digital space-Data capturing in online space-Types-Tracking Mechanism-Ad words and Display Networks.	6

CO	Course Outcomes
CO1	Discuss Digital Marketing and its Frame work.
CO2	Identify, use appropriately and explain digital marketing tools.
CO3	Explain social media marketing and crowd sourcing.
CO4	Discuss online reputation management and its influence.
CO5	Identify the various data analytics and measurement tools in digital marketing.
Text Books:	
1	Seema Gupta (2020) Digital Marketing Second Edition, Mc Graw Hill
2	Philip Kotler (2019) , Marketing 4.0: Moving from Traditional to Digital, Wiley
3	Jeremy Kagan , Siddharth Shekhar Singh ,(2020) Digital Marketing: Strategy & Tactics, Wiley
4	Punnet Sighn Bhatia (2019) Fundamentals of Digital Marketing ,Pearson Education; second edition.
5	Vandana, Ahuja (2015) Digital Marketing, Oxford University Press India
Reference Books:	
1	Ryan Deiss and Russ Henneberry (2020) Digital Marketing for Dummies, Wiley
2	Joe Pulizzi,(2020) Epic Content Marketing: How to Tell a Different Story, Break through the Clutter, and WinMore Customers by Marketing Less, McGraw Hill.
3	Barker, Barker, Bormann and Neher(2017) Social Media Marketing: A Strategic Approach, 2E South-Western, Cengage Learning.
4	Ryan, Damian (2014) Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page 3rd Edition .
5	Eric Greenberg, and Kates, Alexander(2013) Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw Hill Professional
Web resources:	
1	https://collegedunia.com/courses/seo/seo-courses-on-udemy
2	https://collegedunia.com/courses/social-media-marketing/udemy-social-media-marketing
3	https://collegedunia.com/courses/google-ads
4	https://collegedunia.com/courses/google-analytics
5	https://collegedunia.com/courses/web-designing

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1	1	2	3	3	3
CO2	3	3	3	3	3	2	1	2	3	3	3
CO3	3	2	2	2	3	1	2	2	3	3	3
CO4	3	2	3	2	3	1	-	2	3	3	3
CO5	3	3	3	3	3	2	2	3	3	3	3
Total	15	13	13	12	15	7	6	11	15	15	15
Average	3	3	3	2	3	1	1	2	3	3	3

3 – Strong, 2- Medium, 1- Low

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PCAL41	**Ecommerce & its Applications**	SLC	**0**	**0**	1	3	2	4	25	75	100

Learning Objectives

LO1	Understand the fundamental concepts of E-Commerce and its difference from traditional business practices.
LO2	Explain the various types and models of E-Commerce such as B2B, B2C, C2C, and P2P along with their real-world applications.
LO3	Learn the process of developing an E-Commerce website, including planning, system analysis, design, implementation, and maintenance.
LO4	Gain knowledge about E-Commerce security and encryption techniques to ensure safe and reliable online transactions.
LO5	Understand various electronic payment systems and study the growth, trends, and challenges of E-Commerce in India.

Unit	Content	Hours
1	**UNIT I** E-Commerce: E-Commerce Practice vs Traditional Practices, Benefits of E-Commerce to Organization, Consumers and Society, Limitations of E-Commerce.	14
2	**UNIT – II** Types of E-Commerce: B2C, B2B, C2C, P2P. Major Business to Consumer (B2C) Business Models: Portal, E-Tailer, Content Provider, Transaction Broker, Market Creator, Service Provider, Applications in B2C: E-Banking, E-Trading, E-Auction, Introduction and Overview of these Concepts. Application in B2B: Major Business to Business (B2B), Business Models, E-Distributor, B2B Service Provider, Match Maker, Benefits of B2B on Procurement, Just in Time Delivery, Consumer to Consumer (C2C) Business Models, Peer to Peer (P2P) Business Models.	14
3	**UNIT – III** Building on E-Commerce Website: Planning – The Systems Development Life Cycle, System Analysis, Identify Business Objectives, System Functionality and Information Requirements, System Design – Hardware and Software Platforms, Building the System – In-house vs Outsourcing, Hosting, Testing the System, Implementations and Maintenance.	14
4	**UNIT – IV** Security and Encryption: The E-Commerce Security Environment - Dimensions of E-Commerce Security, Security Threats in the E-Commerce Environment, Malicious Code, Hacking, Credit Card Fraud, Spoofing, Denial of Service (DoS) Attacks, Sniffing. Technology Solutions: Protecting Internet Communication,	14

	Encryption, Securing Channels of Communication, Secure Sockets Layer (SSL), Protecting Networks, Firewalls and Proxy Server, Protecting Servers and Clients.	
5	**UNIT – V** E-Commerce Payment Systems: Digital Wallets, Digital Cash, Online Stored Value System, Digital Accumulating, Balance Payment Systems, Digital Credit Card Payment Systems, Digital Cheque Payment Systems. E-Commerce and India: Overview of E-Commerce in India	14

CO	Course Outcomes
CO1	Explain the basic concepts, benefits, and limitations of E-Commerce in comparison with traditional business practices.
CO2	Identify and differentiate between various types of E-Commerce models (B2B, B2C, C2C, P2P) and their business applications.
CO3	Design and outline the steps involved in developing an E-Commerce website using system development life cycle principles.
CO4	Demonstrate awareness of E-Commerce security threats and apply suitable technological measures such as encryption, SSL, and firewalls.
CO5	Evaluate different digital payment systems and discuss the current scenario and scope of E-Commerce in India.
Textbooks:	
1	David Kosiur, understanding Electronic Commerce, Addison Wesley.
2	Soka, From EDI to Electronic Commerce, Tata McGraw- hill.
Reference Books:	
1	Saily Chan, Electronic Commerce Management, John Wiley,1998.
2	Neil Randall, The Internet in a Wee, 2ndEdn. Prentice Hall of India, New Delhi.
3	Kamalesh, K. Balaji and Debjani Nag, “E-Commerce”, the cutting eduge of business, Tata McGraw-Hill, 2000
4	Marilyn Greenstein and Todd M. Fein Mann, Electronic Commerce, security, Risk Management, Irwin McGraw Hill, 2000. Course Material: website links, e-Books and e-journals
Web resources:	
1	https://nptel.ac.in/courses/110105083
2	https://www.coursera.org/learn/introduction-e-commerce
3	https://www.edx.org/course/digital-transformation-in-business
4	https://alison.com/course/diploma-in-e-business

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2	3	2	3	3	3
CO2	3	3	2	3	2	3	3	2	3	3	3
CO3	2	3	3	2	3	3	3	3	2	3	3
CO4	3	3	2	3	2	3	3	3	3	3	2
CO5	3	2	3	3	3	2	2	3	3	2	3
Total	14	14	13	13	13	13	14	13	14	14	14
Average	3	3	2	2	2	2	3	2	3	3	3

3 – Strong, 2- Medium, 1- Low