PERIYAR UNIVERSITY
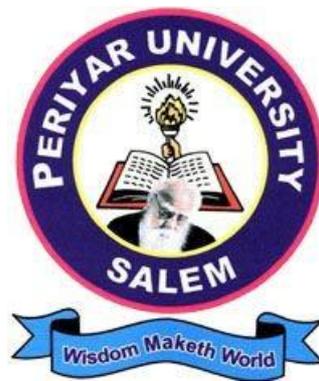
PERIYAR PALKALAI NAGAR SALEM 636 011

MASTER OF COMPUTER APPLICATIONS

SEMESTER PATTERN

Under Choice Based Credit System

REGULATIONS AND SYLLABUS

FOR AFFILIATED COLLEGES 1

(Effective from the Academic year 2023 - 2024 onwards)

CONTENTS

PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR SALEM 638 011

Regulations
Effective from the Academic year 2023 - 2024

i) OBJECTIVE OF THE COURSE

To develop the Post Graduate in Computer Applications with strong knowledge of theoretical computer applications and can be employed in research and development units of industries and academic institutions. Enables the students to pursue lifelong multidisciplinary learning, function effectively on teams to accomplish a common goal and become innovative through technical advancement. To meet dynamic global needs, the syllabus is focused on technical concepts, to enrich the knowledge of students.

ii) CONDITIONS FOR ADMISSION

Candidates who have passed in any one of the following or equivalent are eligible to apply:

i) Bachelor's degree (under 10+2+3/4) in any subject with Mathematics at +2 level.

ii) Bachelor's degree (under 10+2+3/4 or 10+3 year Diploma + 3 year later entry BE) in any subject with Mathematics / Business Mathematics / Statistics as one of the subject

iii) DURATION OF THE COURSE

The programme for the degree of Master of Computer Applications shall consist of two Academic years divided into four semesters.

iv) EXAMINATIONS

The examination shall be of three hours duration for each course at the end of each semester. The candidate failing in any subject(s) will be permitted to appear in the subsequent examination.

The practical / project should be an individual work. The University examination for practical / project work will be conducted by the internal and external examiners jointly at the end of each semester.

v) PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES DESCRIPTION

Programme	Master of Computer Applications
Programme Code	MCA
Duration	**PG - Two Years**
Programme Outcomes (Pos)	**PO1: Problem Solving Skill** knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** lity to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** ite contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**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. **PSO 2 - Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill 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.

	PSO4 – Contribution to Business World
	To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
	PSO 5 – Contribution to the Society
	To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

vi) METHODS OF EVALUATION & METHODS OF ASSESSMENT

METHODS OF EVALUATION		
Internal Evaluation	Continuous Internal Assessment Test – 10 Marks	**25 Marks**
	Assignments / Snap Test / Quiz – 5 Marks	
	Seminars – 5 Marks	
	Attendance and Class Participation – 5 Marks	
External Evaluation	End Semester Examination	**75 Marks**
	Total	**100 Marks**

METHODS OF ASSESSMENT	
Remembering (K1)	• The lowest level of questions require students to recall in formation from the course content • Knowledge questions usually require students to identify information in the text book.
Understanding (K2)	• Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. • The questions go beyond simple recall and require students to combine data together
Application (K3)	• Students have to solve problems by using / applying a concept learned in the class room. • Students must use their knowledge to determine a exact response.
Analyze (K4)	• Analyzing the question is one that asks the students to break down something in to its component parts. • Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations.
Evaluate (K5)	• Evaluation requires an individual to make judgment on something. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem–solving. • Evaluation questions do not have single right answers.
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills

vii) STRUCTURE OF MASTER OF COMPUTER APPLICATIONS PROGRAMME

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	EA	Total
FIRST SEMESTER							
23PCA01	Core I: Discrete Mathematics	5	7		25	75	100
23PCA02	Core II: Linux and shell programming	5	7		25	75	100
23PCA03	Core III: Python Programming	4	6		25	75	100
23PCAE	Elective - I	2	3		25	75	100
23PCAEP0	Elective Lab I	1		2	40	60	100
23PCAE_	Elective – II	2	3		25	75	100
23PCAEP0_	Elective Lab – II	1		2	40	60	100
	Total	20	26	4			
SECOND SEMESTER							
23PCA04	Core IV: Data Structures and Algorithms	5	6		25	75	100
23PCA05	Core V: Data Mining and Warehousing	5	6		25	75	100
23PCAP01	Core Lab I : Data Structures and Algorithms Lab	4		4	40	60	100
23PCAE_	Elective - III	2	3		25	75	100
23PCAEP_	Elective Lab III	1		3	40	60	100
23PCAE0_	Elective - IV	2	3		25	75	100
23PCAEP0_	Elective Lab -IV	1		3	40	60	100
23PHR01	Fundamentals of Human Rights (NME)	1	2		25	75	100
	Total	21	20	10			

	THIRD SEMESTER						
23PCA06	Core VI: Advanced Java Programming	5	6		25	75	100
23PCA07	Core VII: Web Technology	5	6		25	75	100
23PCA08	Core VIII: Advanced Machine Learning	5	6		25	75	100
23PCAP02	Core Lab II: Advanced Java Programming Lab	4		4	40	60	100
23PCAP03	Core Lab V: Web Technologies Lab	3		4	40	60	100
23PCANMEP01	NME Lab I : Integrated Technology(AML) Lab (Sef-Study Course)	2		4	40	60	100
23PCAI01	Core IX: Internship and Industrial Activity	2				100	100
	Total	26	18	12			
	FOURTH SEMESTER						
23PCAP04	Core - IX Industry Dynamics Technology-Data Visualisation Lab	5		5	40	60	100
23PCA09	Core – X Big Data Analytics	5	6		25	75	100
23PCAPR1	Core : Project work and Viva-voce	7		10	50	150	200
23PCAE_	Elective – V	2	3		25	75	100
23PCAEP_	Elective Lab - V	1		2	40	60	100
23PCASECP_	Skill Enhancement Professional Competency Skill	2	4		25	75	100
23PCAX01	Extension Activity	1					
	Total	23	13	17			
	Grand Total	90					

viii) ELECTIVES LIST

Elective Course–I
  23PCAE01   Data Engineering and Management
  23PCAEP01   Data Engineering and Management Lab
  23PCAE02   Architecture and Frameworks
  23PCAEP02   Architecture and Frameworks lab

Elective Course–II
23PCAE03   Software Development Technologies
23PCAEP03   Software Development Technologies Lab
23PCAE04   Soft Computing
23PCAEP04   Soft Computing Lab

Elective Course–III
23PCAE05   Internet of Things
23PCAEP05   Internet of Things Lab
23PCAEP06   Computer Vision
23PCAEP06   Computer Vision Lab

Elective Course–IV
23PCAE07   Cyber Security
23PCAEP07   Cyber Security Lab
23PCAE08   Block chain Technologies
23PCAEP08   Block chain Technologies Lab

Elective Course–V
23PCAE09   Social Networks
23PCAEP09   Social Networks Lab
23PCAE10   High Performance Computing
23PCAEP10   High Performance Computing Lab

Skill Enhancement Course - Professional Competency Skill list (any one)
23PCASECP01   Data Visualization Tools
23PCASECP02   Soft Skill Development Lab

ix) EDC-EXTRA DISCIPLINARY COURSE LIST
Students are expected to opt EDC (Non major elective) offered to other departments.

1. Principles of Information Technology
2. Fundamentals of Computers and Communications
3. E-Commerce

x) EXTERNAL ASSESSMENT QUESTION PATTERN (THEORY)

Time: 3 Hours   Max. Marks: 75

PART- A: 15x1 = 15 marks
Answer all the questions
Three questions from each unit (Multiple Choice Questions)

PART- B: 2x5 = 10 marks
Answer any TWO questions
One question from each unit

PART- C: 5x10 = 50 marks
Answer all the questions
One question from each unit (either or type)

The Passing minimum shall be 50% out of 75 marks (38 marks)

xi) CONTINUOUS INTERNAL ASSESSMENT FOR PRACTICAL

Test1   :   15 Marks
Test2   :   15 Marks
Record :   10 Marks
- - - - - - - - - - -- - - - - -
Total   :   40 Marks
- - - - - - - - - - - - - - --

(Record Note must be compulsorily submitted while attending the Practical Examination and No passing minimum)

xii) EXTERNAL ASSESMENT QUESTION PATTERN (PRACTICAL)

Exam duration: 3 Hours   Max. Marks:60

There will be two questions with or without subsections to be given for the practical examination. Every question should be chosen from the question bank prepared by the examiner(s).

Distribution of Marks

Each question	: 30 Marks
Problem Understanding	: 05 Marks
Program writing	: 10 Marks
Debugging	: 10 Marks
For Correct Results	: 05 Marks

xiii) ASSESSMENT OF PROJECT WORK

<div style="margin-left:2em">

Continuous Internal Assessment   : 50 Marks

         Review I   : 25 Marks

         Review II   : 25 Marks

External Assessment :

Evaluation & Viva-Voce (Jointly)   : 150 Marks

</div>

> **Common instruction for the project work**
> - The Candidate should submit the filled in format as given in Annexure-I to the department for approval during the 1st Week of IV Semester.
> - Periodically the project should be reviewed.
> - The Student should submit three copies of their Project work.
> - A Sample format is enclosed in Annexure-II.
> - Format of the Title page and Certificate are enclosed in Annexure-III.
> - The students may use power point presentation during their viva voce examination.

xiv) PASSING MINIMUM

The candidate shall be declared to have passed in the Theory / Practical / Project Work examination, if the candidate secures not less than 50% marks in EA and also in total of the prescribed marks. However submission of a record note book is a must.

xv) CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who obtain 75% and above in the aggregate shall be deemed to have passed the examination in **First Class with Distinction** provided they pass all the examinations prescribed for the programme at the first appearance. Candidates, other than the above, who secure not less than 60% of the aggregate marks in the whole examinations, shall be declared to have passed the examination in **First Class**. The remaining successful candidates shall be declared to have passed in **Second Class**.

Candidates who pass all the examinations prescribed for the programme in first instance and within a period of two academic years from the year of admission are only eligible for **University Ranking.**

xvi) MAXIMUM DURATION FOR THE COMPLETION OF THE PROGRAMME

The maximum duration to complete the programme shall be three academic years after normal completion of the programme.

xvii) COMMENCEMENT OF THIS REGULATION

These regulations shall take effect from the academic year 2023-24, that is, for students who are admitted to the first year of the programme during the academic year 2023-24 and thereafter.

PERIYAR UNIVERSITY

Name of the College   :

Programme   :

Name of the Student   :

Register Number   :

Title of the Project Work   :

Address of Organization / Institution :

Name of the External Guide   :

Designation   :

Place :

Date: Signature of External Guide

                                       (With seal)

Name of the Internal Guide   :

Qualification   :

Teaching Experience   :

Place :

Date: Signature of Internal Guide

CONTENTS

A. Format of the title page

TITLE OF THE PROJECT WORK

A Project work submitted in partial fulfilment of the requirements for the degree

of

Master of Computer Applications

to the

Periyar University, Salem – 11

Submitted by

Name of the Student

Reg. No.

Under the Guidance of

**Name of the guide
(Designation, Name of the department)**
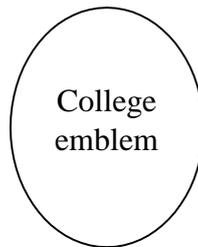
College
emblem

Name of the Department

College Name

(Affiliated to Periyar University)

Place with Pin Code

Month – Year

<div align="center">

College Name

(Affiliated to Periyar University)

Place with Pin Code

</div>

College
emblem
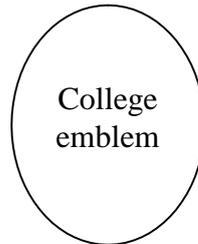
This is to certify that the Project Work entitled **Title of the Project** submitted in partial fulfillment of the requirements of the degree of **Master of Computer Applications** to the Periyar University, Salem is a record of bonafide work carried out by **Name of the student** **Reg. No._____** under my supervision and guidance.

Head of the Department   **Internal Guide**

Submitted for Viva-Voce Examinations held on _____ at **Name of the college, Place with pincode**.

External Examiner   **Internal Examiner**

23PCA01 - Discrete Mathematics

Course Objective

- To know the concepts of relations and functions
- To distinguish among different normal forms and quantifiers
- To solve recurrence relations and permutations & combinations
- To know and solve matrices , rank of matrix & characteristic equations
- To study the graphs and its types

Unit-I

Relations- Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations— Representation of a relation by a matrix -Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function

Unit-II

Mathematical Logic-Logical connectives-**Well formed formulas** – Truth table of well formed formula –Algebra of proposition –Quine's method- **Normal forms of well formed formulas**- Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-**Rules of Inference for propositional calculus** – **Quantifiers**- Universal Quantifiers- Existential Quantifiers

Unit-III

Recurrence Relations- Formulation -solving recurrence Relation by Iteration- solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two-Solving Linear Non homogeneous Recurrence Relations. **Permutations**-Cyclic permutation-Permutations with repetitions- permutations of sets with   indistinguishable objects-**Combinations**- Combinations with repetition

Unit-IV

Matrices- special types of matrices-Determinants-Inverse of a square matrix-Cramer's rule for solving linear equations-Elementary operations-Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems

Unit-V
Graphs -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix   representation of graphs

Text book
1. N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

Reference Book

1. Kimmo Eriksson &Hillevi Gavel, Discrete Mathematics & Discrete Models, Studentlitteratur AB, 2015.
2. Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill, 2012

Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand the concepts of relations and functions distinguish among normal forms	K2
CO2:	To analyze and evaluate the recurrence relations	K4,K5
CO3:	To distinguish among various normal forms and predicate calculus	K5
CO4:	To solve and know various types of matrices	K1
CO5:	To evaluate and solve various types of graphs	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	S	S	S	S	M
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	M	S	S	M	S	M	S	S	M
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	S	S	M

S- Strong; M-Medium; L-Low

23PCA02 - Linux and Shell Programming

Course Objective

- To teach principles of operating system including File handling utilities, Basic Linux commands, Scripts and filters.
- To familiarize fundamentals of shell (bash), shell programming, pipes, Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
- To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
- To facilitate students in understanding Inter process communication, semaphore and shared memory.
- To explore real-time problem solution skills in Shell programming.

Unit-I

Basic bash Shell Commands: Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. **Basic Script Building:**Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. **Using Structured Commands:**Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

Unit-II

More Structured Commands: Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

Unit-III

Creating Functions: Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

Unit-IV

Regular Expressions: Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. **Advanced sed:** Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in

scripts-Creating sed utilities. **Advanced gawk:** Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

Unit-V

Working with Alternative Shells: Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh.**Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

 Text book:

1. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley Publishing, 3rd Edition, 2015.**Chapters:** 3, 11 to 14, 16 to 25.
2. Mokhtar Ebrahim, Andrew Mallett, "Mastering Linux Shell Scripting", Packt Publishing, 2nd Edition, 2018. **Chapter:** 14.

Reference Books:

1. ClifFlynt,SarathLakshman,ShantanuTushar, "Linux Shell Scripting Cookbook ", Packt Publishing, 3rd Edition, 2017.
2. Stephen G.Kochan, Patrick Wood, "Shell Programming in Unix, Linux, and OS X", Addison Wesley Professional, 4th Edition, 2016.
3. Robert Love, "Linux System Programming", O'Reilly Media, Inc, 2013
4. W.R. Stevens, "Advanced Programming in the UNIX environment", 2nd Edition, Pearson Education, 2013
5. Graham Glass, King Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003

Course Outcomes :

On the successful completion of the course, students will be able

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	S	S	S	-	S	L	-	M	M	M
CO1	S	S	M	-	S	L	-	M	M	M
CO2	S	S	M	-	S	L	-	M	M	S
CO3	S	S	M	-	S	L	-	M	M	M
CO4	S	S	M	-	S	L	-	M	M	M
CO5	S	S	S	-	S	L	-	M	M	M

S- Strong; M-Medium; L-Low

23PCA03 - Python Programming

Course Objectives:

- To acquire programming skills in core Python
- To learn Strings and function
- To develop object oriented skills in Python
- To comprehend various Python Packages
- To develop web applications using Django

Unit I

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

Unit II

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

Unit III

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 - GraphicalUser 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

Unit IV

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The DataFrame - The Index Objects – Data Vizualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts

Unit V

Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with QuerySets and Managers – Retrieving Objects – Building List and Detail Views

Text Book:

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)**

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills in python and develop applications using conditional branches and loop	K1-K6
CO2	Create python applications with strings and functions	K1-K6
CO3	Understand and implement the Object Oriented Programming paradigm with the concept of objects and classes, Inheritance and polymorphism	K1-K6
CO4	Evaluate the use of Python packages to perform numerical computations and data visualization	K1-K6
CO5	Design interactive web applications using Django	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	S	S	S	S	M
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	M	S	S	M	S	M	S	S	M
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	S	S	M

S- Strong; M-Medium; L-Low

SEMESTER II
23PCA04 - Data Structures and Algorithms

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

Unit-I
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.

Unit-II
Algorithm Analysis: Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

Unit-III
Stacks, Queues, and Deques: 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.

Unit-IV
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, Multisets, and Multimaps.

Unit-V
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-Shortest Paths-Minimum Spanning Trees.

Text book:
1. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011. (Unit – 1)**Chapters:** 1, 2, 3.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5)**Chapters:** 3 to 12, and 14.

Reference books:

1. Dr. Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.

2. Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	Understand various ADT concepts	K1-K6
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems	K1-K6
CO3	Apply with proper ADT models with problem understanding	K1-K6
CO4	Apply and Analyze right models based on the problem domain	K1-K6
CO5	Evaluate modern data structures with Python language	K1-K6

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	S	S	S	L
CO2	S	M	S	M	M	L	L	L	L	L
CO3	S	S	S	L	L	L	M	M	M	M
CO4	S	S	S	L	L	L	M	M	M	L
CO5	S	S	S	L	M	M	S	S	S	S

S- Strong; M-Medium; L-Low

23PCA05 - Data Mining and Warehousing

Course Objectives

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

UNIT I

Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective.
Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.

UNIT II

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

UNIT III

Clustering: Introduction – Similarity and Distance Measures – Outliers – Hierarchical Algorithms - Partitional Algorithms.
Association rules: Introduction - large item sets - basic algorithms – parallel & distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.

UNIT IV

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

UNIT V

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

Text Book:

1. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson education,2003.

2. C.S.R. Prabhu, "Data Warehousing Concepts,Techniques, Productsand Applications", PHI, Second Edition.

Reference Book:

1. Arun K.Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd.,2003.

2. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", TMCH, 2001.

3. Jiawei Han & Micheline Kamber, "Data Mining Concepts & Techniques", 2001, Academic press.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand the basic data mining techniques and algorithms	K1-K6
CO2:	Understand the Association rules, Clustering techniques and Data warehousing contents	K1-K6
CO3:	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining	K1-K6
CO4:	Design data warehouse with dimensional modeling and apply OLAP operations	K1-K6
CO5:	Identify appropriate data mining algorithms to solve real world problems	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create

Mapping with Programming Outcomes									
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

23PCAP01 - Data Structures and Algorithms Lab

Course Objectives:
- To understand Stack , Queue and Doubly Linked ADT structures.

- To implement different ADT structures with real-time scenarios.

- To analyze the recursion concepts.

- To apply different sorting and tree techniques.

- To implement modern data structures with Python language.

Implement the following problems using Python 3.4 and above

1. Recursion concepts.

    i)   Linear recursion

    ii) Binary recursion.

2. Stack ADT.

3. Queue ADT.

4. Doubly Linked List ADT.

5. Heaps using Priority Queues.

6. Merge sort.

7. Quick sort.

8. Binary Search Tree.

9. Minimum Spanning Tree.

10. Depth First Search Tree traversal.

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	Strong understanding in various ADT concepts	K1-K6
CO2	To become a familiar with implementation of ADT models	K1-K6
CO3	Apply sort and tree search algorithms	K1-K6
CO4	Evaluate the different data structure models	K1-K6
CO5	Learn how to develop ADT for the various real-time problems	K1-K6

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	S	S	M	M
CO2	S	M	S	M	M	L	S	M	S	L
CO3	S	S	S	L	L	L	M	M	M	M
CO4	S	S	S	M	M	S	M	M	S	S
CO5	S	S	S	S	L	M	S	M	M	M

S- Strong; M-Medium; L-Low

23PHR01 - Fundamentals of Human Rights

Unit I: Introduction:

Meaning and Definitions of Human Rights – Characteristics and Importance of Human Rights – Evolution of Human Rights – Formation, Structure and Functions of the UNO - Universal Declaration of Human Rights – International Covenants – Violations of Human Rights in the Contemporary Era.

Unit II: Human Rights in India:

Development of Human Rights in India – Constituent Assembly and Indian Constitution – Fundamental Rights and its Classification – Directive Principles of State Policy – Fundamental Duties.

Unit III:

Rights of Marginalized and other Disadvantaged People: Rights of Women – Rights of Children – Rights of Differently Abled – Rights of Elderly - Rights of Scheduled Castes – Rights of Scheduled Tribes – Rights of Minorities – – Rights of Prisoners – Rights of Persons Living with HIVAIDS – Rights of LGBT.

Unit IV:

Human Rights Movements: Peasant Movements (Tebhaga and Telangana) – Scheduled Caste Movements (Mahar and Ad-Dharmi) – Scheduled Tribes Movements (Santhal and Munda) – Environmental Movements (Chipko and Narmada BachaoAndolan) – Social Reform Movements (Vaikom and Self Respect).

Unit V:

Redressal Mechanisms: Protection of Human Rights Act, 1993 (Amendment 2019) – Structure and Functions of National and State Human Rights Commissions – National Commission for SCs – National Commission for STs – National Commission for Women – National Commission for Minorities – Characteristics and Objectives of Human Rights Education.

References

1. SudarshanamGankidi, Human Rights in India: Prospective and Retrospective, Rawat Publications, Jaipur, 2019.

2. SatvinderJuss, Human Rights in India, Routledge, New Delhi, 2020.

3. Namita Gupta, Social Justice and Human Rights in India, Rawat Publications, Jaipur, 2021.

4. Mark Frezo, The Sociology of Human Rights, John Willy & Sons, U.K. 2014.

5. Chiranjivi J. Nirmal, Human Rights in India: Historical, Social and Political Perspectives, Oxford University Press, New York, 2000.

6. Dr. S. Mehartaj Begum, Human Rights in India: Issues and perspectives, APH Publishing Corporation, New Delhi, 2010.

7. Asha Kiran, The History of Human Rights, Mangalam Publications, Delhi, 2011.

8. Bani Borgohain, Human Rights, Kanishka Publishers & Distributors, New Delhi-2, 2007.

9. Jayant Chudhary, A Textbook of Human Rights, Wisdom Press, New Delhi, 2011.

23PCA06 - Advanced Java Programming

Course Objectives

- To gain knowledge of Object Oriented Programming Concept in Java
- To understand usages of String functions in Java
- To familiarize with the applet and swing
- To grasp the concepts on Java Beans
- To comprehend the connection between Relational Database and Java.

Unit – I

An Overview of Java: Object Oriented Programming- Data Types, Variables, and Arrays: Primitive Types-Literals Variables - Type Conversion and Casting- Arrays-Operators: Control Statements-Classes and Methods – Inheritance- Exception Handling.

Unit – II

String Handling: The String Constructors - String Length - Special String Operations - Character Extraction - String Comparison - Searching Strings - Modifying a String - Input/Output: The I/O Classes and Interfaces – File - Byte Streams - Character Streams.

Unit – III

The Applet Class: Basic Architecture - Applet Skeleton - Display methods - Status Window – Passing Parameters. Introducing GUI Programming with Swing– Introducing Swing - Swing Is Built on the AWT- Two Key Swing Features - The MVC Connection - Components and Containers - The Swing Packages - A Simple Swing Application - Exploring Swing.

Unit- IV

Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API - A Bean Example. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies session tracking.

Unit – V

Network Programming: Working with URLs- Working with Sockets - Remote Method Invocation. Introduction to Database Management Systems - Tables, Rows, and Columns - Introduction to the SQL SELECT Statement - Inserting Rows - Updating and Deleting Existing Rows - Creating and Deleting Tables - Creating a New Database with JDBC - Scrollable Result Sets.

Text Books:

1. Herbert Schildt, "Java the Complete Reference", 10th edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2. Tony Goddis, "Starting out with Java from Control Structures Through Objects" 6th Edition, Pearson Education Limited, 2016

Reference books :

1. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", TMGH Publishing Company Ltd, New Delhi, 2013
2. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi,2012.

Course Outcomes
On the successful completion of the course, students will be able

CO1:	Understand the Object Oriented Program including classes and methods; inheritance and exception handling	K1-K6
CO2:	Complete comprehension of String functions and I/O Streams	K1-K6
CO3:	Creation of graphical representation using Applet	K1-K6
CO4:	Application of Servlets for designing Web based applications	K1- K6
CO5:	Usage of JDBC connectivity and implementation of the concept to get desired results from database	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	-	M	S	-	-	-	S
CO2	S	S	S	-	M	S	-	-	-	L
CO3	S	S	M	-	L	S	-	-	-	M
CO4	M	S	M	-	S	S	-	-	-	M

CO5	S	M	M	-	M	L	-	-	-	M

S- Strong; M-Medium; L-Low

23PCA07 - Web Technologies

COURSE OBJECTIVES:

- Understand the fundamentals of the web and thereby develop web applications using various development languages and tools.
- Enrich knowledge about XHTML control and Cascading Style Sheets.
- Provide in- depth knowledge about Javascript.
- To enhance knowledge in XML documents with presentations using CSS and XSLT.
- Deliver depth knowledge about PHP, Angular JS, Jquery.

UNIT -I

WEB FUNDAMENTALS AND HTML: A Brief Introduction to the Internet - The World Wide Web - Web Browsers - Web Servers -URLs, MIME, HTTP, Security- Introduction to HTML- Origins and Evolution of HTML and HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Markup - Images- Hypertext Links - Lists, Tables, Forms, The Audio Element, The Video Element - Organization Elements, The Time Element

UNIT – II

INTRODUCTION TO XHTML AND CSS: Basic syntax, Standard structure, Basic text-markup, Images, Hypertext Links. Lists, Tables, Forms, Frames, syntactic differences between HTML and XHTML-Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The<span> and <div>tags, Conflict resolution.

UNIT - III

THE BASICS OF JAVASCRIPT: Overview of JavaScript, Object orientation and JavaScript, general Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts.

JAVASCRIPT AND XHTML DOCUMENTS: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Model

UNIT- IV

DYNAMIC DOCUMENTS WITH JAVASCRIPT AND XML: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Color and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements. Introduction to XML, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT Style Sheets, Web services.

UNIT - V

PHP, ANGULAR JS AND JQUERY: Introduction to PHP: Overview of PHP -General Syntactic Characteristics -   Primitives, Operations, and Expressions - Output - Control Statements - Arrays - Functions - Pattern Matching - Form Handling -   Cookies - Session Tracking - Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS. Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations, Examples.

TEXT BOOKS:

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,   3rdEdition, 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.

Course outcomes:

On the successful completion of the course, students will be able

CO1	Design dynamic web pages using Javascript, Jquery and Angular Java script	K1
CO2	Develop Web pages using HTML, CSS and XML	K2
CO3	Create web application using PHP and MySQL	K3, K4
CO4	To design dynamic web pages using Angular javascript	K2,K3
CO5	Develop interactive web pages using Jquery	K4,K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	S	M	M	S	M	M
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	S	S	M	S	S	M	M	S	M
CO4	S	S	S	M	S	M	M	S	S	M
CO5	S	S	S	M	S	S	M	S	M	S

S- Strong; M-Medium; L-Low

23PCA08 - Advanced Machine Learning

Course Objectives

- To understand the concepts of Machine Learning.
- To understand the theoretical and practical aspects of types of machine learning
- To teach and get familiarized with supervised learning and their applications.
- To teach and get familiarized with the concepts and algorithms of unsupervised learning.
- To appreciate the concepts and algorithms of deep learning.

Unit I:

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.

Managing and Understanding Data: Data Structures, Vectors And Factors: Lists, Data frames, Matrixes and arrays - Managing Data - Exploring and Understanding Data: Exploring the Structure of Data, Exploring Numeric variables - Exploring Categorical Variables- Exploring Relationships between Variables.

Unit II:
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- Example – filtering Mobile Phone Spam with the Naive Bayes Algorithm.

Divide and Conquer – **Classification Using Decision Trees and Rules:** Understanding Decision Trees- Example – Identifying Risky Bank Loans using C5.0 Decision Trees- Understanding Classification Rules- Example – Identifying Poisonous Mushrooms with Rule Learners.

Unit III:

Forecasting Numeric Data – **Regression Methods:**Understanding Regression- Example – Predicting Medical Expenses using Linear Regression- Understanding Regression Trees and Model Trees- Example – Estimating the Quality of Wines with Regression Trees and Model Trees.

Black Box Methods Neural Networks and Support Vector Machines: Understanding Neural Networks, from Biological to Artificial Neurons, Activation Functions, Network Topology, Training Neural Networks with Backpropagation - Modeling the Strength of Concrete with ANNs- Understanding Support Vector Machines- Performing OCR with SVMs- Finding Patterns – Market Basket Analysis Using Association Rules: Understanding Association Rules- Example – Identifying Frequently Purchased Groceries with Association Rules.

Unit IV:

Finding Groups of Data – **Clustering with K-Means:** Understanding Clustering- The k-means Algorithm for clustering- Finding teen market segments using k-means Clustering- Evaluating Model Performance: Measuring Performance for Classification- Beyond Accuracy – other Measures of Performance, Visualizing Performance Tradeoffs.

Improving Model Performance: Tuning Stock Models for Better Performance-Using Caret for Automated Parameter Tuning- Creating a simple Tuned Model- Customizing the Tuning Process- Improving Model Performance with meta-learning- Understanding Ensembles- Bagging- Boosting- Random forests.

Unit V:

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),Restricted Boltzmann Machines (RBMs).

Convolutional Neural Networks (CNNs): Structure and Properties of CNNs - Components of CNN Architectures- Convolutional Layer, Pooling Layer, Rectified Linear Units (ReLU) Layer, Fully Connected (FC) Layer, Loss Layer - Tuning Parameters ,Notable CNN Architectures, Regularization- Recurrent Neural Networks (RNNs): Fully Recurrent Networks, Training RNNs with Back-Propagation Through Time (BPPT)- Elman Neural Networks, Neural History Compressor, Long Short-Term Memory (LSTM), Traditional and Training LSTMs - Structural Damping Within RNNs, Tuning Parameter Update Algorithm.

Text Books:

1. Brett Lantz, "Machine Learning with R", Addison-Wesley Packt Publishing, 2013.
2. TawehBeysolow, "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.

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.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data	**K1-K6**
CO2	To comprehend, apply and evaluate the classification techniques for real-world applications	**K1-K6**
CO3	To understand, use and perform evaluation of Regression methods	**K1-K6**
CO4	To recognize, implement and analyse the unsupervised techniques for real-world applications	**K1-K6**
CO5	To understand, identify, implement and review the deep learning techniques for real-time applications	**K1-K6**

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	-	-	S	L	-	S	-	-
CO2	S	S	M	-	S	L	-	S	-	-
CO3	S	S	S	-	S	L	-	S	-	S
CO4	S	S	M	-	S	L	-	S	-	-
CO5	S	S	S	-	S	L	-	S	-	S

S- Strong; M-Medium; L-Low

23PCAP02 - Advanced Java Programming Lab

COURSE OBJECTIVES:

● To implement object oriented concepts in JAVA
● Develop the program using concepts Network programme
● Learn how to create a program in java beans.
● Learn how to connect relational database to Java
● Develop the program using concepts Applet

List of Experiments:

1. Implementation of and Exception handling concepts with different type of Exception.
2. Build a Swing application to implement metric conversion.
3. Use Grid Layout to design a calculator and simulate the functions of a simple calculator.
4. Create a Color palette with a matrix of buttons using Applet.
5. To invoke a servlet from HTML forms.
6. To invoke servlet from Applets.
7. To invoke servlet from JSP.
8. Implement message communication using Network Programming.
9. Write a program to connect databases using JDBC.
10. Implementation of Java Beans.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Implement classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem	K1, K2
CO2:	Apply Applets and Swing programs	K3
CO3:	Develop Servlets and JSP for creating Web based applications using JDBC	K4, K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	S	S	M	M
CO2	S	M	S	M	M	L	S	M	S	L
CO3	S	S	S	L	L	L	M	M	M	M
CO4	S	S	S	M	M	S	M	M	S	S
CO5	S	S	S	S	L	M	S	M	M	M

S- Strong; M-Medium; L-Low

23PCAP03 - Web Technology Lab

COURSE OBJECTIVES:

At the end of the course, the student should be able to do:

- Learn how to create web pages using HTML, CSS and Javascript.
- Implement dynamic web pages using Javascript, Jquery and Angular Java script
- To create web applications using PHP and MySQL
- Create web pages using XML and Cascading Style Sheets
- Create XML documents and Schemas.

PROGRAM LIST

1. Develop a web page to display your education details in a tabular format.

2. Develop a web page to display your CV on a web page.

3. Design a Homepage having three links: About Us, Our Services and
   Contact Us. Create separate web pages for the three links.

4. Design a web page to demonstrate the usage of inline CSS, internal CSS
   and external CSS.

5. Design an XML document and create a style sheet in CSS & display the
   document in the browser.

6. Develop a web page to Create image maps.

7. Design a web page to perform input validation using Angular Javascript.

8. Develop a web page in PHP to fetch details from the database.

9. Design a web page to hide paragraph using JQuery

10. Create a web page and add Javascript to handle mouse events and form
    events

Course outcomes:

On the successful completion of the course, students will be able

CO1	Design dynamic web pages using JavaScript, Jquery and Angular Java script	K1
CO2	Develop Web pages using HTML, CSS and XML	K2
CO3	Create web application using PHP and MySQL	K3, K4
CO4	Develop interactive web pages using Jquery	K2,K3
CO5	To design dynamic web pages using Angular javascript	K4,K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	S	M	M	S	M	M
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	S	S	M	M	S	M	M	S	M
CO4	S	M	S	M	S	M	M	S	S	M
CO5	M	M	S	M	S	S	M	S	M	M

S- Strong; M-Medium; L-Low

23PCANMEP01 - Integrated Technology (AML) Lab

Course Objectives

- To formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To apply machine learning algorithms to solve problems of moderate complexity.
- To apply CNN to solve problems of moderate complexity.
- To apply LSTM and RNN to solve problems.

List of Programs

1. Write a python program to compute the Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, Standard Deviation

2. Implement a Linear Regression and Multiple Linear Regression with a Real Dataset

3. Implementation of Logistic Regression using sklearn

4. Implement a binary classification model.

5. Classification with Nearest Neighbours and NavieBaye Algorithm

6. Implementation Decision tree for classification using sklearn and its parameter tuning

7. Implement the k-means algorithm.

8. Implement an Image Classifier using CNN in TensorFlow/Keras.

9. Implement an Autoencoder in TensorFlow/Keras.

10. Implement a SimpleLSTM using TensorFlow/Keras.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	To understand and implement the mathematical and statistical prospective of machine learning algorithms through python programming	**K1-K6**
CO2	To recognize and develop the machine learning models through python in built functions	**K1-K6**
CO3	To understand, impart and develop the machine learning models for real-time dataset	**K1-K6**
CO4	To comprehend , impart and implement the deep learning models for real-time applications	**K1-K6**
CO5	To identify and evaluate the performance machine learning models for real-time dataset	**K1-K6**

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	-	S	-	-	-	M	-
CO2	S	S	S	-	S	-	-	-	M	-
CO3	S	S	S	-	S	-	-	-	M	S
CO4	S	S	S	-	S	-	-	-	M	-
CO5	S	S	S	-	S	-	-	-	M	S

S- Strong; M-Medium; L-Low

23PCAP04 Industry Dynamics Technology (Data Visualisations) Lab

Course Objectives

- To learn the basic functions and operations of Excel and tableau
- To explore to design, build, and deploy various charts for applications,
- To comprehend, design and deploy the label and heat map
- To understand and deploy dashboard
- To understand the functions of tableau for data process.

List of Programs

Note: Use the following Dataset
http://www.tableau.com/sites/default/files/training/global_superstore.zip
Implement the following using Excel

1. Create Pie chart for Sales and Sales % by Country (sorted in descending order)
2. Create Bar chart for Sales by Country by Year (rounded to nearest thousand and sorted by Grand Total)
3. Create Line char for Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)
4. Create Scatter chart for Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)
5. Create heat map for Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)
6. Design and create the label for vendor list
7. Design and create the dash board

Implement the following using Tableau
8. Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)
9. Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)
10. Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Enable to create and apply Spread sheet and Tableau for various data processing	K1-K6
CO2:	Gains knowledge to create and design various visualization tools in Excel and Tableau.	K1-K6
CO3:	Comprehend, create and deploy labels and heat map.	K1-K6
CO4:	Enable to create and apply dashboard for various data processing	K1-K6
CO5:	Illustrate and apply data visualization tool for any data set	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	L	M	S	-	-	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-	-	-
CO4	S	M	M	S	M	L	-	-	-	-	-	-
CO5	M	S	M	L	S	M	-	-	-	-	-	-

S – Strong, M – Medium, L - Low

23PCA09 Big Data Analytics

Course Objectives

- To introduce big data tools & Information Standard formats.
- To understand the basic concepts of big data.
- To learn Hadoop, HDFS and MapReduceconcepts.
- To teach the importance of NoSQL.
- To explore the big data tools such as Hive, HBase and Pig.

UNIT I

Big Data and Analytics: Classification of Digital Data: Structured Data- Semi Structured Data and Unstructured Data.

Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop.

Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools

UNIT II

Technology Landscape:NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

UNIT III

Mongodb and Mapreduce Programming:MongoDB: Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.

MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

UNIT IV

Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having – RCFile - Implementation - Hive User Defined Function - Serialization and Deserialization.

UNIT V

Pig: Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined

Functions - Parameter Substitution – Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive

Text Book:

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publications, First Edition,2015

Reference Book:

1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc. (2013)
2. Tom White, "Hadoop The Definitive Guide", O'Reilly Publications, Fourth Edition, 2015
3. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, "Hadoop For Dummies", Wiley Publications, 2014
4. Robert D.Schneider, "Hadoop For Dummies", John Wiley & Sons, Inc. (2012)
5. Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 Chuck Lam, "Hadoop In Action", Dreamtech Publications, 2010

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools	K1-K6
CO2:	To collaborate,apply and review the computing for big data in Hadoop, and NoSQL environment.	K1-K6
CO3:	To comprehend, implement and review the concepts of data science and big data analytics projects using MapReduce, and MongoDB	K1-K6
CO4:	To understand, use and analyze the concepts of big data analytics projects using HIVE database.	K1-K6
CO5:	To illustrate, develop and review the concepts of PIG database in Hadoop environment.	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

23PCAE01 - Data Engineering and Management

Course Objectives:

- To understand Data Management concepts
- To get brief knowledge on Data Modeling
- To analyse the techniques used in Distributed Databases
- To assess Distributed database and Business Modelling
- To get familiar with CRM tools

Unit-I

DATABASE DEVELOPMENT: Database architecture of an information system-Overview of the database development process-Conceptual data modeling-Relational data analysis-Roles of a data model-Physical database design. DATA MANAGEMENT: Problems encountered without data management-Data management responsibilities-Data management activities-Roles within data management-Benefits of data management-Relationship between data management and enterprise

Unit-II

CORPORATE DATA MODELLING: Need for a corporate data model-Nature of a corporate data model- Develop a corporate data model - Corporate data model principles. DATA DEFINITION AND NAMING: Elements of a data definition-Data naming conventions. DATA QUALITY: Issues associated with poor data quality-Causes of poor data quality-Dimensions of data quality-Data model quality-Improving data quality. DATA ACCESSIBILITY: Data security-Data integrity-Data recovery

Unit-III:

USE OF PACKAGED APPLICATION SOFTWARE: Application software packages-Impact on data management. DISTRIBUTED DATA AND DATABASES: Rationale for distributing data-Perfect distributed database system-Top down fragmentation and partitioning. Bottom up integration-The management of replication. BUSINESS INTELLIGENCE: Data warehousing-Multidimensional model of data-Standard reporting tools-Online analytical processing OLAP-Relational schema for a data warehouse.

Unit-IV:

CRM: Three main pillars of CRM. GETTING TO KNOW YOUR CUSTOMER: 360-degree client view. UTILIZING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN YOUR CRM STRATEGY: Evolution of AI-Current state of AI-Teaming up AI with people-Applying AI to your CRM solution-ethical aspects of AI-An example of AI in CRM processes.

Unit-V:

CLOUD VERSUS ON PREMISE VERSUS HYBRID: Factors influencing vendor selection-Hybrid deployment-what are your options. CRM DIFFERENTIATORS: It's not about the feature list; it's about the ecosystem-Fourth industrial revolution and CRM-AI and smart cloud-To cloud or not to cloud-Leveraging smart cloud into CRM-Big data-Social selling and advertising-Implementation tools-Sustainable CRM platform.

Text Books:

1. Keith Gordon, "Principles of Data Management Facilitating Information Sharing", BCS Learning, 2013. (Chapters:1-5, 7,8,12,13,14)
2. Max Fatouretchi, "The Art of CRM", Packt Publishing, 2019.(Chapters: 1,2,5,8,9)

Reference Books:

1. Peter Ghavami, "Big Data Management_ Data Governance Principles for Big Data Analytics", De Gruyter, 2020.
2. Francis Buttle, Stan Maklan, Customer Relationship Management Concepts and Technologies, Routledge, 2019.

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	Comprehend the Data Management concepts and analyse the relationship with the enterprise	**K1-K6**
CO2	Analyze Data Modelling concepts and assess its quality	**K1-K6**
CO3	Understand and implement business modelling techniques	**K1-K6**
CO4	Evaluate the use of Artificial Intelligence and Machine Learning in CRM	**K1-K6**
CO5	Develop CRM applications in cloud	**K1-K6**

K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	S	S	S	S	M
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	M	S	S	M	S	M	S	S	M
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	S	S	M

S- Strong; M-Medium; L-Low

23PCAEP01 -Data Engineering and Management Lab

Course Objectives:

- To acquire basic scripting knowledge in MongoDB
- To learn CRUD Operation on MongoDB database
- To comprehend MongoDB using DbVisualizer
- To be familiar with Zoho CRM features
- To customize your application using Zoho CRM

1. Write a script to create a MongoDB database and perform insert operation
2. Write a MongoDB script to perform query operations
3. Write a MongoDB Script to perform update operations
4. Write a MongoDB Script to update documents with aggregation pipeline
5. Write a MongoDB script to delete single and multiple documents
6. Write a MongoDB script to perform string aggregation operations
7. Design a Data Model for MongoDB using DbVisualizer
8. Perform CRUD operations using DbVisualizer
9. Create a Zoho CRM account and organize your Tasks, Meetings and Deals
10. Create and maintain a project using Zoho CRM features

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the scripting knowledge in MongoDB and perform basic operations in shell prompt	**K1- K6**
CO2	Implement, Create, Read, Update and Delete Operations on MongoDB database	**K1- K6**
CO3	Analyze MongoDB using DbVisualizer	**K1- K6**
CO4	Assess Zoho CRM features for managing the customer relationships	**K1- K6**
CO5	Create a customized application in Zoho CRM	**K1- K6**

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	M	S	S	M	S	M	S	S	S
CO4	S	S	S	M	S	S	S	L	S	S
CO5	S	S	S	S	M	S	S	S	S	S

S- Strong; M-Medium; L-Low

23PCAE02 -Architecture and Frameworks

Course Objectives

- To understand the basics, benefits and purpose of software architecture
- Understand the quality attributes to fulfil the software requirements and relates the software with an organization
- Explore the design patterns, best practice and paradigms of efficient software development
- Understand the performance and security measures of software architecture
- Enable the developers to advance their carrier in software domain

Unit – I

Software architecture introduction – Importance of Software architecture –Software architecture consumers – Architect role - software architecture in an organization – Types of software architects – Software development methodologies – Project management – Office politics – Software risk management – Configuration management – Software product lines

Unit – II

Domain Knowledge – Developing business acumen – Domain-driven design – requirement engineering – requirement elicitation –Software Quality attributes: Maintainability – Usability –Availability – Portability – Interoperability - Testability

Unit – III

Software Architectures design – Importance - Top-down Versus bottom-up design approaches – Architectural drivers – Documenting the Software architecture design – Systematic approach - Attribute-driven design – Microsoft's technique for architecture and design –Architecture-centric design method – Architecture development method – Tracking the progress of the software architecture's design.

Unit – IV

Designing orthogonal software systems – Minimizing complexity – SOLID design principles – Software architecture patterns – layered – Event-driven architecture – Model-View patterns – Service-oriented architecture

Unit – V

Architecting Modern Applications.- Importance of Performance – Performance improvement - Server side caching – Web application performance – Database performance -Securing software systems – Threat modelling – Secure by design

Text Book

1. Joseph Ingeno, "Software Architect's Handbook" Packt Publishing 2018.

Reference books

1. Oliver Vogel, Indo Arnold, ArifChughtaiandTImoKehrer, "Software Architecture" Springer-Verlag, 2011.
2. Ian Gorton, "Essential Software architecture", Second Edition, Springer, 2011

3. Len Bass, Paul Clements and Rick Kazman, "Software architecture in practice", Third edition, Addison-Wesley, 2013

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand, analyze and evaluate the purpose of Software architecture and development methodologies with consideration of risk management	K1-K6
CO2	Comprehend, apply and evaluate the domain knowledge for software development process and determine the impact of quality attributes.	K1-K6
CO3	Understand, track and examine the systematic approach for various software design models with effective document process	K1-K6
CO4	Illustrate and summarize the functions of orthogonal systems with complexity, design principles and design pattern for software architecture	K1-K6
CO5	Comprehend, analyze and evaluate the performance and security measures for Server, Web and Database applications in order to create the secure software systems for various domain applications	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create

Mapping with Programme Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	-	L	M	S	M	M	L	S
CO2	M	S	-	M	M	L	S	S	M	M
CO3	S	M	-	S	S	M	S	M	M	S
CO4	S	M	L	S	M	L	S	L	S	M
CO5	M	S	M	L	S	L	M	S	L	S

S- Strong; M-Medium; L-Low

23PCAEP02 -Architecture and Frameworks - Lab

Course Objectives
- To understand and implement the basic concepts of Software architecture and its functions.
- To acquire programming skills to develop Implement various technologies and services associated with network protocols along with the challenges of data transfer.
- Implement the importance and functioning of Routing Protocols over communication service.
- To acquire skills to connect two routers and any two switches.
- To comprehend related to SSH protocols and accessing the remote device.

Note: Use the solid servers and client specification for implementation
https://github.com/solid/specification/.

Implement the following using Linux / Windows environments

1. Find the WebID profile document and display the necessary attributes

2. Set and access the primary authentications with account recovery mechanisms

3. Set and access the secondary authentications with account recovery mechanisms

4. Design authorization and web access control

5. Find the content representation

6. Reading resources from HTTP REST API and WebSockets API

7. Writing resources from HTTP REST API and WebSockets API

8. Data notification using Social Web App protocol

9. Managing subscriptions and friends list using Social Web App protocol

10. Managing list of followers and following list using Social Web App protocol

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills of Software architecture tools and packages	K1-K6
CO2	Understand and implement the user profiles and authentication with recovery mechanism.	K1-K6
CO3	Comprehend and evaluate the access control and content representation use of FTP server	K1-K6
CO4	Understand and implement reading and writing resources for various applications	K1-K6
CO5	Identify and examine the notifications, friends, and follower list of social application protocols.	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create

Mapping with Programme Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	S	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-
CO3	S	M	S	M	S	M	-	-	-	-
CO4	S	M	L	S	M	L	-	-	-	-
CO5	M	S	M	L	S	L	-	-	-	-

S- Strong; M-Medium; L-Low

23PCAE03 - Software Development Technologies

Course Objectives

- To learn and Implementing Micro services
- To analysing the Azure Kubernetes Service
- To learn and anlyse .NET DevOps for Azure and its applications
- To building code for .NET core applications
- To get familiarized with Azure pipelines

Unit -I

Implementing Microservices: Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options. Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric. Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service Using Application Insights, Cluster monitoring, Infrastructure monitoring.

Unit-II

Azure Kubernetes Service (AKS): Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native kubernetes dashboard, Prometheus and Grafana. Securing Microservices: Authentication in microservices, Implenting security using API gateway pattern, Creating application using Ocrlot and securing APIs with Azure AD. Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges. Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack.

Unit-III

.NET DevOps for Azure: DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure.

Unit-IV

Building the code: Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection. Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for release candidates, Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.

Unit-V

Introduction to APIs: Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management. API Development: Considerations, Standards, kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization.

Text Book

1. Harsh Chawla and Hemant Kathuria, Building Microservices Applications on Microsoft Azure- Designing, Developing, Deploying, and Monitoring, Apress, 2019.
2. Jeffrey Palermo , NET DevOps for Azure A Developer's Guide to DevOps Architecture the Right Way, Apress, 2019.
3. Thurupathan and Vijayakumar, Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud, Apress, 2018.

Reference Books

1. Karl Matthias and Sean P. Kane, Docker: Up and Running, O'Reilly Publication, Second Edition 2018.
2. Len Bass,IngoWeber,LimingZhu,"DevOps, A Software Architects Perspective", AddisonWesley-Pearson Publication, First Ediiton 2015.
3. John Ferguson Smart,"Jenkins, The Definitive Guide", O'Reilly Publication, First Ediiton 2011.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, apply and summarize the basic concepts of Micro services communication Microsoft Azure and Dev Ops for software development life cycle	K1-K6
CO2:	To illustrate, and implement Azure Kubernetes Service tools for software development life cycle	K1-K6
CO3:	To recognize, analyse and summarize the functionalities of .NET Dev Ops for Azure applications	K1-K6
CO4:	To understand, design and evaluate the principles and architecture service tools for software development life cycle.	K1-K6
CO5:	To comprehend, implement and review the functionalities of API and API gateways for cloud and Azure applications	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	-	M	-	-	-	S	-
CO2	S	S	M	-	M	-	-	-	S	-
CO3	S	S	S	-	S	-	-	-	S	S
CO4	S	S	M	-	M	-	-	-	S	-
CO5	S	S	M	-	M	-	-	-	S	-

S- Strong; M-Medium; L-Low

23PCAEP03 -Software Development Technologies Lab

Course Objectives

- To understand the concept of DevOps with associated technologies and methodologies.
- To be familiarized with Jenkins, which is used to build & test software Applications
- To understand Continuous integration in Devops environment.
- To understand Docker to build, ship and run containerized images
- To use Docker to deploy and manage Software applications running on Container.

List of Programs

1. Deploy Version Control System / Source Code Management, install git and create a GitHub account.
2. Perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet
3. Continuous Integration: install and configure Jenkins with Maven/Ant/Gradle to setup a build Job.
4. Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.
5. Implement Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
6. Setup and Run Selenium Tests in Jenkins Using Maven.
7. Implement Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
8. Implement Dockerfile instructions, build an image for a sample web application using Dockerfile.
9. Install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
10. Implement LAMP/MEAN Stack using Puppet Manifest.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To Understand and analyse the importance of Jenkins to Build, Deploy and Test Software Applications	K1-K6
CO2:	To synthesis and summarize the importance of Software Configuration Management in DevOps	K1-K6
CO3:	To identify, analyze and illustrate the Containerization of OS images and deployment of applications over Docker	K1-K6
CO4	To design, analyze and develop the Pull based Software Configuration Management	K1-K6
CO5	To design, analyze and develop Puppet Manifest	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	-	M	-	-	-	S	S
CO2	S	S	M	-	M	-	-	-	S	S
CO3	S	S	M	-	M	-	-	-	S	S
CO2	S	S	M	-	M	-	-	-	S	S
CO3	S	S	M	-	M	-	-	-	S	S

S- Strong; M-Medium; L-Low

23PCAE04 - Soft Computing

COURSE OBJECTIVES:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- To understand supervised and unsupervised learning algorithms
- To enable the students to gain a basic understanding of neural networks.
- To know about fuzzy logic, fuzzy inference systems, and their functions.
- To impart basic knowledge on Genetic algorithms and their applications.

UNIT-I

INTRODUCTION TO SOFT COMPUTING: Artificial Neural Networks- Biological Neurons- Basic Models of Artificial Neural Networks-Connections-Learning-Activation Functions- Important Terminologies of ANNs- Muculloch and Pitts Neuron-Linear Separability- Hebb Network-Flowchart of Training Process-Training Algorithm.

UNIT - II

SUPERVISED LEARNING NETWORK : Perceptron Networks–Perceptron Learning Rule-Architecture-Flowchart for Training Process-Perceptron Training Algorithms for Single Output Classes-Perceptron Training Algorithm for Multiple Output Classes-Perceptron Network Testing Algorithm - Adaptive Linear Neuron-Delta Rule for Single Output Unit-Flowchart for training algorithm-Training Algorithm – Testing Algorithm - Multiple Adaptive Linear Neurons-Architecture-Flowchart of Training Process-Training Algorithm-Back Propagation Network-Architecture-Flowchart for Training Process-Training Algorithm-Learning Factors of Back-Propagation Network-Radial Basis Function Network-Architecture-Flowchart for Training Process-Training Algorithm.

UNIT-III

UNSUPERVISED LEARNING NETWORK: Associative Memory Networks - Auto Associative Memory Network‑Architecture-Flowchart for Training Process-Training Algorithm-Testing Algorithm- Bidirectional Associative Memory- Architecture-Discrete Bidirectional Associative Memory-Iterative Auto Associative Memory Networks - Linear AutoAssociative Memory-Kohonen Self-Organizing Feature Map- Architecture-Flowchart for Training Process-Training Algorithm.

UNIT-IV

INTRODUCTION TO FUZZY LOGIC: Classical Sets –Operations on Classical Sets-Fuzzy sets - Fuzzy Sets- Properties of Fuzzy Sets- Fuzzy Relations –Membership Functions: Fuzzification- Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods–Max-Membership Principle-Centroid Method-Weighted Average Method-Mean Max Membership-Center of Sums-Center of Largest Area-First of Maxima - Fuzzy Set Theory - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Measures – Belief and Plausibility Measures-Probability Measures-

Possibility and Necessity Measures- Formation of Rules –Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT-V

GENETIC ALGORITHM: Introduction - Biological Background - Traditional Optimization and Search Techniques -Gradient Based Local Optimization Method-Random Search-Stochastic Hill Climbing-Simulated Annealing-Symbolic Artificial Intelligence-Operators in Genetic Algorithm -Encoding-Selection-Crossover-Mutation - Stopping Conditions for Genetic Algorithm Flow-Genetic Programming-Working of Genetic Programming-Characteristics of Genetic Programming-Data Representation.

TEXT BOOKS

1. Principles of Soft Computing, S.N. Sivanandam, S.N.Deepa, Wiley, Third Edition, 2019.

REFERENCE BOOKS

1. Das, A. (2018). Artificial Intelligence and Soft Computing for Beginners.
2. Amit, K. (2018). Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain. CRC press.
3. Rajasekaran, S., &Pai, G. V. (2011). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd.
4. Jang, J. S. R., Sun, C. T., &Mizutani, E. (2004). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.
5. Gupta, M. M. (2004). Soft computing and intelligent systems: theory and applications. Elsevier.
6. Jang, J. S. R., Sun, C. T., &Mizutani, E. (1997). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

Course outcomes:

- On the successful completion of the course, students will be able to

CO1	To provide an introduction to the basic principles, techniques, and applications of soft computing	K1, K2
CO2	To get familiar with Neural network architectures and supervised learning algorithms	K3
CO3	To understand the architectures and algorithms of Unsupervised Learning techniques	K3, K4
CO4	Develop the skills to gain a basic understanding of fuzzy logic theory and fuzzy inference systems	K4
CO5	Ability to learn traditional optimization and search techniques and genetic programming	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	S	M	S	M
CO2	M	S	M	S	M	M	M	S	M	S
CO3	M	M	S	S	S	M	M	S	S	S
CO4	S	S	M	M	M	S	S	S	S	M
CO5	S	S	S	S	S	M	S	M	M	S

S- Strong; M-Medium; L-Low

23PCAEP04 -Soft Computing Lab

COURSE OBJECTIVES:

- To implement various Supervised Neural Network-based approaches

- To apply the fuzzy-based logical operations and arithmetic operations

- To implement unsupervised neural network approaches

- To solve a problem using a simple genetic algorithm

- To implement logic gates.

Program List

1. Implementation of Logic gates using Artificial Neural Network.

2. Implementation of Perception Algorithm.

3. Implementation of Back Propagation Algorithm.

4. Implementation of Self Organizing Maps.

5. Implementation of Radial Basis Function Network.

6. Implementation of De-Morgan's Law.

7. Implementation of McCulloch Pits Artificial Neuron model

8. Implementation of Simple genetic algorithm

9. Implementation of fuzzy based Logical operations

10. Implementation of fuzzy based arithmetic operations

Course outcomes:

On the successful completion of the course, students will be able to

CO1	To apply supervised learning algorithms for real datasets	K1,K2
CO2	To implement Unsupervised Learning techniques	K3
CO3	To apply fuzzy based arithmetic and logical operations	K3, K4
CO4	To find solutions for problems using Genetic algorithm	K4
CO5	To implement DeMorgan's Law	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	M	S	S	S	M	S	M
CO2	M	S	M	M	M	M	M	S	M	S
CO3	M	M	S	S	S	M	M	S	S	S
CO4	S	S	S	M	M	S	S	M	S	S
CO5	S	S	S	S	S	M	M	M	M	S

S- Strong; M-Medium; L-Low

23PCAE05 - Internet of Things

Course Objectives:

- To get familiar with the evolution of IOT with its design principles
- To outline the functionalities and protocols of internet communication
- To analyze the hardware and software components needed to construct IOT applications
- To identify the appropriate protocol for API construction and writing embedded code
- To realize various business models and ethics in Internet of Things

UNIT I FUNDAMENTALS OF IOT

Evolution of Internet of Things – Enabling Technologies – IOT Architectures: oneM2M, IOT World Forum (IOTWF) and Alternative IOT models – Simplified IOT Architecture and Core IOT Functional Stack -– Fog, Edge and Cloud in IOT – Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II IOT PROTOCOLS

IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IOT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT – III DESIGN AND DEVELOPMENT

Prototyping Embedded Devices: Electronics - Embedded Computing Basics – Arduino - Raspberry Pi - Beagle Bone Black - Electric Imp. Prototyping the Physical Design: Non digital Methods - Laser Cutting - 3D printing - CNC Milling - Repurposing/Recycling.

UNIT – IV

Prototyping Online Components: Getting started with an API - Writing a New API - Real-Time Reactions - Other Protocols. Techniques for Writing Embedded Code: Memory Management - Performance and Battery Life – Libraries - Debugging.

UNIT – V

Business Models: History of Business Models – Model – Internet of Starting up – Lean Startups. Moving to Manufacture: Designing Kits - Designing Printed circuit boards – Certification – Costs - Scaling Up Software. Ethics: Privacy – Control – Environment – Solutions.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ─IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 (UNIT I and II)

2. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014. (UNIT III, IV and V)

Reference Books:

1. Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Market Deployement" , River Publishers, 2014.

2. Peter Waher, "Learning Internet of Things" ,Packt Publishing, 2015.

3. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBoneBlack",McGraw Hill, 2015.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Comprehend the IoT evolution with its architecture and sensors	K1- K6
CO2:	Understand the networking concepts for communication and underlying IoT protocols	K1- K6
CO3:	Assess the embedded technologies and develop prototypes for the IoT products	K1- K6
CO4:	Evaluate the use of Application Programming Interface and design an API for IoT in realitime	K1- K6
CO5:	Recognize the ethics of business models and perform security analysis	K1- K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	M	S	S	S	S	M	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	M

S- Strong; M-Medium; L-Low

23PCAEP05 -Internet of Things Lab

Course Objectives:

- To create IoT program to turn ON/OFF LED
- To implement IoT program for object detection
- To develop IoT programs for agricultural purpose
- To create web server program for local hosting
- To design IoT application for health monitoring

1. To develop an IoT program to turn ON/OFF LED light (3.3V)
2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.)
3. To develop an IoT program using Humidity and Temperature Monitoring (Forest fire Detection, Weather Monitoring)
4. To develop an IoT web server program for local hosting
5. To develop an IoT program using Soil Moisture Sensor
6. To develop an IoT program using Ultrasonic Sensor (Distance Measurement, etc.)
7. To develop an real-time IoT program using Relay Module (Smart Home Automation with 230V)
8. To develop an IoT program for Fire Detection (Home, Industry,etc.)
9. To develop an IoT program for Gas Leakage detection (Home, Industry, etc.)
10. To develop an IoMT program using Heartbeat Sensor

Course Outcomes

On the successful completion of the course, students will be able to,

CO1	Implement IoT programs to turn ON/OFF LED	K1- K6
CO2	Develop IoT programs for object detection	K1- K6
CO3	Create IoT programs for agricultural purpose	K1- K6
CO4	Implement web server program for local hosting	K1- K6
CO5	Design IoT application for health monitoring	K1- K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	M	S	S	S	S	M	S	S	M
CO4	S	S	S	S	S	S	S	S	S	L
CO5	S	S	S	S	M	S	L	S	S	M

S- Strong; M-Medium; L-Low

23PCAE06 - Computer Vision

Course Objectives:
- To get understanding about Computer vision techniques behind a wide variety of real-world applications.
- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
- To get an idea of how to build a computer vision application with Python language.
- To understand various machine learning techniques that are used in computer vision tasks.
- To incorporate machine learning techniques with computer vision systems.

Unit-I
Basic Image Handling and Processing: PIL – the Python Imaging Library-Matplotlib-NumPy-SciPy-Advanced example: Image de-noising. **Local Image Descriptors:** Harris corner detector-SIFT - Scale-Invariant Feature Transform-Matching Geotagged Images.

Unit-II
Image to Image Mappings: Homographies-Warping images-Creating Panoramas. **Camera Models and Augmented Reality:** The Pin-hole Camera Model-Camera Calibration-Pose Estimation from Planes and Markers-Augmented Reality.

Unit-III
Multiple View Geometry: Epipolar Geometry-Computing with Cameras and 3D Structure-Multiple View Reconstruction-Stereo Images. **Clustering Images:** K-means Clustering-Hierarchical Clustering-Spectral Clustering.

Unit-IV
Searching Images: Content based Image Retrieval-Visual Words-Indexing Images-Searching the Database for Images-Ranking Results using Geometry-Building Demos and Web Applications. **Classifying Image Content:** K-Nearest Neighbors-Bayes Classifier-Support Vector Machines-Optical Character Recognition.

Unit-V
Image Segmentation: Graph Cuts-Segmentation using Clustering-Variational Methods. **OpenCV:** Python Interface-OpenCV Basics-Processing Video-Tracking.

Text Book:

1. Programming Computer Vision with Python – Jan Erik Solem.

Reference Books:

1. Mastering OpenCV 4 with Python : A practical guide – Alberto Fernandez Villan.

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	To understand and recall computer vision and its application areas	K1-K6
CO2	To develop build a computer vision system	K1-K6
CO3	To apply and analyze a design range of algorithms for image processing and computer vision	K1-K6
CO4	To develop incorporate machine learning techniques with computer vision system	K1-K6
CO5	To apply and analyze image segmentation and image registration	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	L	M	M	M	S
CO2	S	M	L	M	M	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L
CO4	S	S	S	M	M	L	M	L	M	L
CO5	S	S	S	M	M	L	S	L	S	L

S- Strong; M-Medium; L-Low

23PCAEP06 - Computer Vision Lab

Course Objectives:

- To get an idea of how to build a computer vision application with Python language.

- To learn the basic image handling and processing

- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.

- To get an idea of how to implement the image transforms.

- To understand various image segmentation algorithms.

Implement the following problems using Python with OpenCV

1. Image Loading, Exploring, and displaying an Image.
2. Access and Manipulate of Image Pixels.
3. Image Transformations.
   - i) Resizing
   - ii) Rotation
4. Addition operation of Two Images.
5. Image filtering operations
   - i) Mean Filtering
   - ii) Gaussian Filtering
6. Image Binarization Using Simple Thresholding method.
7. Edge Detection operation using Sobel and Scharr Gradients.
8. Find Grayscale and RGB Histograms of an Image.
9. Segment an Image using K-means Clustering algorithm.
10. Write a program to classify an Image using KNN Classification algorithm.

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	To develop and implement the image loading and exploring	K1-K6
CO2	To Evaluate the image transforms	K1-K6
CO3	To apply and analyze for image processing denoising algorithms	K1-K6
CO4	To design and develop the Image Segmentation using Edge	K1-K6
CO5	To apply and analyze image clustering and classification algorithms	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	L	M	M	M	S
CO2	S	M	L	M	M	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L
CO2	S	S	S	M	M	L	M	L	M	L
CO3	S	S	S	M	M	L	S	L	S	L

S- Strong; M-Medium; L-Low

23PCAE07 -Cyber Security

Course Objectives:
- To understand the basics of Cybercrime and Computer forensics with protecting mechanism

- To explore the working principles of WLAN, Email and Smartphone along with security mechanism and guidelines

- To gain the ability to understand the importance of cyber investigations with its functioning role and learn the basics of Wi Fi and its security measures

- To understand and learn the method of seize the digital evidence
- To learn and analyze the concepts of digital forensics with cybercrime prevention techniques

Unit – I

Introduction to cybercrime: Classification of cybercrimes – reasons for commission of cybercrime – malware and its type – kinds of cybercrime – authentication – encryption – digital signatures – antivirus – firewall – steganography – computer forensics – why should we report cybercrime – introduction counter cyber security initiatives in India – generating secure password – using password manager-enabling two-step verification – security computer using free antivirus.

Unit – II

Tips for buying online: Clearing cache for browsers – wireless LAN-major issues with WLAN-safe browsing guidelines for social networking sites – email security tips – introduction-smartphone security guidelines – purses, wallets, smart phones – platforms, setup and installation-communicating securely with a smartphone.

Unit – III

Cyber investigation roles**:** Introduction – role as a cybercrime investigator – the role of law enforcement officers – the role of the prosecuting attorney – incident response: introduction-post mortem versus live forensics – computer analysis for the hacker defender program-network analysis – legal issues of intercepting Wi-Fi transmission – Wi-Fi technology – Wi-Fi RF-scanning RF – eavesdropping on Wi-Fi – fourth amendment expectation of privacy in WLAN.

Unit – IV

Seizure of digital information: introduction – defining digital evidence – digital evidence seizure methodology – factors limiting the wholesale seizure of hardware – other options for seizing digital evidence – common threads within digital evidence seizure – determining the most appropriate seizure method– conducting cyber investigations–demystifying computer/cyber crime – IP addresses – the explosion of networking – interpersonal communication.

Unit – V

Digital forensics and analyzing data: introduction – the evolution of computer forensics–phases of digital forensics-collection – examination-analysis – reporting – Cyber crime prevention: Introduction – crime targeted at a government agency.

Text books:

1. Dr.JeetendraPande, **"**Introduction to Cyber Security" Published by Uttarakhand Open University, 2017.(Chapter: 1.2-6.4,9.3-12.2)
2. Anthony reyes, Kevin o'shea, Jim steele, Jon R. Hansen, Captain Benjamin R. Jean Thomas Ralph, "Cyber-crime investigations" - bridging the gaps between security professionals, law enforcement, and prosecutors, 2007.(Chapter: 4, 5, 6, 7, 8, 9,10)

Reference Books:

1. Sebastian Klipper, "Cyber Security" Ein Einblickfur Wirtschaftswissenschaftler Fachmedien Wiesbaden,2015
2. John G.Voller Black and Veatch, "Cyber Security" Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada ©2014.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand, describe, analyze and examine the basics of Cyber security concepts and its implementation in India	K1- K6
CO2:	Comprehend and demonstrate the security tips in browsers, WLAN, social networks, Email security and Smart phone. Apply the investigations in post mortem andForensics	K1- K6
CO3:	Understand, apply and evaluate the various investigation roles and Wi Fi protecting mechanisms.	K1- K6
CO4:	Understand, illustrate and evaluate the method of seize the digital information and evidences forensics data and evaluate the forensics reports	K1- K6
CO5:	Comprehend, apply and appraise the methods digital forensics with cybercrime prevention techniques	K1- K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6-

Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	-	L	M	L	M	M	-	M
CO2	M	S	-	L	M	L	M	M	-	M
CO3	M	S	L	L	M	L	M	M	-	M
CO2	S	M	L	S	M	L	S	M	-	M
CO3	M	S	M	L	S	L	M	S	-	S

S- Strong; M-Medium; L-Low

23PCAEP07 - Cyber Security Lab

COURSE OBJECTIVES
- To learn and implement to Change the wireless device mode as monitor mode
- To develop in multiple vulnerabilities webserver
- To understand and implement the open ports in the network
- To acquire programming skills in Implement various wireless device modes
- To comprehend related to find the sub domains of webpage

Implement the following using any cyber security tools

1. Install virtual box (kali Linux)
2. Generate a secure password using keepass
3. Change the wireless device mode as monitor mode
4. Find the known and open vulnerabilities of system using metaspolit
5. Identify the multiple vulnerabilities webserver using nikto tool
6. Identify the open ports in the network using nmap tools
7. List all the network around us and display the information about the networks
8. Sniff and capture the packet sent over HTTP requests
9. Find the owners of internet resources using Whois Lookup tool
10. Find the subdomains of webpage using knock tool

Course Outcomes

   On the successful completion of the course, students will be able to

CO1:	Comprehend the programming skills in Change the wireless device mode as monitor mode	K1-K6
CO2:	Understand and implement multiple vulnerabilities webserver	K1-K6
CO3:	Evaluate the use of different wireless device modes	K1-K6
CO4:	Design to Solve related to find the subdomains of webpage	K1-K6
CO5:	Create and applyopen ports in the network	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5-Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	-	-	-	-	L	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S
CO2	S	-	S	-	S	L	-	-	-	S
CO3	S	-	S	-	S	L	-	-	-	S

S- Strong; M-Medium; L-Low

23PCAE08 – Block chain Technologies

COURSE OBJECTIVES

- To understand about Blockchain is an emerging technology platform for developing decentralized applications and data storage.
- To comprehend fundamentals of Public Key Cryptographytechnology and Consensus Algorithms.
- To familiarize with Bitcoin Network, Bitcoin Clients, APIs and Paymentstechnology of blockchain operations.
- To engage with Components of the Ethereum ecosystem.
- To grasp about Development Tools and Frameworks.

Unit I: Blockchain, Decentralization

Blockchain : The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Blockchain - Consensus - CAP theorem and blockchain. **Decentralization:** Decentralization using blockchain - Methods of decentralization -Routes to decentralization - Blockchain and full ecosystem decentralization - Pertinent terminology - Platforms for decentralization - Innovative trends.

Unit II: Public Key Cryptography, Consensus Algorithms and Smart Contracts

Public Key Cryptography: Asymmetric cryptography - Cryptographic constructs and blockchain technology. **Consensus Algorithms:** Introducing the consensus problem - Analysis and design - Classification - Algorithms - Choosing an algorithm. **Smart Contracts:** History - Definition - Ricardian contracts - Smart contract templates – Oracles - Deploying smart contracts - DAO

Unit III: Bitcoin

Bitcoin: Bitcoin—an overview - Cryptographic keys - Transactions - Blockchain – Mining. **Bitcoin Network and Payments:** The Bitcoin network - Wallets - Bitcoin payments - Innovation in Bitcoin - Advanced protocols - Bitcoin investment and buying and sellingBitcoin. **Bitcoin Clients and APIs:** Bitcoin client installation - Experimenting further with bitcoin-cli - Bitcoin programming.

Unit IV: Alternative Coins

Alternative Coins: Theoretical foundations - Difficulty adjustment and retargeting algorithms - Bitcoin limitations - Extended protocols on top of Bitcoin -Development of altcoins.**Ethereum: Ethereum –** an overview - Ethereum network - Components of the Ethereum ecosystem - EthereumVirtual Machine (EVM) - Smart contracts. - Blocks and blockchain - Wallets and client - Nodes and miners - APIs, tools, and DApps - Supporting protocols - Programming languages.

Unit V: Development Tools and Frameworks, Use Cases & Security

Development Tools and Frameworks : Languages - Compilers - Tools and libraries - Frameworks - Contract development and deployment - Layout of a Solidity source code file - Solidity language. **Use Cases:** IoT – Government - Health -Finance – Media. **Scalability and**

Other Challenges: Scalability - Privacy - Security - Other challenges.

TEXT BOOKS

Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Cryptocurrency Technologies. Princeton University Press, 2016. ISBN 978-0691171692

REFERENCES

Andreas Antonopoulos. Mastering Bitcoin: Programming the open block chain. Oreilly Publishers, 2017. ISBN 978-9352135745

Course Outcomes

On the successful completion of the course, students will be able to

CO1 :	Understand, apply and examine the characteristics of blockchain,bitcoin and consensus algorithm in centralized and decentralized methods.	K1-K6
CO2 :	Comprehend and demonstrate the application of hashing and public key cryptography in protecting the blockchain.	K1-K6
CO3 :	Understand and analyse the elements of trust in a Blockchain: validation, verification, and consensus.	K1-K6
CO4	Comprehend and evaluate the alternate coin, Ethereum and smart contract.	K1-K6
CO5	Grasp and apply the knowledge of Tools and languages for applications	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5-Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	-	-	-	-	L	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S
CO2	S	-	S	-	S	L	-	-	-	S
CO3	S	-	S	-	S	L	-	-	-	S

S- Strong; M-Medium; L-Low

23PCAEP08 –Block chain Technologies Lab

Course Objectives

- To learn the basics of Blockchain and apply cryptographic algorithms

- To design, build, and deploy smart contracts and distributed applications,

- To deploy Private Blockchain and smart contracts on Ethereum.

- To understand and deploy cryptocurrencies and their functions in applications

- To implement Blockchain for various use cases.

Implement the following

1. Create a Public Ledger and Private Ledger with the various attributes like Access, Network Actors, Native token, Security, Speed and examples.
2. Building and Deploying MultiChain private Blockchain
3. Write Hello World smart contract in a higher programming language (Solidity)
4. Construct the Naïve block chain
5. Construct and deploy your contract (Use deploy method)
6. Set up a Regtest environment
7. Build a payment request URI
8. Hashcash implementation
9. Develop a toy application using Blockchain
10. Create simple wallet transaction from one account to another account using Metamask.

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Enable to setup your own private Blockchain and deploy smart contracts on Ethereum.	K1-K6
CO2:	Gains familiarity and implement with cryptography and Consensus algorithms.	K1-K6
CO3:	Create and deploy projects using Web3j.	K1-K6
CO4:	Recall and deploy the structure and mechanism of Bitcoin, Ethereum, Hyperledger	K1-K6
CO5:	Implement Blockchain for various use cases	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5-Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	S	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-
CO2	S	M	L	S	M	L	-	-	-	-
CO3	M	S	M	L	S	L	-	-	-	-

S- Strong; M-Medium; L-Low

Course Objectives

- To learn about Social media, Social networking and Webcasts
- To understanding and building a Word Press Powered Website
- To analysis the Social Networking & Micro-Blogging.
- To learn and analysis the Widgets & Badges.
- To explore the importance of Website optimization.

Syllabus

UNIT I: Introduction: Social Media Strategy-Important First Decisions -Websites, Blogs - RSS Feeds Mapping -Preparation - Multimedia Items Gathering Content for Blog Posts RSS Feeds & Blogs-RSS Feeds-The Feed Reader-The Feed-Options for Creating an RSS Feed-Planning Feed-Blogs-Options for Starting. Blog and RSS Feed-Feed or Blog Content-Search Engine Optimization (SEO)-Feed Burner-RSS Feed and Blog Directories-An Optimization Plan for Blog or RSS Feed

UNIT II: Building a Word Press Powered Website: Word Press as A CMS - Diversity of Word Press Sites-The Anatomy of a Word Press Site -a Brief Look at the Word Press Dashboard Planning - Site Themes Plug-ins setting up Sidebars Building Pages- Posting Blog Entries. Podcasting, Vidcasting, & Webcasting- Publishing Options for Podcast-Creating and Uploading Podcast Episodes-Publishing Podcast Optimizing Podcast-Webcasting

UNIT III: Social Networking & Micro-Blogging: Facebook-The Facebook Profile -Myspace LinkedIn-Twitter-Niche Social Networking Sites-Creating Own Social Network-Promoting Social Networking Presence- Social Bookmarking & Crowd-Sourcing - Social Bookmarking-A Social Bookmarking Strategy- Crowd-Sourced News Sites- Preparation And Tracking Progress Media Communities-Image Sharing Sites-Image Sharing Strategy-Video Sharing Sites-Video Sharing Strategy-Searching And Search Engine Placement-Connecting With Others.

UNIT IV: Widgets & Badges: Highlighting Social Web Presence-Sharing And Syndicating Content Making Site More Interactive-Promoting Products And Making Money-Using Widgets In Word Press-Widget Communities And Directories- Working Widgets Into Strategy Social Media Newsrooms-Building Social Media Newsroom - Populating The Newsroom-Social Media News Releases-Social Media Newsroom Examples. More Social Tools-Social Calendars-Social Pages Wikis-Social Search Portals-Virtual Worlds.

Unit V: Website optimization: A Website Optimization Plan-Streamlining Web Presence-An Integration Plan- Looking to the Future-Life streaming: The Future of Blogging-Distributed Social Networking-Social Ranking, Relevancy, and ―Defriending-Web 3.0 or The Semantic Web-Mobile Technology- Measuring Your Success-A Qualitative Framework-A Quantitative Framework-Tools to Help You Measure-Come To Your Own Conclusions

Text Book:

1. Deltina hay ―A Survival Guide To social Media and Web 2.0 Optimization‖, Dalton Publishing, 2009

Reference Books:

1. Miriam Salpeter ―Social Networking for Career Success‖ Learning Express, 2011.
2. Miles, Peggy, ―Internet world guide to webcasting‖ Wiley, 2008 Professionals", Wiley Publication,2015.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, impart and summarize the concepts of Social media, Social networking and Webcasts	K1-K6
CO2:	To comprehend, design and develop a Word Press Powered Website	K1-K6
CO3:	To understand, implement and perform evaluation of Social Networking and Micro-Blogging	K1-K6
CO4	To collaborate, implement and analyse the Widgets and Badges in social networking environment	K1-K6
CO5	To understand, illustrate and perform evaluation of web optimization for social networks	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	-	S	L	-	S	-	S
CO2	S	S	S	-	S	L	-	S	-	S
CO3	S	S	S	-	S	L	-	S	-	S
CO4	S	S	S	-	S	L	-	S	-	S
CO5	S	S	S	-	S	L	-	S	-	S

S- Strong; M-Medium; L-Low

23PCAEP09 - Social Networking Lab

Course Objectives

- To familiarize the tools required to manage social network applications
- To analyze social networks like Facebook, LinkedIn, Google+, GitHub
- To teach the fundamental techniques and principles in achieving social networking environment.
- To enable students to have skills that will help them to solve real time applications.
- To get explore in the Github API.

List of Programs

1. Creating and Exploring Twitter's API
2. To analyzing and visualizing tweets and tweet entities with frequency analysis
3. Creating and Exploring Facebook's Social Graph API
4. To analyzing the Facebook's Social Graph connections
5. Creating and Exploring LinkedIn API
6. To downloading LinkedIn connections as a CSV file
7. Creating and Exploring Google+ API
8. To create and querying Human Language Data with TF-IDF
9. Creating and Exploring GitHub's API
10. To analyzing GitHub interest graph

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand , implement and review the fundamental techniques and principles for social networks.	K1-K6
CO2:	To design and develop the programs using the tools required to develop and manage social network like Facebook, LinkedIn, Google+, GitHub	K1-K6
CO3:	To create and explore the functionality of social networking tools such as GitHub	K1-K6
CO4	To understand , implement and review the fundamental principles for social network graph.	K1-K6
CO5	To comprehend and critically analyse the existing API for social networks	K1-K6

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M		M	S	-	-	-	S
CO2	S	M	S	S	S	M	-	-	-	S
CO3	S	S	S	S	S	S	-	-	-	S
CO4	S	M	S	S	S	M	-	-	-	S
CO5	S	S	S	S	S	S	-	-	-	S

S- Strong; M-Medium; L-Low

23PCAE10 - High Performance Computing

Course Objectives:

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

Unit-I
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.

Unit-II
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.

Unit-III

Basics of parallelization: Introduction to Parallelism -Parallel scalability. **Shared memory parallel programming with OpenMP:** Short introduction to OpenMP-OpenMP-parallel Jacobi algorithm.

Unit-IV

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++.

Unit-V

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.

Text book:

1. Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011.**Chapters:** 1 to 10.

Reference books:

1. Michael W. Berry, Kyle A. Gallivan, EfstratiosGallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
2. Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	Understand of the HPC and ccNUMA concepts	**K1- K6**
CO2	Design and develop a parallel programming with modern C, C++ and new version of FORTRAN	**K1- K6**
CO3	Apply with parallel computing	**K1- K6**
CO4	Develop an efficient OpenMP programming	**K1- K6**
CO5	Evaluate an efficient MPI programming	**K1- K6**

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	L	S	S	S	S
CO2	S	M	L	M	M	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L
CO4	S	S	S	M	S	L	M	L	M	S
CO5	S	S	S	M	M	L	M	M	M	M

S- Strong; M-Medium; L-Low

23PCAEP10 - High Performance Computing Lab

Course Objectives:

- To understand concepts of High Performance Computing.

- To get brief knowledge about PB and Slurm.

- To understand techniques of OpenMP and OpenMPI.

- To understand Parallel computing concepts.

- To get familiar with CUDA.

(Implemented either PB, Slurm,OpenMP, OpenMPI, and CUDA)

1. Demo: - Access and best practices on HPC
2. Matrix multiplication with Job scheduling (PB or Slurm)
3. Vectors add with malloc shared
4. Vector add program with MPI
5. Hello world task for Multithreading with openMP
6. openMP shared memory on Host and Device
7. openMP Matrix Multiplication with parallelism and Barrier
8. openMP with Reduction on operands and aggregate functionality
9. Vector and Matrix multiplication on CUDA

10.Feed forward computing on CUDA

Course Outcomes:

On the successful completion of the course, students will be able to,

CO1	Apply and Evaluate the HPC Programs	**K1-K6**
CO2	Design and Develop a MPI Programs	**K1-K6**
CO3	Design and Develop a different programming concepts of OpenMP	**K1-K6**
CO4	Develop an efficient PB and Slurm programming	**K1-K6**
CO5	Evaluate an efficient CUDA programming	**K1-K6**

K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	L	S	S	S	S
CO2	S	M	L	M	M	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L
CO4	S	S	S	M	S	L	M	L	M	S
CO5	S	S	S	M	M	L	M	M	M	M

S- Strong; M-Medium; L-Low

Course Objectives:

- To learn the basic functions and operations of Excel and tableau

- To explore to design, build, and deploy various charts for applications,

- To comprehend, design and deploy the label and heat map

- To understand and deploy dashboard

- To understand the functions of tableau for data process.

LIST OF PROGRAMS

Note: Use the following Dataset
http://www.tableau.com/sites/default/files/training/global_superstore.zip
Implement the following using Excel

1. Create Pie chart for Sales and Sales % by Country (sorted in descending order)
2. Create Bar chart for Sales by Country by Year (rounded to nearest thousand and sorted by Grand Total)
3. Create Line char for Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)
4. Create Scatter chart for Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)
5. Create heat map for Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)
6. Design and create the label for vendor list
7. Design and create the dash board

Implement the following using Tableau

8. Sales by Ship Mode (First Class, Same Day, Second Class and Standard Class)
9. Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class)
10. Sales by Category by Sub-Category (in thousands and sorted by sales value in descending order)

Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Enable to create and apply Spread sheet and Tableau for various data processing	K1-K6
2	Gains knowledge to create and design various visualization tools in Excel and Tableau.	K1-K6
3	Comprehend, create and deploy labels and heat map.	K1-K6
4	Enable to create and apply dashboard for various data processing	K1-K6
5	Illustrate and apply data visualization tool for any data set	K1-K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create		

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	S	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-
CO4	S	M	M	S	M	L	-	-	-	-
CO5	M	S	M	L	S	M	-	-	-	-

S- Strong; M-Medium; L-Low

23PCASECP02 Soft Skill Development Lab

Course Objectives:

- To enable students to gain basic communication skills in professional and social contexts effectively.
- To acquire useful words and apply them in situational context.
- To develop listening and reading skills through comprehension passages
- To enrich the leadership qualities and interpersonal communication
- To enhance essential characteristics in writing
-

EXCERCISES

1. Characteristics of Technical Writing
2. Development of Employability Skills
3. Vocabulary Development
4. Sentence Completion
5. Error Spotting
6. Interpretation of Verbal Analogy
7. Interpretation of Reading (Comprehension -Conception)
8. Interpretation of Reading (Comprehension -Reasoning)
9. Practice for writing E-mails/Technical Blogs/Forums
10. PPT Preparation / Demonstration of Technical Presentation
11. Preparation of Resume
12. Preparation for Job Interviews / Mock Interview Section
13. Group Discussion Skills
14. Developing Listening Skill(Comprehension)
15. Practice for Short Speeches / Situational Conversation
16. English through Mass Media
17. Essential Grammar
18. Communicating and collaborating with peer members
19. Team Empowerment
20. Persuasive Communication

Text Books

1. Uma Narula, "Development Communication: Theory and Practice", Revised Edition, Har-Aanad Publication, 2019.

2. Annette Capel and Wendy Sharp, "Cambridge English: Objective First", Fourth Edition, Cambridge University Press, 2013.

3. Emma Sue-Prince, "The Advantage: The 7 Soft Skills You Need to Stay One Step Ahead", First Edition, FT Press, 2013.

4. Guy Brook-Hart, "Cambridge English: Business Benchmark",Second Edition, Cambridge University Press, 2014.

5. Norman Lewis, "How to Read Better & Faster", Binny Publishing House, NewDelhi, 1978.

Reference Books

1. Michael McCarthy and Felicity O'Dell, "English Vocabulary in Use:100 Units of Vocabulary Reference and Practice", Cambridge UniversityPress,1996.

2. Murphy, Raymond, "Intermediate English Grammar", Second Edition, Cambridge University Press, 1999.

Expected Course Outcomes:	
On the successful completion of the course, student will be able to:	
1	Improves the professional communication skills	K1-K6
2	Apply useful words in the correct situation	K1-K6
3	Improves the listening and reading skills	K1-K6
4	Acquire the leadership qualities	K1-K6
5	Improves the writing ability	K1-K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create	

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	M	S	S	S	S	-
CO2	S	M	S	S	S	M	S	S	S	-
CO3	S	S	S	S	S	S	S	S	S	-
CO4	S	M	M	S	M	L	S	S	S	-
CO5	M	S	M	L	S	M	S	S	S	-

S- Strong; M-Medium; L-Low