DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
(AUTONOMOUS)
RE-ACCREDITED WITH 'A++' GRADE BY NAAC

College with Potential for Excellence, Linguistic Minority Institution
Affiliated To University Of Madras
ARUMBAKKAM, CHENNAI -106.

B.Sc. COMPUTER SCIENCE

ACADEMIC YEAR 2025-2026

I-VI SEMESTERS

SCHEME AND SYLLABUS

Effective for the students admitted from 2025-2026 batch onwards

CONTENTS

SCHEME

SYLLABUS

INSTITUTION

VISION

To impart value based quality academia; To empower students with wisdom and to charge them with rich Indian traditions and culture; To invoke the self, to broaden the same towards nation building, harmony and Universal brotherhood.

MISSION

To ensure sustained progress and development in imparting quality education, to pioneer new avenues of teaching and research and to emerge as an institution with potential for excellence.

B.Sc. COMPUTER SCIENCE

VISION

To achieve Excellency in academics by rigorous value based education and outstanding teaching practices.

MISSION

M1	To organize seminars, Guest-Lectures and symposiums for the benefit of the students to acquire knowledge on recent trends.
M2	To enable the students to be industry ready by developing state-of-the-art curriculum in tune with industry requirements.
M3	To develop young minds with active and creativeness for improving their skill-sets needed for enriched career development along with imbibing high moral values in them.
M4	To make students to understand the concepts using innovative teaching materials.

PROGRAM EDUCATION OBJECTIVES (PEOs)

PEO1	To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.
PEO2	To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.
PEO3	To continue a lifelong professional development in computing that contributes in self and societal growth.

PEO TO MISSION STATEMENT MAPPING

MISSION STATEMENTS	PEO1	PEO2	PEO3
M1	3	2	2
M2	3	3	2
M3	3	3	3
M4	3	2	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAM OUTCOMES (PO) IN RELATION TO GRADUATE ATTRIBUTES

PO1	Apply knowledge of mathematics and computer science to analyse, design, and develop efficient computing solutions for complex real-world problems.
PO2	Identify, formulate, and investigate accounting problems and data analytics using appropriate research methods, tools, and techniques to derive effective and innovative solutions.
PO3	Utilize modern engineering tools, software, and technologies to design, implement, and evaluate computer-based systems with an understanding of their limitations and potential.
PO4	Understand and apply ethical principles and assess the societal, legal, and environmental impacts of computing technologies, promoting sustainability and responsible professional practices.
PO5	Communicate effectively in both technical and non-technical contexts and function efficiently as an individual and as a part of diverse teams in multidisciplinary environments.
PO6	Demonstrate leadership qualities, project management skills, and a commitment to continuous learning to adapt to evolving technologies and global challenges in the computing field.

MAPPING OF POs TO PEOs

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6
PEO1	3	3	2	3	3	3
PEO2	2	3	2	3	3	3
PEO3	3	3	3	3	2	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAM SPECIFIC OUTCOMES

PSO 1	Learning the applications of various software elements which help to identify various analysis and design methodologies
PSO 2	Demonstrate by developing computer programs in the area related to algorithm, web designing, facilitating efficient design for complex problems.
PSO 3	Enables the students to be familiar with the modern- day issues, latest trends in computing and technology and create ideas and solutions to existing problems
PSO 4	Building code in Various Programming Languages and applications
PSO 5	Detailed Glimpse of Orientation and Interconnection. Gains Knowledge in the various aspects of new Trends and Technologies

B.Sc. COMPUTER SCIENCE

ELIGIBILITY FOR ADMISSION

A pass in the Higher Secondary Examination (Academic Stream) conducted by the Government of Tamil Nadu with Mathematics as one of the subjects.

DURATION OF THE COURSE

The duration of the course for three academic years consisting of six semesters and each semester comprises of 90 days.

a. Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year the third and fourth semesters and the third academic year the fifth and sixth semester respectively.

b. The odd semesters shall consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester.

ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the Degree only if he /she has undergone the prescribed course of study in a College affiliated to the University for a period of not less than

three academic years, passed in all the Six-Semesters examination with the prescribed earning of **142 credits**.

SCHEME OF EXAMINATIONS

As per the University Regulation the following split up of marks are to be followed.

(i) SPLIT UP FOR INTERNAL AND EXTERNAL MARKS FOR THEORY AND PRACTICAL PAPER:

Sl.No.	Paper	Internal	External	Total
1.	Theory	50	50	100
2.	Practical	50	50	100

(ii) SPLIT UP FOR INTERNAL ASSESSMENT MARKS FOR THEORY

CIE-Continuous Internal Evaluation (50 Marks)

.

CIA	30
Generic Skill	15
Attendance	5
Total	50

ESE- End Semester Examination (100 Marks; weightage 50%)

SCHEME OF I SEMESTER B.Sc. COMPUTER SCIENCE PROGRAM

Component	Course Category	Course Code	Name of the course	Over All Credits	Hrs Distribution				Total contact Hours	Marks		
					L	T	P	S		CIA	ESE	Total
Part I	**AECC**		Language I	3	4	-	-	-	4	50	50	100
Part II	**AECC**		English I	3	4	-	-	-	4	50	50	100
Part III	**Core Course I**		**Core Course I**- Python Programming Essentials **(Also common to B.C.A)**	4	4	1	-	-	5	50	50	100
Part III	**Core Practical I**		**Core Practical I-** Python Programming Essentials Lab **(Also common to B.C.A)**	2	-	1	3		4	50	50	100
Part III *	**Generic Elective I**		**Generic Elective I -** Mathematics I	3	4	1	-		5	50	50	100
Part IV	**Skill Enhancement Course – DS I**		**Skill Enhancement Course – Discipline Specific I (T) - Data Structures**	2	3	1	-		4	50	50	100
Part IV	**Skill Enhancement Course – NME I(A)/NME I (B)**		**Skill Enhancement Course – NME I (A)-** Fundamentals of Information Technology/ **NME I (B)-** Network Security Basics a) Those who have studied Tamil up to XII Std. shall take either Fundamentals of information Technology(or) Network Security (or) Advanced Tamil. b) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two courses (level will be at 6th Standard).	2	2	-	-		2	50	50	100
Part IV **	**Soft Skill I**		**FC-**Soft Skill I	2	2	-	-		2	50	50	100
				21	**23**	**3**	**4**		**30**	**400**	**400**	**800**

CIA-Continuous Internal Assessment **ESE**-End Semester Examination, *Syllabus framed and approved by Mathematics Department, **Syllabus framed and approved by English Department

SCHEME OF II SEMESTER B.Sc. COMPUTER SCIENCE PROGRAM

Component	Course Category	Course Code	Name of the course	Over All Credits	Hrs Distribution				Total contact Hours		Marks	
					L	T	P	S		CIA	ESE	Total
Part I	**AECC**		Language II	3	4	-	-	-	4	50	50	100
Part II	**AECC**		English II	3	4	-	-	-	4	50	50	100
Part III	**Core Course II**		**Core Course II-** Programming Techniques using C++ **(Also common to B.C.A)**	4	4	1	-	-	5	50	50	100
Part III	**Core Practical II**		**Core Practical II** – Programming Techniques using C++ Lab	2	-	1	3	-	4	50	50	100
Part III *	**Generic elective II**		**Generic Elective II -** Mathematics II	3	4	1	-	-	5	50	50	100
Part IV	**Skill Enhancement Course – DS II**		**Skill Enhancement Course – Discipline Specific II -** Web Design	2	3	1	-	-	4	50	50	100
Part IV	**Skill Enhancement Course – NME II (A)/ NME II (B)**		**Skill Enhancement Course – NME II (A)-** HTML & Web design/ **NME II (B)-** Crypto Currency a) Those who have studied Tamil up to XII Std. shall take either HTML &Web design or Crypto Currency (or) Advanced Tamil. b) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two courses (level will be at 6th Standard).	2	2	-	-		2	50	50	100
**Part IV ** **	**Soft Skill II**		Soft Skill II	2	2	-	-		2	50	50	100
				21	**23**	**3**	**4**		**30**	**400**	**400**	**800**

CIA-Continuous Internal Assessment **ESE**-End Semester Examination *Syllabus framed and approved by Mathematics Department **Syllabus framed and approved by English Department

SCHEME OF III SEMESTER B.Sc. COMPUTER SCIENCE PROGRAM

Component	Course Category	Course Code	Name of the course	Over All Credits	Hrs Distribution				Total contact Hours	Marks		
					L	T	P	S		CIA	ESE	Total
Part I	**AECC**		Language III	3	5	-	-	-	5	50	50	100
Part II	**AECC**		English III	3	4	-	-	-	4	50	50	100
Part III	**Core Course III**		**Core Course III-** Object oriented programming concepts using JAVA **(Also common to B.C.A)**	4	3	1	-	-	4	50	50	100
Part III	**Core Course IV**		**Core Course IV-** Principles of Operating Systems **(Also common to B.C.A)**	4	3	1	-	-	4	50	50	100
Part III	**Core Practical III**		**Core Practical III** –Object Oriented Programming concepts using JAVA Lab	2	-	1	2	-	3	50	50	100
Part III *	**Generic elective III**		**Generic Elective III -** Statistics I	3	3	1	-	-	4	50	50	100
Part III	**Discipline Specific Elective I-Employability Course I (A) / Employability Course I (B) / Employability Course I (C)**		**Discipline Specific Elective-** **DSE I (A) -** Web Application Development using ReactJS and Node.js/ **DSE I (B) -** Web Application Development using AngularJS and Node.js/ **DSE I (C) -** Vue.js Development	3	2	1	-	-	3	50	50	100
Part IV	**Industrial Visit**		Industrial Visit	1	-	-	-	-	-	-	-	-
Part IV	**EVS**		EVS	-	1	-	-	-	1	-	-	-
Part IV **	**Soft Skill III**		Soft Skill III	2	2	-	-	-	2	50	50	100
				25	**23**	**4**	**3**		**30**	**400**	**400**	**800**

CIA-Continuous Internal Assessment

ESE-End Semester Examination

*Syllabus framed and approved by Statistics Department

**Syllabus framed and approved by English Department

SCHEME OF IV SEMESTER B.Sc. COMPUTER SCIENCE PROGRAM

Component	Course Category	Course Code	Name of the course	Over All Credits	Hrs Distribution				Total contact Hours		Marks	
					L	T	P	S		CIA	ESE	Total
Part I	**AECC**		Language IV	3	5	-	-	-	5	50	50	100
Part II	**AECC**		English IV	3	4	-	-	-	4	50	50	100
Part III	**Core Course V**		**Core Course V**- Database Systems **(Also common to B.C.A & B.Sc. Data Science)**	4	3	1	-	-	4	50	50	100
Part III	**Core Course VI**		**Core Course VI -** Foundations of Computer Networks **(Also common to B.C.A)**	4	3	1	-	-	4	50	50	100
Part III	**Core Practical IV**		**Core Practical IV** – Database Systems Lab **(Also common to B.C.A)**	2	-	1	2	-	3	50	50	100
Part III *	**Generic elective III**		**Generic Elective III -** Statistics II	3	3	1	-	-	4	50	50	100
Part III	**Discipline Specific Elective II – Entrepreneurship Course II (A) / Entrepreneurship Course II (B) / Entrepreneurship Course II (C)**		**Discipline Specific Elective- DSE II (A)** – Digital Marketing / **DSE II (B)** -Building Mobile Applications / **DSE II (C)** - Search Engine Optimization	3	2	1	-	-	3	50	50	100
Part IV	**EVS**		EVS	2	1	-	-	-	1	50	50	100
Part IV **	**Soft Skill IV**		Soft Skill IV	2	2	-	-	-	2	50	50	100
				26	**23**	**4**	**3**		**30**	**450**	**450**	**900**

CIA-Continuous Internal Assessment **ESE**-End Semester Examination

*Syllabus framed and approved by Statistics Department

**Syllabus framed and approved by English Department

SCHEME OF V SEMESTER B.Sc. COMPUTER SCIENCE PROGRAM

Component	Course Category	Course Code	Name of the course	Over All Credits	Hrs Distribution				Total contact Hours	Marks		
					L	T	P	S		CIA	ESE	Total
Part III	**Core Course VII**		**Core Course VII-** Web Programming with PHP **(Also common to B.C.A)**	4	4	1	-	-	5	50	50	100
Part III	**Core Course VIII**		**Core Course VIII-** Open Source Technologies	4	3	1	-	-	4	50	50	100
Part III	**Core Course IX**		**Core Course IX:** Introduction to Data Mining	4	4	1	-	-	5	50	50	100
Part III	**Core Practical V**		**Core Practical V** – Web Programming with PHP Lab **(Also common to B.C.A)**	2	-	-	4	-	4	50	50	100
Part III	**Core Practical VI**		**Core Practical VI** – Open Source Technologies Lab	2	-	1	3	-	4	50	50	100
Part III	**Discipline Specific Elective III - Employability Course III (A) / Employability Course III (B) / Employability Course III (C)**		**Discipline Specific Elective III – DSE III (A)-** Software Engineering Concepts **/ DSE III (B)-** Fundamentals of Software Project Management / **DSE III (C)-** Software Testing Techniques	3	3	1	-	-	4	50	50	100
Part III	**Multi-Disciplinary Elective/Open Elective – MDE I (A) / MDE I (B) / MDE I (C)**		**Multidisciplinary Elective – MDE I (A) -** Bioinformatics Databases/ **MDE I (B) -** Bioinformatics: Sequence Analysis / **MDE I (C)-** Bioethics & Biodiversity	3	3	1	-	-	4	50	50	100
Part III	**Internship**		Internship	2	-	-	-	-	-	-	-	-
Part IV	**Value Education**		Value Education	2	-	-	-	-	-	50	50	100
				26	**17**	**5**	**8**		**30**	**400**	**400**	**800**

CIA-Continuous Internal Assessment

ESE-End Semester Examination

SCHEME OF VI SEMESTER B.Sc. COMPUTER SCIENCE PROGRAM

Component	Course Category	Course Code	Name of the course	Over All Credits	Hrs Distribution				Total contact Hours	Mark		
					L	T	P	S		CIA	ESE	Total
Part III	**Core Course X**		Core Course X: Artificial Intelligence	4	4	1	-	-	5	50	50	100
Part III	**Core Course XI**		Core Course XI: Introduction to Data Science	4	4	1	-	-	5	50	50	100
Part III	**Core Course XII**		Core Course XII: Foundational Machine Learning	4	4	1	-	-	5	50	50	100
Part III	**Core Practical VII**		Core Practical VII: Foundational Machine Learning Lab	2	-	1	3	-	4	50	50	100
Part III	**Discipline Specific Elective IV -Employability Course IV (A) / Employability Course IV (B) / Employability Course IV (C)**		**Discipline Specific Elective-DSE IV (A) -** MongoDB with NOSQL/ **DSE IV (B) -** PostgreSQL/ **DSE IV (C)** - Mariadb	3	-	-	4	-	4	50	50	100
Part III	**Discipline Specific Elective V - Entrepreneurship course V (A) / Entrepreneurship course V (B) / Entrepreneurship course V (C)**		**Discipline Specific Elective-DSE V (A) -** Block chain Technology/ **DSE V (B) -** Design Principles of IOT/ **DSE V (C) -**Principles of Cloud Computing	3	-	-	4	-	4	50	50	100
Part III	**Core Project**		**Mini Project**	2	-	-	3	-	3	50	50	100
Part V	**Extension Activity**		Extension Activity	1	-	-	-	-	-	-	-	-
				23	**12**	**3**	**15**		**30**	**350**	**350**	**700**

CIA-Continuous Internal Assessment

ESE-End Semester Examination

OVERALL CREDIT DISTRIBUTION

Component	Credits
Part I	12
Part II	12
Part III	94
Part IV	23
Part V	1
Total	142
Extra Credits (maximum)	21
Overall	163

Sl.No	Category	Course Category	No of Courses	Credits	Total Credits
	Part I	Language	4	3	12
	Part II	English	4	3	12
	Part III	Core Course	12	4	48
		Core Practical	7	2	14
		Core Project	1	2	2
		Generic Elective	4	3	12
		Discipline Specific Elective	5	3	15
		Multi- Disciplinary Elective	1	3	3
1.	Part IV	Skill Enhancement Course - NME	2	2	4
2.		Skill Enhancement Course - Discipline Specific	2	2	4
3.		Soft Skill	4	2	8
4.		Industrial Visit	1	1	1
5.		EVS	1	2	2
6.		Value Education	1	2	2
7.		Internship/Industrial Training	1	2	2
8.	Part V	Extension Activity			1
9.	Total Mandatory Credits		142		

10.	**Extra Credits** **Note: Students can take extra credit course from their own department or from other department as per the Admitting Body / University norms.** **Self-Study course (2C)** - (Department specific, curriculum and Evaluation scheme and assessment to be framed by the department **Value added course** - minimum 30hrs **(2C)** **Certificate Course/Short-Time Course** - minimum of 15 days (minimum 45 hrs) **(3C) -** preferred online **Swayam/NPTEL/MOOC courses (2C)** - maximum of 12 credits **Skilled based vocational courses (2C)** e.g. basic computing skill, tailoring, jewel making, beauty parlour course, interiors etc., through skill development cell of college. **Other languages (2C)** **International HRD program** – 30hrs **(2C)**

FIRST SEMESTER

CORE I

Course Title: PYTHON PROGRAMMING ESSENTIALS

(Also common to B.C.A)

Course Code :	**Credits : 04**
L:T:P:S : 4:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To interpret the fundamental Python syntax and semantics.
- To infer the use of Python control flow statements.
- To express proficiency in the handling of strings and functions.
- To determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
- To identify the commonly used operations involving file systems.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the basic concepts, features, and syntax of Python programming. Demonstrate the use of variables, data types, and operators in Python programs.
CO2	Construct Python programs using conditional and looping control structures.
CO3	Develop functions and make use of Python's Strings.
CO4	Illustrate the use of Python data structures like lists, tuples, and dictionaries.
CO5	Implement file handling operations.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO 1**	**PSO2**	**PSO 3**	**PSO4**	**PSO 5**
CO1	3	2	2	3	3	2	3	3	0	2	2
CO2	3	3	3	3	2	3	3	3	0	2	2
CO3	3	2	3	3	3	2	3	3	3	2	3
CO4	3	2	3	3	2	3	3	3	3	3	3
CO5	3	3	3	2	2	2	3	3	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl. No.	**CONTENTS OF MODULE**	**Hrs**	**COs**

1	**MODULE I:** Basics of Python Programming: History of Python-Features of Python-Literal constants -Variables - Identifiers–Keywords-Built-in Data types -Output Statements – Input Statements-Comments – Indentation-Operators-Expressions-Type conversions. Python Arrays: Defining and Processing Arrays – Array methods.	15	CO1
2	**MODULE II:** Control Statements: Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. Jump Statements: break, continue and pass statements.	15	CO2
3	**MODULE III:** Functions: Function Definition – Function Call – Variable Scope and its lifetime-Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. Python Strings: String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. Modules: import statement- The Python module – NumPy(), SciPy(),dir() function – Modules and Namespace – Defining our own modules.	15	CO3
4	**MODULE IV**: Lists: Creating a list -Access values in list-Updating values in lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	15	CO4
5	**MODULE V:** Python File Handling: Types of files in Python - Opening and Closing files-Reading and Writing files: write () and writelines() methods- append() method – read() and readlines() methods – File methods - File Positions- Renaming and deleting files.	15	CO5

TEXT BOOKS:

1. Reema Thareja, "Python Programming using problem solving approach", Second Edition, 2022, Oxford University Press.
2. Dr. R. Nageswara Rao**,** "Core Python Programming", Third Edition, 2021, Dreamtech Publishers.

REFERENCE BOOKS:

1. Vamsi Kurama**,** "Python Programming: A Modern Approach", Pearson Education.
2. Mark Lutz, "Learning Python", Orielly.
3. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.
4. James Payne**,"** Beginning Python: Using Python 2.6 and Python 3", Wiley India,2010

E-REFERENCES:

1. https://www.google.co.in/books/edition/Programming_with_Python
2. https://www.programiz.com/python-programming
3. https://www.guru99.com/python-tutorials.html

CORE PRACTICAL I

Course Title: PYTHON PROGRAMMING ESSENTIALS LAB

Course Code :	**Credits : 02**
L:T:P:S : 0:1:3:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 50**

LEARNING OBJECTIVES:

- To write, test and debug Python Programs.
- To implement Conditionals and Loops for Python Programs
- To work with functions and Strings in Python.
- To use functions and represent Compound data using Lists, Tuples and Dictionaries.
- To read and write data from & to files in Python and develop Application.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the basic concepts, features, and syntax of Python programming. Demonstrate the use of variables, data types, and operators in Python programs.
CO2	Construct Python programs using conditional and looping control structures.
CO3	Develop functions and make use of Python's Strings.
CO4	Illustrate the use of Python data structures like lists, tuples, and dictionaries.
CO5	Implement file handling operations.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2	1	3	2	2	2	1
CO2	3	3	3	3	2	1	3	3	2	2	2
CO3	3	3	2	3	2	2	3	3	2	2	2
CO4	3	3	3	3	3	2	3	3	2	2	2
CO5	3	3	3	3	2	2	3	2	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

LAB EXERCISES:

1. Program using variables, constants, I/O statements in Python.
2. Program using Operators in Python.
3. Program using Conditional Statements.
4. Program using Loops.
5. Program using Jump Statements.
6. Program using Functions.
7. Program using Recursion.

8. Program using Arrays.
9. Program using Strings.
10. Program using Import Statements.
11. Program using Modules.
12. Program using Lists.
13. Program using Tuples.
14. Program using Dictionaries.
15. Program for File Handling.

TEXT BOOKS:

1. Allen B. Downey – *Think Python: How to Think Like a Computer Scientist*, 2nd Edition, O'Reilly
2. Charles R. Severance – *Python for Everybody*, 1st Edition
3. Mark Lutz – *Learning Python*, 5th Edition, O'Reilly

REFERENCE BOOKS:

1. Vamsi Kurama**,** "Python Programming: A Modern Approach", Pearson Education.
2. Mark Lutz, "Learning Python", Orielly.
3. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.
4. James Payne**,"** Beginning Python: Using Python 2.6 and Python 3", Wiley India,2010

E-REFERENCES:

1. https://www.google.co.in/books/edition/Programming_with_Python
2. https://www.programiz.com/python-programming
3. https://www.guru99.com/python-tutorials.html

SKILL ENHANCEMENT COURSE- DISCIPLINE SPECIFIC I
Course Title: DATA STRUCTURES

Course Code	**:**	**Credits**	**: 02**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam	**: 1.30 Hours**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

- Explaining the concept of data structures and its applications
- Structuring the Applications of Arrays, Searching Techniques.
- Emphasizing the types of Linked Lists and Polynomials.
- Explaining the Types of Trees.
- Elaborating the concepts of Graphs, Dijkstra's Shortest Path

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To Demonstrate the Definition and Classification of Arrays. To study about the concepts of Searching Techniques. To impart the concepts of Sorting Techniques.
CO2	To elaborate the operations and applications of Stack. To impart the applications of Queues and operations on the Queues.
CO3	To elaborate the Addition of Polynomials. To study the Operations on Linked Lists.
CO4	Representation of Trees. To impart the knowledge of Tree Traversals, Threaded Binary Trees.
CO5	Representation of Exception and Pre-Defined Exception. To Point out the Importance of Graphs, Traversals and Algorithms.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	3	3	3	3
CO4	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	2	3	2	2	3	3	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No	**CONTENTS OF MODULE**	**Hrs**	**COs**

1	**MODULE I:** Data Structures – Definition and Classification-Arrays Array Operations – Representation of Arrays-Application of Arrays Searching Techniques – Linear Search, Binary Search. Sorting techniques – Bubble Sort, Selection Sort, Insertion Sort.	12	CO1
2	**MODULE II:**Stack – Operations on Stacks - Stack applications – Infix to Postfix notation and Evaluation of Postfix notation. Queues - Operations on the Queues - Circular queue – Dequeue	12	CO2
3.	**MODULE III:**Introduction to the Linked List - Basic operations on linked list – Singly Linked Lists – Doubly Linked Lists – Circularly Linked Lists –Addition of Polynomials.	12	CO3
4.	**MODULE IV:T**rees - Basic Terminology - Binary Trees - Representation of Trees and Binary trees - Binary Tree Traversals – Binary Search Trees - Threaded Binary Trees.	12	CO4
5.	**MODULE V:** Graphs – Basic Terminology – Representation of Graphs - Graph Traversals– Minimum Cost Spanning tree - Dijkstra's Shortest Path.	12	CO5

TEXT BOOKS:

1. S. Sahni& E. Horowitz, "Fundamentals of Data Structure", Second Edition, 1999, Galgotia Publications.
2. Alfred V.Aho, John E.Hopcraft, Jeffrey D.Ullman, "Data Structures and Algorithms", 2009,Addison- Wesley.Edition, Wiley Publications, 2017.

REFERENCE BOOKS:

1. G.A.Vijayalakshmi Pai,"Data structures and Algorithms-Concepts, Techniques and Applications", First Edition, 2011, Tata McGraw-Hill.
2. Dr. A. Chitra, "Data Structures", 2009, Vijay Nicole Imprints Private Limited.

E-REFERENCES:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/data_str_ algo/ frameset.htm
2. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html 3. n.wikibooks.org/wiki/Data structures

SKILL ENHANCEMET COURSE- NME- I (A)

COURSE TITLE: FUNDAMENTALS OF INFORMATION TECHNOLOGY

Course Code :		**Credits**	**:02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.30 Hours**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

- To introduce the fundamental concepts of software, hardware, and data
- To explore the history and evolution of information technology with a focus on digital environment
- To evaluate various type of networking applications for the real time world.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To developing practical skills and knowledge in multiple areas.
CO2	Develop programming, software development, database management, networking, and cybersecurity.
CO3	Students are expected to be able to analyze problems, design solutions, and apply relevant technologies to solve real-world issues.
CO4	To understand network concepts, protocols, and security measures, including setting up and configuring networks.
CO5	To identify and mitigate security risks, understanding concepts like cryptography, authentication, and authorization.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	3	3	3	3	2	2	3	2
CO2	3	3	2	2	3	2	3	3	2	3	2
CO3	2	3	3	3	3	2	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3	2	3	3
CO5	2	3	3	3	3	2	2	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

S.No	**CONTENTS OF MODULE**	**Hrs**	**Cos**

1	**MODULE I**: Introduction to Information Technology-Understanding the Digital Domain-Representing Numbers and text in Binary-binary code	**6**	**CO1**
2	**MODULE II:** Fundamentals of Computers: Computer Hardware-SoftwareSystem. Software-Application Software-Translators-MLL-HLL-ALL.	**6**	**CO2**
3	**MODULE III:** Transmission of Information: Fundamentals of CommunicationsFiber Optics-Wireless Communications-ISDN.	**6**	**CO3**
4	**MODULE IV:**Computer Networking: Goals-Topologies-Local Area NetworksWide Area Networks-Communication Protocol	**6**	**CO4**
5	**MODULE V:** Internet Architecture-Types of Network Security-Internet applications-Internet Address-Domain Name-E-mail.	**6**	**CO5**

TEXT BOOKS:

1. "Information Technolgy" by Shambhavi roy, Clinton Daniel, and Manish Agarwal.
2. " Fundamentals of Information Technology" by Sayan Banerjee

REFERENCE BOOKS:

1. Fundamentals of Information Technology by Pradeep K Sinha, Priti Sinha 2nd edition.

E-REFERENCES:

1. https://en.wikipedia.org/wiki/Information_technology
2. http://www.davidkelly.ie/research/bibliographies-resources/technology-standardshttp://www.davidkelly.ie/research/bibliographies-resources/technology-standards-bibliography/bibliography/

SKILL ENHANCEMET COURSE - NME-I (B)

Course title: **NETWORK SECURITY BASICS**

Course Code	**:**	**Credits**	**: 02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.30 Hours**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

- To introduce the fundamental concepts network security and protocols
- The core objective of network security is to maintain the confidentiality, integrity and availability of data.
- To evaluate various methods to prevent unauthorized access, misuse, or damage to network resources and data.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To Understand of Network Security Fundamentals
CO2	Understands the Identification of Threats and Vulnerabilities:
CO3	Understands the role of Design and Implementation of Countermeasures**.**
CO4	Learn different types of Cryptography and Cryptanalysis**.**
CO5	Apply Research and Emerging Technologies:

Mapping of Course Outcomes Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	3	3	3	3	3	3	2	2	3	2
CO2	3	3	3	2	3	2	3	3	2	3	2
CO3	2	3	3	3	3	2	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3	3	3	2
CO5	2	3	3	3	3	3	2	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

S.No	CONTENTS OF MODULE	Hrs	Cos
1	**MODULE I: Firewall** Network security basics, Understanding the basics, Security Fundamentals, Types of Security, Firewall Tool	6	CO1
2	**MODULE II: Malware** Malware types. Malware analysis techniques, Malware Prevention and Detection Malware analysis tools, Network protocols	6	CO2
3	**MODULE III: Email Security** Define Email Security, Common Threats to Email Security, Types of Prevention methods for Email, Email services and Solutions.	6	CO3
4	**MODULE IV: Information Security** Data security, social Engineering, Phishing, Antivirus Software, Ransomwar, Data Privacy. Key concepts of Information Security.	6	CO4
5	**MODULE V: Web Security** Cyber security, Cyber threats, Cryptography, Data privacy, Cyber Crime, WAF (Web application Firewall), Website security.	6	CO5

TEXT BOOKS:

1. "Network security and Management" by Brijendra Singh 3rd edition.
2. "Network Security Assessment" by Chris McNAb.

REFERENCE BOOKS:

1. Network Security Essentials by William Stallings 6th Edition.

E- REFERENCES:

1. https://nordlayer.com/blog/books-on-network-security/
2. https://bpbonline.com/collections/network-security

SECOND SEMESTER

CORE II

Course Title: PROGRAMMING TECHNIQUES USING C++

(Also common to B.C.A)

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 100**

LEARNING OBJECTIVES:

- Discuss and elaborate the concept of OOPs.
- Analyse the problem and apply the retreated concept in Application areas.
- Usage of pointers and Outline of files.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Revise the basics of Building any programming language. Introduction of OOPs and its Concept.
CO2	Define functions and its important in building the code, Advantage of using Inline function. Explanation about Arrays with illustration.
CO3	Definition of Classes and important of Object. Benefits of using Friend Function. Define the concept of constructor, destructor and its usage and its implementations.
CO4	Develop programs for overloading Unary and Binary Operators. Enhance reusability features using the concept inheritance. Avoid the duplicate of multiple inheritance using virtual base class.
CO5	Access the memory Address of any variable using pointers. Create file and Apply File Modes based on its usage.
CO6	Revise the basics of Building any programming language. Introduction of OOPs and its Concept.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	3	3	3	3	3	3	3	3	2	3	2
CO 2	3	3	3	2	3	2	3	3	3	3	2
CO 3	2	3	3	3	3	2	3	3	3	3	2
CO 4	3	3	3	3	3	2	3	3	3	3	2

CO 5	2	3	3	3	3	3	3	2	3	3	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I:** Basic concepts of OOP Structures-I/O Statements-Data TypesOperators-Control Structures: Decision making statements, Looping Statements.	**15**	**CO1**
2	**MODULE II:** Functions - Function declarations and definitions - Passing arguments - Inline functions – Function Overloading-Arrays –one dimensional and two dimensional arrays – Passing arrays to functions.	15	CO2
3	**MODULE III:** Classes & Objects: Class-Defining member function, StaticData Memebers-Passing objects to function-Returning ObjectsFriend function-Default Arguments-Constructor-Types of Constructors-Destructors.	15	CO3
4	**MODULE IV:** Operator Overloading-Rules for overloading OperatorsOverloading of unary and binary operators. Inheritance-Types of Inheritance-Virtual base classes.	15	CO4
5	**MODULE V:** Pointers-this Pointer-Pointer to an Object-Virtual functions. Working with files-Classes for file stream operations-Opening and closing a file-Detecting EOF-File modes for opening.	15	CO5

TEXT BOOKS:

1. E.Balaguruswamy, “Object Oriented Programming in C++”, Sixth Edition, 2012,TMH.

REFERENCE BOOKS:

1. H. Schildt, “The Complete Reference C++”, Fourth Edition, 2002,TMH
2. KanetkarY,”Let us C++”, Third Edition, 1999, BPBPublishers.
3. John R Hubbard, “Programming with C++”, Third Edition, 2009,TMH.

E-REFERENCES:

1. http://en.highscore.de/cpp/boost/
2. .http://bookboon.com/en/structural-programming-with-c-plus-plus-ebook

CORE PRACTICAL II

Course Title: PROGRAMMING TECHNIQUES USING C++ LAB

Course Code	**:**	**Credits**	**: 02**
L:T:P:S	**: 0:1:3:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

- To develop the programming skills in C++.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Develop C++ programs using classes and objects.
CO2	Use constructors, destructors, and function/constructor overloading.
CO3	Apply inheritance and virtual base classes.
CO4	Implement polymorphism and file handling in C++.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3	2	3	2	2	2	2
CO2	3	3	3	3	2	2	3	3	2	2	2
CO3	3	3	2	3	3	2	3	2	2	2	2
CO4	3	3	3	3	3	3	3	3	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

LAB EXERCISES:

C++

1. Program using classes and objects.
2. Program using Inline function.
3. Program using Static Members.

4. Program using constructor and destructor.
5. Program for various types of inheritance.
6. Program for Function Overloading.
7. Program using operator overloading.
8. Program using virtual functions.
9. Program using files.

TEXT BOOKS:

1. E.Balaguruswamy, “Object Oriented Programming in C++”, Sixth Edition, 2012,TMH.

REFERENCE BOOKS:

1. H. Schildt, “The Complete Reference C++”, Fourth Edition, 2002,TMH
2. KanetkarY,”Let us C++”, Third Edition, 1999, BPBPublishers.
3. John R Hubbard, “Programming with C++”, Third Edition, 2009,TMH.

E-REFERENCES:

1. http://en.highscore.de/cpp/boost/
2. .http://bookboon.com/en/structural-programming-with-c-plus-plus-ebook

SKILL ENHANCEMET COURSE - DISCIPLINE SPECIFIC II
Course title: WEB DESIGN

Course Code :	**Credits :0 2**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 1.30 Hours	**ESE Marks : 50**

LEARNING OBJECTIVES:

- Explaining the concept of Web design and its applications.
- Detailed description for Internet Domains and establishing Connectivity Internet.
- Structuring the HTML tags, Lists, Tables, Frames, Forms and Forms elements.
- Emphasizing the DHTML Style Sheets, Linking a Style Sheet and Web page designing.
- Explaining the concepts of JavaScript, Functions and Looping constructs.
- Elaborating the concept of JavaScript Document Object Model and Cookies.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To Demonstrate Internet Basic concepts and Internet Domains To Study about Internet Server Identities To impart the concepts of Establishing Connectivity on the Internet
CO2	To classify the HTML Tags. To impart Lists, Frames and Table To the Forms and Forms Elements.
CO3	To elaborate DHTML Style Sheets and Element of the Style. To impart Linking a style sheet to a html documents and Web page designing.
CO4	Representation of JavaScript Data types, Control and Looping and Functions. To point out the knowledge about the Dialog Boxes.
CO5	Representation of JavaScript Document Object Model and Event Handling. To point out Form object, User Defined Object and Cookies.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO 4	PO5	PO6	PSO1	PSO2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3	3	3	2	3	2	2
CO2	3	3	3	2	3	3	3	3	3	3	3
CO3	3	3	2	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	2	3	3	2	3	3	2	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**:Internet: Basic Concepts – Communicating on Internet – Internet Domains – Internet Server Identities – Establishing Connectivity on the Internet	12	CO1
2	**MODULE II:** Introduction to HTML -Anchor Tag – Hyperlink - Head and Body Section– Heading - Horizontal Ruler – Paragraphs – Tags - Images and Picture – Lists – Tables – Frames - Forms and forms elements.	12	CO2
3	**MODULE III:** DHTML and Style sheets - Defining styles - Elements of style - Linking a style sheet to a html documents - Inline style - External style sheets - Multiple styles- Web page designing.	12	CO3
4	**MODULE IV:** Introduction to Java script- Advantage of JavaScript - Data type - Variable – Array - Operator and Expression - Control and looping Constructs - Functions - Dialog Boxes.	12	CO4
5	**MODULE V:** JavaScript Document Object Model- Event Handling - Form Object - Built in Object - User Defined Object-Cookies.	12	CO5

TEXT BOOKS:

1. Ivan Bayross, "Web Enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP", Fourth Edition, 2010, BPB Publications

REFERENCES BOOKS:

1. Harvey M. Deitel, Paul J. Deitel, Tem R. Nieto, "Internet & World Wide Web – How to program", Third Edition, 2002, Prentice Hall

E-REFERENCES:

1.http://books.google.co.in/books?id=BrASwbtAGGUC&pg=PA69&source=gbs_selected_pages&cad=2#v=onepag e&q&f=false

SKILL ENHANCEMET COURSE - NME-II (A)

Course title: HTML AND WEB DESIGN

Course Code	**:**	**Credits**	**: 02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.30 Hours**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

- To introduce students to the fundamentals of web development, including how websites function, how web pages are structured, and how browsers interpret code.
- To develop proficiency in HTML for creating well-structured, semantically meaningful web pages using standard tags and attributes.
- To familiarize students with design principles such as usability, accessibility, visual hierarchy, and layout in web development.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand Web Development Basics
CO2	Create well-structured and semantically meaningful web pages using HTML5 elements
CO3	Embed and manage images in web pages using <img> and appropriate attributes (alt text, width, height, etc.).
CO4	Integrate multimedia like images, audio, and video using appropriate HTML tags and formats.
CO5	Apply media queries and responsive design principles to ensure websites are mobile-friendly and work across devices.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	2	3	3	3	3	3	2	3	2	2
CO2	3	3	3	2	3	3	3	3	3	3	3
CO3	3	3	2	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	2	3	3	2	3	3	2	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

S.No	CONTENTS OF MODULE	Hrs	Cos
1	**MODULE I**: World Wide Web: Introduction the web defined – web browser details – web writing styles – web presentation outline, design, and management – registering web pages. Searching the World Wide Web: introduction – directories, search engines and meta search engines – search fundamentals – search strategies – how does a search engine works. Telnet and FTP : introduction – telnet and remote login – File transfer – Computer Viruses	6	CO1
2	**MODULE II**:HTML Basics: Understanding HTML – Setting Up the Document Structure – Formatting Text by Using Tags – Using Lists and Backgrounds – Creating Hyperlinks and Anchors Style Sheets and Graphics: Introduction to Style sheets	6	CO2
3	**MODULE III**: Graphics: Selecting a Graphics Format – Preparing Graphics for Web Use – Inserting Graphics – Arranging Elements on the Page – Controlling Image Size and Padding	6	CO3
4	**MODULE IV**: Hyper linking from Graphics – Utilizing Thumbnail Graphics – Including Alternate Text for Graphics- Navigation: Creating Navigational Aids – Creating Tables – Formatting Tables	6	CO4
5	**MODULE V**: Layouts: Creating Division-Based Layouts – Creating User Forms – Using Frames for Layout – Incorporating Audio and Video	6	CO5

TEXT BOOKS:

1. HTML and CSS: Design and Build Websites" by Jon Duckett published by Wiley.
2. HTML, CSS, & Javascript All-In-One for Dummies by Paul McFedries published by Wiley.

REFERENCE BOOK:

1. Learning Web Design by Jennifer Robbins published by O'Reilly Media

E- REFERENCES:

1.https://www.w3schools.com/html/

SKILL ENHANCEMET COURSE - NME-II (B)

Course title: CRYPTO CURRENCY

Course Code	**:**	**Credits**	**: 2**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 1.30 Hrs**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

- To introduce the fundamental concepts of cryptocurrencies, including digital currencies, block chain technology, and distributed ledgers.
- To explore the history and evolution of cryptocurrencies, with a focus on key milestones such as Bitcoin and the development of Ethereum.
- To evaluate various cryptocurrency platforms, wallets, and exchanges, understanding their roles in the crypto ecosystem.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understands the foundational principles of block chain technology, including decentralization.
CO2	Understands the origin, development, and fundamental concepts and working principle of cryptocurrencies
CO3	Understands the role of cryptocurrency exchanges in facilitating the buying, selling, and trading of digital assets.
CO4	Learn different types of crypto wallets (hot/cold) and explain how cryptocurrency transactions are executed and verified.
CO5	Apply cryptographic hashing, digital signatures, and public-key infrastructure.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	2	3	3	3	3	3	2	3	2	2
CO2	3	3	3	2	3	2	3	3	2	3	3
CO3	3	3	2	3	3	2	3	2	3	2	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	3	3	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

S.No	CONTENTS OF MODULE	Hrs	CO
1	**MODULE I**: **Blockchain** : Introduction to Block Chain-Blockchain TransactionsWorking method of blockchain-Different types of blockchain-Anonymous and decentralized of Blockchains	6	CO1
2	**MODULE II**: **Cryptocurrencies:** Define Cryptocurrency-How does it Works? Pros & cons of Cryptocurrency-Bitcoins-Digital Currencies-Advantages and Disadvantages	6	CO2
3	**MODULE III**: **Crypto Exchanges:** History of Cryptocurrency---How it does the exchanges-CEX s and DEXs-Global exchanges	6	CO3
4	**MODULE IV**: **Wallets :** Concept of Cryptowallet-importance of Cryptowallet- types of Cryptowallet -Hot Vs Cold Wallet-Wallet Best Practices-Advantages and Disadvantages	6	CO4
5	**MODULE V: Crypto Analysis: Introduction**- Types of Analysis-Crypto Analysis techniques- Types of Attacks-Application of Crpytography.	6	CO5

TEXT BOOKS:

1. Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications by Imran Bashir, Packt Publishing
2. Cryptocurrency: How Bitcoin and Digital Money Are Challenging the Global Economic Order by Paul Vigna and Michael J. Casey published by St. Martin's Press 2015.

REFERENCE BOOKS:

1. The Basics of Bitcoins and Block chains by Antony Lewis 2018, Crypto currency investing, Trading by Vincent Norman 2022.

E-REFERENCES:

1. https://en.wikipedia.org/wiki/Cryptocurrency

THIRD SEMESTER

CORE III

Course Title: OBJECT-ORIENTED PROGRAMMING CONCEPTS USING JAVA

(Also common to B.C.A)

Course Code :	**Credits : 04**
L: T: P: S: 3:1:0:0	**CIA Marks : 50**
Exam Hours: 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Understand the core features of Java, its environment, and fundamental programming concepts.
- Gain knowledge of Java's object-oriented principles
- Explore the use of packages, exception handling, and error management techniques to enhance Java applications.
- Learn how to work with threads, manage synchronization, and handle file operations in Java.
- Develop interactive applets and GUI applications using AWT components.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Write basic Java programs using correct syntax, and apply concepts like data types, variables, and control flow.
CO2	Design and implement Java programs using object-oriented principles like classes, objects, inheritance, and interfaces.
CO3	Create robust Java applications using user-defined packages, exception handling, and error management.
CO4	Create multithreaded programs, synchronize threads, and handle file operations using Java I/O classes.
CO5	Develop interactive Java applets and GUI applications using AWT components, handling basic graphics and user input.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	2	1	3	2
CO2	3	3	2	3	2	2	2	3	2	3	2
CO3	2	3	3	3	3	1	2	3	3	3	2
CO4	2	3	2	2	3	1	2	3	2	3	3
CO5	3	3	3	3	3	3	2	3	3	3	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs

1	**MODULE I:** Introduction to Java - Features of Java – Java Environment - Tokens- Data Types - Variables - Arrays - Operators – Conditional Statements-Iterative Statements-General Structure of a Java Program -Fields and Methods Declaration-Command Line Arguments.	**12**	**CO1**
2	**MODULE II:** Classes and Objects – Constructors – Method Overloading - Static keyword - Final keyword--String & String Buffer Class. Inheritance: Keyword extends -Types -of Inheritance -Keyword super - Overriding of methods - Abstract class and methods. Interface: Defining Interface-Keyword implements -Multiple Inheritance using Interface.	**12**	**CO1, CO2**
3	**MODULE III:** Packages: User-Defined Packages: Naming conventions – Creating and accessing Packages. Exception Handling: Types of errors - Syntax of Exception handling code – Built-in Exceptions – Multiple catch statements – Nested try block – Finally statement- Throwing our exception using throw – Method throwing exception using throws keyword.	**12**	**CO1, CO3**
4.	**MODULE IV:** Threads: Introduction- Thread States or life cycle of thread- Creation of threads using Thread class and Runnable interface –Thread methods -Thread Priorities -Thread Synchronization. I/O Streams: Stream classes – Byte stream classes -Character stream classes - File Streams – Using File class – I/O Exceptions–Random access files.	**12**	**CO4**
5.	**MODULE V:** Applets: Difference between applet and application -Applet life cycle - Building Applet code using Applet tag – Passing parameters to Applets- Drawing various shapes using Graphics Class. AWT Controls: Buttons, Labels, TextField, TextArea, Choice, CheckBox, List, ScrollBar and Layout Managers.	**12**	**CO5**

TEXT BOOKS:

1.Herbert Schildt, "Java: The Complete Reference", McGraw-Hill Education, 13th Edition,2023.

REFERENCE BOOKS:

1.Herbert Schildt , Dr. Coward, Danny “Java: The Complete Reference” 2. Kathy Sierra & Bert Bates, "Head First Java", O'Reilly Media, 2nd Edition.

3. E. Balagurusamy, "Programming with Java", Tata McGraw-Hill.

4. Joshua Bloch, "Effective Java", Pearson Education.

5.Paul Deitel & Harvey Deitel, "Java: How to Program", Pearson Education.

E- REFERENCES:

1. Java Tutorials by W3Schools: https://www.w3schools.com/java/

2. Baeldung Java Tutorials: https://www.baeldung.com/

3. GeeksforGeeks Java Programming: https://www.geeksforgeeks.org/java/

CORE IV

Course Title: PRINCIPLES OF OPERATING SYSTEMS

(Also common to B.C.A)

Course Code :	**Credits 04**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To understand the main components of an OS & their functions.
- To study the process management and scheduling.
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.
- To understand the concepts and implementation Memory management policies and virtual memory.
- To understand the working of an OS as a resource manager, file system manages, process manager, memory manager and I/O manager and methods used to implement the different parts of OS.

Course outcomes: **At the end of course, the student will be able to**

CO1	Describe the important computer system resources and the role of operating system and scheduling of processes by CPU algorithms.
CO2	Understand the process synchronization and Deadlock algorithms.
CO3	Evaluate the requirement for process synchronization and coordination handled by Operating system.
CO4	Describe and analyze the memory management and its allocation policies.
CO5	Identify use and evaluate the file management policies with respect to different Storage management technologies.

Mapping of Course outcomes to program outcomes:

	PO 1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2	3	3	3	3	2	1
CO2	3	2	2	2	2	2	3	-	-	-	1
CO3	3	2	2	1	2	3	3	-	1	-	1
CO4	3	3	3	2	3	2	3	3	2	1	1
CO5	3	2	3	3	3	2	3	3	2	1	1

CORRELATION: 3: STRONG 2: MEDIUM 1: LOW -: NO CORRELATION

Sl. No.	CONTENTS OF MODULE	Hrs	COs

1	**MODULE I:** Views – Goals – Types of Operating Systems - Services – System Calls. Process Management: Definition- Process States-Process Control Block (PCB)-Process Scheduling– Types of Process Scheduling-Thread-Types of threads- Concept of Multithread.	**12**	**CO1**
2	**MODULEII:** Process Synchronization: Critical-Section problem – Semaphores. CPU Scheduling: CPU Schedulers–Scheduling criteria–CPU Scheduling Algorithms: First Come First Serve(FCFS), Shortest Job First (SJF), Round Robin (RR).	**12**	**CO2**
3	**MODULE III:** Deadlocks: Characterization – Methods for handling Deadlocks– Prevention, Avoidance: Bankers Algorithm, Detection of Deadlock and Recovery from deadlock.	**12**	**CO3**
4	**MODULE IV:** Memory Management: Address Binding–Dynamic Loading and Linking – Overlays –Swapping- Logical and Physical Address Space - Contiguous Allocation – Internal and External Fragmentation- Noncontiguous Allocation - Paging and Segmentation schemes.	**12**	**CO4**
5	**MODULE V:** Virtual Memory: Demand Paging –Page Replacement Algorithms– Optimal Page Replacement, First In First Out (FIFO), Least Recently Used (LRU): File Management: File Concepts– Access methods– Directory Structure Protection and consistency semantics.	**12**	**CO5**

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne “Operating System Concepts”, Tenth Edition, 2018, John Wiley & Sons.

REFERENCE BOOKS:

1. Bhatt P. C. P., “An Introduction to Operating Systems: Concepts and Practice”, Third Edition, 2010, Prentice Hall of India.
2. William Stallings, “Operating Systems: Internals and Design Principles”, Pearson, 2015, Global Edition.

E-REFERENCES:

1. **Operating Systems – Geeks for Geeks**
2. http://engineeringppt.blogspot.in/2009/07/operating-system-concepts-8th-edition.html

CORE PRACTICAL III

Course Title: OBJECT ORIENTED PROGRAMMING CONCEPTS USING JAVA LAB

Course Code :	**Credits :2**
L:T:P:S : 0:1:2:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 50**

LEARNING OBJECTIVES:

- Develop Java programs to perform arithmetic operations, demonstrate conditional and iterative statements, and handle command-line arguments.
- Implement constructors, method overloading, and method overriding in Java programs.
- Explore inheritance, the final keyword, and the use of String and StringBuffer classes.
- Create user-defined packages, demonstrate thread methods, and implement thread synchronization.
- Develop and test applets, including their lifecycle, user input handling, and graphical features, along with AWT controls and layout managers.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Apply object-oriented features in Java programs.
CO2	Handle exceptions, packages, and multithreading.
CO3	Develop GUI applications using AWT and applets.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	2	3	2	2	2	2
CO2	3	3	3	3	2	2	3	3	2	2	2
CO3	3	3	2	3	3	3	3	3	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

LAB EXERCISES:

APPLICATIONS

1. Write a Java program to perform arithmetic operations using different operators.
2. Develop a program to demonstrate the use of conditional statements (if-else, switch-case).
3. Implement a Java program to demonstrate iterative statements (for, while, do-while).
4. Develop a program that accepts command-line arguments and displays them.
5. Write a program to illustrate the use of constructors.
6. Implement method overloading and method overriding in a Java program.
7. Develop a program to show the use of the final keyword.
8. Write a Java program to demonstrate the usage of the String and StringBuffer classes.
9. Implement a program demonstrating single and multiple inheritance using the extends keyword.
10. Create a user-defined package and import it into another Java program.
11. Implement a program to demonstrate thread methods like start(), sleep(), join(), and yield().
12. Develop a program to implement thread synchronization.

APPLETS

13. Write a Java program to demonstrate the difference between an applet and an application.
14. Implement an applet to demonstrate the applet life cycle
15. Develop an applet program using the <applet> tag.
16. Create an applet that takes user inputs using parameters.
17. Implement an applet to draw different geometric shapes using the Graphics class.
18. Write a Java program to demonstrate AWT controls like Buttons, Labels, Text Fields, Text Areas, Choices, Checkboxes, Lists, and Scrollbars.
19. Implement a Java program to demonstrate different layout managers.

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne “Operating System Concepts”, Tenth Edition, 2018, John Wiley & Sons.

REFERENCE BOOKS:

1. Bhatt P. C. P., “An Introduction to Operating Systems: Concepts and Practice”, Third Edition, 2010, Prentice Hall of India.
2. William Stallings, “Operating Systems: Internals and Design Principles”, Pearson, 2015, Global Edition.

E-REFERENCES:

1. https://docs.oracle.com/javase/tutorial
2. https://www.javatpoint.com/java-tutorial
3. https://www.w3schools.com/java/

DISCIPLINE SPECIFIC ELECTIVE I (A)

Course Title: WEB APPLICATION DEVELOPMENT USING REACTJS AND NODE.JS

Course Code :	**Credits : 03**
L:T:P:S :2:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Understand the fundamentals of ReactJS and its component-based architecture.
- Develop dynamic and responsive web applications using ReactJS.
- Implement state management using hooks and context APIs.
- Integrate React applications with backend services (REST APIs).
- Apply routing, forms, and validations in React apps.
- To enable back-end development and server-side scripting using Node.js.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the fundamentals of ReactJS and its ecosystem.
CO2	Develop functional components and manage application states effectively.
CO3	Implement navigation using React Router and manage form data.
CO4	Integrate third-party APIs and demonstrate data fetching techniques.
CO5	Understand Node.js environment for back-end development. Deploy and optimize ReactJS and Node.js applications for production.

Mapping of Course Outcomes Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	2	3	2
CO2	3	3	3	2	3	2	3	3	2	3	2
CO3	2	3	3	3	3	2	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3	3	3	2
CO5	2	3	3	3	3	3	2	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction to ReactJS-Overview of Single Page Applications (SPA)Introduction to ReactJS-Setting up React environment (Node, npm, createreact-app)-Understanding JSX-Rendering Elements	**09**	**CO1**
2	**MODULE II** : Components and Props-Functional and Class Components-Props and Data Passing-Component Lifecycle (basic understanding)-Event Handling in React	**09**	**CO2**
3	**MODULE III** : State and Hooks-Introduction to State-setState() methodIntroduction to Hooks (useState, useEffect)-Building Interactive UIs	**09**	**CO3**
4.	**MODULE IV:** React Router and Forms-Routing in React using react-router-domRoute parameters and Navigation-Forms in React-Controlled vs Uncontrolled Components-Form Validation Basics- Data Fetching and APIs-Fetch API and Axios-Making HTTP Requests-Managing API data in state-Handling Loading and Error States.	**09**	**CO4**
5.	**MODULE V: Introduction to Node.js**-Node.js Fundamentals: Event-driven Programming-Setting up Node.js Environment-Node Package Manager (NPM)-Creating Simple Servers using http Module.	**09**	**CO5**

TEXT BOOKS:

1. "React-Up & RunningReact: Up & Running: Building Web Applications" by Stoyan Stefanov, 2021, Second Edition, Shroff/ O'Reilly Publisher.
2. "Learning React Modern Patterns for Developing React Apps" by Alex Banks & Eve Porcello,2020, Second Edition, O'Reilly Media Publisher.
3. **"** Node.Js, Mongodb and Angular Web Development" *by Brad Dayley, Brendan Dayley, and Caleb Dayley, Second Edition, Pearson Education.*

REFERENCE BOOKS:

1. "The Road to React" by Robin Wieruch, 2025 Edition.
2. "Node.js Design Patterns" by Mario Casciaro, Third Edition, Packet Publishing.

E-REFERENCES:

1. https://www.w3schools.com/REACT/DEFAULT.ASP/
2. https://react.dev/learn
3. https://nodejs.org/en/docs/

DISCIPLINE SPECIFIC ELECTIVE I (B)

Course Title: WEB APPLICATION DEVELOPMENT USING ANGULARJS AND NODE.JS

Course Code :	**Credits : 03**
L:T:P:S :2:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To introduce dynamic front-end development using AngularJS.
- Develop dynamic, single-page applications (SPAs) using AngularJS.
- To enable back-end development and server-side scripting using Node.js
- Apply best practices in AngularJS for building scalable web applications.
- To develop full-stack applications combining front-end and back-end technologies.
- To promote building efficient, scalable, and maintainable web applications.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Demonstrate understanding of AngularJS architecture and key concept. Understand the basic concepts of AngularJS for developing dynamic front-end applications.
CO2	Develop interactive web applications using directives, filters, and services. Develop reusable components and manage application state using AngularJS.
CO3	Implement data binding, dependency injection, and routing in AngularJS applications.
CO4	Debug, test, and optimize AngularJS applications for performance. Apply AngularJS knowledge to real-world project development.
CO5	Understand Node.js environment for back-end development. Design and build full-stack web applications using AngularJS and Node.js.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	2	2	3	2	2	2	1
CO 2	3	3	2	3	2	2	2	3	3	3	2
CO 3	2	3	3	3	3	1	3	2	3	3	2
CO 4	2	3	2	2	3	1	2	3	2	3	2
CO 5	3	3	3	3	3	3	2	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I:** Introduction to AngularJS-Overview of AngularJS-Difference between AngularJS and JavaScript-Advantages of AngularJS- Introduction to SPA (Single Page Application)-Setting up the Environment.	09	CO1
2	**MODULE II:** AngularJS Architecture-MVC Architecture-Directives and Data Binding.	09	CO2
3	**MODULE III:** AngularJS Directives – Understand ng Atrributes-Expression and Data Binding-Working with Directives - Modules and ComponentsAngular Controller and View-Scope Hierachy	09	CO3
4.	**MODULE IV:** Advanced AngularJS Concepts-Custom Directives and Builtin Filters-AngularJS Forms- Dependency Injection -Understaing services - Built-in services- Creating Custom Service-Injecting Dependency in Service.	09	CO4
5.	**MODULE V:** Introduction to Node.js-Node.js Fundamentals: Event-driven Programming-Setting up Node.js Environment-Node Package Manager (NPM)-Creating Simple Servers using http Module.	09	CO5

TEXT BOOKS:

1. "AngularJS" by Dipali V. Jadhav (Dhumal), First Edition, Vision Publication.
2. **"** AngularJS: Up and Running -Enhanced Productivity with Structured Web Apps (Greyscale Indian Edition) by Shyam Seshadri, Brad Green, Shroff/O'Reilly .Publications.
3. **"** Node.Js, Mongodb and Angular Web Development" by Brad Dayley, Brendan Dayley, and Caleb Dayley, Second Edition, Pearson Education.

REFERENCE BOOKS:

1. "AngularJS Programming by Example" by AgusKurniawan, First Edition, PE Press, 2014.
2. Node.js Design Patterns" by Mario Casciaro, Third Edition, Packt Publishing.

E-REFERENCES:

1. https://www.w3schools.com/angular/
2. https://angular.dev/tutorials/learn-angular
3. https://docs.angularjs.org/guide
4. https://www.geeksforgeeks.org/angularjs-introduction/
5. https://www.tutorialspoint.com/nodejs/index.htm

DISCIPLINE SPECIFIC ELECTIVE I (C)
Course Title: VUe.js DEVELOPMENT

Course Code :	**Credits : 03**
L:T:P:S :2:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVESS:

- To introduce students to modern JavaScript frameworks.
- To build dynamic and responsive web applications using Vue.js.
- To apply concepts of components, routing, state management, and Vue CLI.
- To integrate backend services with Vue.js applications.
-

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the fundamental concepts of Vue.js framework and its ecosystem.
CO2	Develop and manage Vue.js components and applications.
CO3	Implement routing, state management, and API integration.
CO4	Design real-world projects demonstrating Vue.js concepts.
CO5	Deploy and maintain Vue.js applications professionally.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO 2	PO 3	PO 4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1	3	2	2	3	2	3	2	1
CO 2	3	3	2	2	3	2	3	3	3	3	2
CO 3	2	3	2	3	3	2	3	3	3	3	3
CO 4	2	3	2	3	3	3	3	3	3	3	3
CO 5	2	3	3	3	3	3	3	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction to Vue.js-Introduction to JavaScript FrameworksWhy Vue.js?-Vue Instance and Data Binding-Directives and Template Syntax.	09	CO1
2	**MODULE II**: Components and Props-Building Reusable Components-Props and Custom Events-Component Communication-Lifecycle Hooks.	09	CO2
3	**MODULE III**: Vue Router-Introduction to Vue Router-Defining RoutesNavigation and Route Guards-Nested Routes and Lazy Loading.	09	CO3
4.	**MODULE IV**: State Management with Vuex-Introduction to Vuex-State, Getters, Mutations, Actions-Managing State in Large Applications.	09	CO4
5.	**MODULE V** :HTTP Requests & Vue Ecosystem-Axios for HTTP calls (GET, POST, PUT, DELETE)-Handling API responses and errors-Vue DevTools-Environment files & API URLs-Deployment basics (Netlify/Firebase hosting).	09	CO5

TEXT BOOKS:

1. **"**Fullstack Vue: The Complete Guide to Vue.js**"** by Hassan Djirdeh, Nate Murray, Ari Lerner, Fullstack.io First Edition, Vision Publication.
2. "Vue.js Up and Running: Building Accessible and Performant Web Apps"**,** by Callum Macrae,First Edition, O'Reilly Media

REFERENCE BOOKS:

1. "Vue.js 2 Design Patterns and Best Practices" by Paul Halliday, First Edition, Packt Publishing.

E-REFERENCES:

1. https://vuejs.org/
2. https://www.vuemastery.com/
3. https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference

FOURTH SEMESTER

CORE V

Course Title: DATABASE SYSTEMS
(Also common to B.C.A)

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 100**

LEARNING OBJECTIVES:

- Detailed description for the structure of Database, file and records.
- Structuring the models for Normalization of different Normal Forms.
- Emphasizing the types of statements for control languages.
- Demonstration of Subprograms, Functions and Procedures
- Elaborating the concepts of Triggers and Cursors

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To demonstrate the characteristics of Database Management Systems. To study about the concepts and models of database. To impart the concepts of System Development Life Cycle and E-R Model.
CO2	To classify the keys and the concepts of Relational Algebra. To impart the applications of various Normal Forms Classification of Dependency.
CO3	To elaborate the different types of Functions and Joins and their applications. Introduction of Views, Sequence, Index and Procedure.
CO4	Representation of PL-SQL Structure. To impart the knowledge of Sub Programs, Functions and Procedures.
CO5	Representation of Exception and Pre-Defined Exception. To Point out the Importance of Triggers, Implicit and Explicit Cursors.

Mapping of Course Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	3	3	3	3	3	3	3	3	3	2
CO2	3	2	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	2	2	2	2	2	3	3	3	2	3
CO5	3	2	3	3	3	2	3	3	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction - Database System - Characteristics of Database Management Systems - Architecture of Database Management Systems - Database Models - System Development Life Cycle - Entity Relationship Model	12	CO1
2	**MODULE II:**Introduction to Relational Database Model - Structure of Relational Model – Keys - Relational Algebra - Normalization: Functional Dependency - First Normal form - Second Normal Form-Third Normal form - Boyce-Code Normal Form - Fourth Normal Form.	12	CO2
3	**MODULE III:** SQL: Introduction-Data Retrieval - Single row function - Group function - Set Function – Subquery-Joins. Data Manipulation Language:Insert,Update and Delete Statements-Transaction Control Language - View-Sequence-Synonym-Index-Defining Constraints.	12	CO3
4	**MODULE IV:**PL/SQL: Introduction-PL/SQL Basic-Character Set- PL/SQL Structure-SQL Cursor-Subprograms-Functions-Procedures.	12	CO4
5	**MODULE V:**Exception Handler Introduction - Predefined Exception - User Defined Exception – Triggers - Implicit and Explicit Cursors - Loops in Explicit Cursor.	12	CO5

TEXT BOOKS:

1. Pranab Kumar Das Gupta and P. Radha Krishnan, “Database Management System Oracle SQL and PL/SQL”, Second Edition, 2013, PHI Learning Private Limited.

REFERENCE BOOKS:

1. RamezElmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, 2007, Pearson Publications.
2. Abraham Silberschatz, Henry Korth, S. Sudarshan, “Database System Concepts”, Sixth Edition, 2010, Mc- 1Graw Hill Education.

E-REFERENCE:

1.http://www.amazon.in/DATABASE-MANAGEMENT-SYSTEM-ORACLE-SQL o/dp/B00LPGBWZ0#reader_B00LPGBWZ0

CORE VI
Course Title: FOUNDATIONS OF COMPUTER NETWORKS
(Also common to B.C.A)

Course Code :	**Credits : 04**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To clarify network terminology.
- To provide an opportModuley to do network programming using **TCP/IP**.
- To give the students experience working in programming teams.
- To provide a WLAN measurement experience.
- To expose students to emerging technologies and their potential impact.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Define computer networks, Demonstrate the types of networks, distinguish topologies, Differentiate Transmission mode, Design OSI and TCP/IP Reference model
CO2	Illustrate Transmission media, Analyze the wireless media, Create the structure of Telephone system
CO3	Formulate framing control and flow control, Explain error correcting codes and error detecting codes
CO4	Discuss store and forward switching network, Explain Routing algorithm, Examine congestion control algorithm
CO5	Summarize the elements of transport protocol, Describe DNS,EMAIL,WWW

Mapping of Course Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	3	2	2	3	3	3	2	1	-	-
CO2	3	2	3	3	3	3	2	3	2	1	-
CO3	2	2	2	3	2	3	-	1	3	3	2
CO4	3	2	3	2	2	2	-	-	1	3	3
CO5	2	3	2	2	3	2	-	-	1	2	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW -: NO CORRELATION

Sl. No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction: Definition and Uses of Computer Networks. Network Hardware/Categories of Networks: LAN, WAN and MAN. Line Configuration: Broad Casting and Point to Point Transmission Mode: Simplex, Half duplex and Full Duplex. Network Software: Protocol Hierarchies- Connection Oriented and Connectionless Services – Service Primitives. Reference Models: OSI Reference Model – TCP/IP Reference Model.	**12**	**CO1**
2	**MODULE II**: Physical Layer: Guided Transmission Media: Magnetic Media, Twisted Pair, Coaxial Cable and Fiber Optics. Wireless Transmission: Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission and Light Waves.	**12**	**CO2**
3	**MODULE III**: Data Link Layer: Design Issues: Framing, Error Control and Flow Control. Error Correcting Codes: Hamming Codes. Error Detecting Codes. Elementary Data-link Protocols: A Utopian Simplex Protocol. Sliding Window Protocols: A One-Bit Sliding Window Protocol.	**12**	**CO3**
4	**MODULE IV**: Network Layer: Design Issues: Store and Forward Packet Switching – ServVices provided to the Transport Layer. Routing Algorithms: The Optimality Principle, Flooding, The Shortest Path Routing and Hierarchical Routing.	**12**	**CO4**
5	**MODULE V**: Transport Layer: Elements of Transport Protocols: Addressing, Connection Establishment and Connection Release. TCP: Introduction, TCP Service Model and TCP Segment Header. Application Layer: DNS – Electronic Mail – The World Wide Web.	**12**	**CO5**

TEXT BOOKS:

1. Andrew S. Tanenbaum and David J. Wetherall**,** "Computer Networks", Fifth edition, 2011, PHI.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data Communication and Networking", Fifth Edition, Tata McGraw Hill.
2. William Stallings, "Data and Computer Communications", Eighth Edition, Pearson education Asia.

E-REFERENCES:

1. http://nptel.iitm.ac.in/courses/IIT-MADRAS/Computer_Networks/index.php
2. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
3. http://people.du.ac.in/~ngupta/teach_networks.html

CORE PRACTICAL IV

Course Title: -DATABASE SYSTEMS LAB

Course Code	**:**	**Credits**	**: 2**
L:T:P:S	**: 0:1:2:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

- To make the student aware of the Back-End tool.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Create and manage relational databases using SQL.
CO2	Use queries to manipulate and retrieve data using joins and subqueries.
CO3	Write PL/SQL blocks with procedures and functions.
CO4	Implement triggers and exception handling in PL/SQL.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	3	2	3	2	2	2	2
CO2	3	3	2	3	3	2	3	2	2	2	2
CO3	3	3	2	3	2	2	3	2	2	2	2
CO4	3	2	2	3	2	2	3	2	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

LAB EXERCISES:

1. DDL commands.
2. Specifying constraints-primary key, foreign key, unique, check, not null.
3. DML commands.
4. Joins.
5. Sub queries.
6. Creation of simple PL/SQL block using control constructs.
7. Creation of PL/SQL blocks using exceptional handlers.

8. PL/SQL program using implicit and explicit cursor.
9. PL/SQL program using procedures.
10. PL/SQL program using triggers.
11. Data Manipulation using PL/SQL.

TEXT BOOKS:

1. Andrew S. Tanenbaum and David J. Wetherall**,** "Computer Networks", Fifth edition, 2011, PHI.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data Communication and Networking", Fifth Edition, Tata McGraw Hill.
2. William Stallings, "Data and Computer Communications", Eighth Edition, Pearson education Asia.

E-REFERENCES:

1. http://nptel.iitm.ac.in/courses/IIT-MADRAS/Computer_Networks/index.php
2. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
3. http://people.du.ac.in/~ngupta/teach_networks.html

DISCIPLINE SPECIFIC ELECTIVE II(A)
Course Title: DIGITAL MARKETING

Course Code :	**Credits :3**
L:T:P:S : 2:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To assess the evolution of digital marketing.
- To appraise the dimensions of online marketing mix.
- To infer the techniques of digital marketing.
- To analyse online consumer behaviour
- To interpret data from social media and to evaluate game-based marketing.

Course Outcomes:At the end of the Course, the student will be able to :

CO1	Explain the dynamics of digital marketing
CO2	Examine online marketing mix
CO3	Compare digital media channels
CO4	Explain online consumer behaviour
CO5	Analyse social media data

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	2	2	2	2	2	3	1
CO2	3	3	3	3	2	2	2	3	1	3	2
CO3	2	3	3	3	2	1	2	2	3	3	2
CO4	2	3	2	2	3	1	2	3	2	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I: INTRODUCTION TO DIGITAL MARKETING** Digital Marketing – Transition from Traditional to digital marketing – Rise of Internet – Growth of e-concepts – Growth of e-business to advanced e-commerce – Emergence of Digital marketing as a tool -Digital Marketing Channels – Digital Marketing Applications benefits and challenges -Factors for success of digital marketing-Emerging trends and concepts, Big Data and IOT, Segments based digital marketing. Hyperlocal marketing – OpportModuleies for digital marketing professionals.	**09**	CO1
2	**MODULE II: ONLINE MARKETING MIX** Online marketing mix – E-product – E-promotion– E-price – E-place – Consumer segmentation–Targeting–Positioning–Consumers and online shopping issues Website characteristics affecting online purchase decisions–Distribution and implication on online marketing mix decisions–Digitization and implication on online marketing mix decisions	**09**	CO2
3	**MODULE III: DIGITAL MEDIA CHANNELS** Digital media channels–Search engine marketing–ePR–Affiliate marketing Interactive display advertising–Opt-in-email marketing and mobile text messaging, social media and viral marketing–Online campaign management using–Facebook, Twitter, Instagram, Snapchat, Pinterest–Metaverse Marketing-Advantages and disadvantages of digital media channels–Metaverse marketing	**09**	CO2
4	**MODULE IV: ONLINE CONSUMER BEHAVIOR** Online consumer behavior –Cultural implications of key website characteristics Dynamics of online consumer visit–Models of website visits–Web and consumer decision making process–Database marketing–Electronic consumer relationship management–Goals–Process–Benefits–Role–Next generation CRM.	**09**	CO3
5	**MODULE V: ANALYTICS AND GAMIFICATION** Digital Analytics–Concept–Measurement framework–Demystifying web data Owned social metrics–Measurement metrics for Facebook, Twitter, YouTube, Slide Share, Pinterest, Instagram, Snapchat and LinkedIn–Earned social media metrics - Digital brand analysis– Meaning– Benefits– Components– Brand share dimensions Brand audience dimensions– Market influence analytics– Consumer generated media and opinion leaders– Peer review– Word of mouth– Influence analytics– Mining consumer generated media– Gamification and game based marketing– Benefits Consumer motivation for playing online games.	**09**	CO4

TEXT BOOKS:

1. Puneet Singh Bhatia, (2019) “Fundamentals of Digital Marketing”, 2nd Edition, Pearson Education Pvt Ltd, Noida.
2. Dave Chaffey, Fiona Ellis-Chadwick, (2019) “Digital Marketing”, Pearson Education Pvt Ltd, Noida.

3. Chuck Hemann& Ken Burbary, (2019) “Digital Marketing Analytics”, Pearson Education Pvt Ltd, Noida.

REFERENCE BOOKS:

1. Seema Gupta, (2022) “Digital Marketing” 3rdEdition, McGraw Hill Publications Noida.
2. Kailash Chandra Upadhyay, (2021) “Digital Marketing: Complete Digital Marketing Tutorial”, Notion Press, Chennai.
3. Michael Branding, (2021) “Digital Marketing”, Empire Publications India Private Ltd, New Delhi.

E-REFERENCES:

1. https://www.digitalmarketer.com/digital-marketing/assets/pdf/ultimate-guide-todigitalmarketing.pdf
2. https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching tips/educational-technologies/all/gamification-and-game-based-learning
3. https://journals.ala.org/index.php/ltr/article/download/6143/7938

DISCIPLINE SPECIFIC ELECTIVE II(B)

Course Title: BUILDING MOBILE APPLICATIONS

Course Code :	**Credits : 03**
L:T:P:S : 2:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To facilitate students to understand android SDK
- To help students to gain basic understanding of Android application development
- To understand how to work with various mobile application development frameworks
- To inculcate working knowledge of Android Studio development tool
- To learn the basic and important design concepts and issues of development of mobile Applications
-

Course Outcomes: At the end of the Course, the student will be able to:

CO1	• To identify various concepts of mobile programming that make it unique from programming for other platforms
CO2	• To Create, test and debug Android application by setting up Android development
CO3	• To Demonstrate methods in storing, sharing and retrieving data in Android applications
CO4	• To Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces
CO5	• To Create interactive applications in android using no code concept.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	2	2	3	2	2	3	1
CO2	3	3	3	3	2	2	2	3	1	3	2
CO3	2	3	3	3	2	1	2	2	3	3	2
CO4	2	3	2	3	3	1	2	3	2	3	2
CO5	3	3	2	3	3	3	3	3	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	**CONTENTS OF MODULE**	**Hrs**	**COs**

1	**MODULE I: MOBILE PLATFORM AND APPLICATIONS** Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues	**09**	CO1
2	**MODULE II: INTRODUCTION TO ANDROID** Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.	09	CO2
3	**MODULE III: ANDROID APPLICATION DESIGN ESSENTIALS** Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	09	CO2
4	**MODULE IV: ANDROID USER INTERFACE DESIGN & MULTIMEDIA** User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures	09	CO3
5	**MODULE V:NO-CODE MOBILE APPLICATION** Understanding No-Code: What, Why, and How- Benefits & Limitations of No-Code tools-No-Code vs Low-Code vs Traditional Development-Overview of Popular No-Code Platforms for Mobile Apps. Creating a simple mobile app using Glide-Setting up navigation and linking screens-Designing forms and collecting user input- Customizing themes and layouts.	09	CO4

TEXT BOOKS:

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.
3. Prasanth Kumar Pattnaik,Rajib Mall,”Fundamentals of Mobile Computing”,PHI Learning Pvt.Ltd,New Delhi-2012

REFERENCE BOOKS:

1. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd, 2010
2. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2009

3. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O"Reilly, SPD Publishers, 2015. ISBN-13: 978-9352131341

E-REFERENCES:

1. https://drive.google.com/file/d/1ommvu9CR5QtKfBGYHI9a2Fk2PjWtpQla/view?usp=drive_link
2. Fragments | App architecture | Android Developers
3. The 8 best no-code app builders in 2025 | Zapier

DISCIPLINE SPECIFIC ELECTIVE II(C)

Course Title: SEARCH ENGINE OPTIMIZATION

Course Code :	**Credits : 03**
L:T:P:S : 2:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Learners will gain a clear understanding of how search engines operate and the role SEO plays in digital marketing strategies.
- Learners will be able to conduct keyword research independently, identify relevant keywords, and understand user intent to target the right audience.
- Learners will be capable of optimizing webpage elements such as titles, headings, URLs, meta descriptions, and images for better search visibility.
- Learners will understand the importance of backlinks and will be equipped with beginner strategies to improve website authority.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand how search engines work and why SEO matters
CO2	Perform basic keyword research using free and paid tools
CO3	Optimize web pages for search engines and users
CO4	Develop strategies for building backlinks
CO5	Conduct a basic SEO audit of a website

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	2	3	3	3	2	2	3
CO2	3	3	3	3	2	3	3	2	3	3	3
CO3	2	3	3	3	2	3	3	2	2	3	3
CO4	2	3	2	3	3	3	2	2	3	3	3
CO5	3	3	2	3	3	3	3	3	2	2	3

CORRELATION: 3- STRONG 2-MEDIUM 1-LOW

Sl No.	**CONTENTS OF MODULE**	**Hrs**	**COs**

1	**MODULE I:** Introduction to SEO **-** Importance of SEO for Websites - How Search Engines Work (Crawling, Indexing, Ranking) - Basics of Search Engine Algorithms (Google, Bing, etc.) - Types of SEO (On-Page, OffPage, Technical) - White Hat vs. Black Hat SEO	**09**	CO1
2	**MODULE II:**Keyword Research & Optimization **-** Understanding Keywords and Their Importance - Types of Keywords (Short-Tail, Long-Tail, LSI) - Tools for Keyword Research (Google Keyword Planner, Uber suggest) - How to Choose the Right Keywords -Keyword Placement in Content	**09**	CO2
3	**MODULE III:**On-Page SEO **-** Title Tag & Meta Description Optimization -URL Structure & Best Practices - Header Tags (H1, H2, H3) - Image Optimization (Alt Text, Compression) -Internal Linking Strategies	**09**	CO3
4	**MODULE IV:**Off-Page SEO **-** Introduction to Backlinks - Importance of HighQuality Backlinks - Basics of Link Building (Guest Blogging, Social Media Links) -Role of Social Media in SEO	**09**	CO4
5	**MODULE V:** SEO Tools & Performance Tracking **-** Introduction to Google Search Console - Basics of Google Analytics for SEO - Checking Website Performance & Traffic - Common SEO Mistakes to Avoid - Future Trends in SEO	**09**	CO5

TEXT BOOK:

1. **Beginners Guide to SEO by Nishant Baxi published by Notion Press First edition,2023**
2. **The Beginner's Guide to SEO by Moz**
   Download URL:
   https://d2eeipcrcdle6.cloudfront.net/guides/Moz-The-Beginners-Guide-To-SEO.pdf?utm_source=chatgpt.com

REFERENCE BOOK:

1. **Search Engine Optimization Starter Guide (by Google)** Download URL:
   https://www.cuit.columbia.edu/sites/default/files/content/search-engine-optimization-starter-guide.pdf?utm_source=chatgpt.com

E- REFERENCES:

1. Moz SEO Guide **-** https://moz.com/beginners-guide-to-seo
2. https://developers.google.com/search/docs/beginner/seo-starter-guide

FIFTH SEMESTER

CORE VII

Course Title: WEB PROGRAMMING WITH PHP
(Also common to B.C.A)

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 100**

LEARNING OBJECTIVES:

- Understand the usage of PHP and MySQL in dynamic web development.
- Understand PHP language data types, logic controls, built-in and user-defined functions
- Be able to setup and configure MySQL, PHP, and Apache web server development environment.
- Select, insert, update and delete data using SQL language.
- Understand Object oriented programming paradigm in PHP.
- Build a simple, yet functional web application using PHP/MySQL

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Recall The Basic Concepts Scripting Language Identify Variables and Constants Recognize Variable's Scope
CO2	Classify the types of Conditional Statements and iterations. Summarize File Handlings
CO3	Relate Reordering and Multidimensional Arrays Use String Functions in an Appropriate places
CO4	Correlate OOP Concepts with PHP Scripts Categorize Errors and Handling Functions
CO5	Use Relational Database Concepts with MySQL

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	2	-	2	-	1	1	3	2	1	2	2	1
CO2	2	2	2	-	1	1	3	2	2	2	2	2
CO3	3	2	3	-	2	2	3	3	3	3	3	2
CO4	3	1	3	2	2	2	3	3	3	3	3	2
CO5	3	2	3	2	2	2	3	3	3	3	3	3

CORRELATION: 3- STRONG 2-MEDIUM 1-LOW -:NO CORRELATION

Sl. No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I:** Using PHP – Creating a sample application – Embedding PHP with HTML – Adding Dynamic Content – Accessing form variables – Understanding Identifiers – Examining Variable Types – Declaring and Using Constants – Understanding Variable Scope – Using Operators – Using Variable Handling Functions	**15**	**CO1**
2	**MODULE II:** Conditional Statements and Iterations: Making Decisions with Conditionals – Repeating Actions through Iterations. Storing and Retrieving Data: Processing Files – Opening a file – Writing to a File – Reading from a file – Using Other file Functions	**15**	**CO2**
3	**MODULE III:** Using Arrays: Why is an Array? – Numerically Indexed Arrays – Arrays with Different Indices – Array Operators - Multidimensional Arrays – Reordering Arrays – Loading Arrays from Files – Performing Other Array Manipulations – String Manipulations	**15**	**CO3**
4	**MODULE IV:** Object – Oriented PHP: Understanding Object – Oriented Concepts – Creating Classes, Attributes and Operations in PHP – Implementing Inheritance in PHP – Understanding Advanced Object – Oriented Functionality in PHP – Error and Exception Handling.	**15**	**CO4**
5	**MODULE V:** Using MySQL: Relational Database Concepts –Creating Your Web Databases – Working with Your MYSQL Databases – Accessing Your MYSQL Database From the Web with PHP	**15**	**CO5**

TEXT BOOKS:

1. Luke Welling, Laura Thomson (2024), PHP and MYSQL Web Development, Fourth Edition, Developer's Library

REFERENCE BOOKS:

1. Mike Mcgrath(2021), PHP– in – easy – steps, Fourth Edition
2. Jon Duckett (2022), PHP and MySQL: Server Side Web Development,

E-REFERENCES:

1. http://www.w3schools.com/php/
2. http://www.codingModule.com/php-tutorial-language-introduction

CORE VIII

Course Title: OPEN SOURCE TECHNOLOGIES

Course Code :	**Credits : 04**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To introduce the philosophy, licensing, and commModuley models of open source software.
- To gain practical skills in using open source operating systems, tools, and languages.
- To develop web and backend applications using open source frameworks and databases.
- To implement version control, deployment tools, and contribute to OSS projects.

Course outcomes: **At the end of course, the student will be able**

CO1	Understand open source principles, licenses, and collaboration models
CO2	Work efficiently with Linux OS, shell scripting, and command-line tools
CO3	Develop programs using Ruby and integrate backend technologies
CO4	Implement web apps with open source databases and server-side scripting
CO5	Use Git, Docker, and frameworks to manage development workflows

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3	3	3	2	3	2	3
CO2	3	3	3	3	3	3	3	2	2	2	2
CO3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	2	2	2	3	3	3	3	3

CORRELATION: 3- STRONG 2-MEDIUM 1-LOW

Sl. No.	CONTENTS OF MODULE	Hrs	Cos
1	**MODULE I:** Introduction to Open Source Software-Definition, benefits, challenges-Open source vs free software-OSS licensing: GPL, MIT, Apache, BSD-Open source commModuleies (GitHub, GitLab)-Version control using Git and GitHub basics.	**12**	**CO1**
2	**MODULE II:** Open Source Operating Systems and Tools-Linux: architecture, installation, distributions-Shell Constructs: loops, functions, file handling Text editors: Vim, Nano, VS Code (open source)-Package managers (apt, yum, dnf, snap)	**12**	**CO2**
3	**MODULE III:** Open Source Programming Languages-History, Features and installations of **Ruby-**Variables-Constants-Data Types(numbers, strings, arrays, hashes),I/O Operatons(gets.puts,print),Condition Structures (if, unless,case,loops)-Methods and scope.	**12**	**CO3**
4	**MODULE IV**:. Open Source Backend and Databases-Introduction to LAMP stack-SQLite:setup and queries. **Introduction to Web Development Frameworks-Overview of Open Source Web Development frameworks:**Full-stack vs. micro-frameworks-Popular frameworks: **Laravel**, **Django**, **React**, **Vue.js**, **Flask.**	**12**	**CO4**
5	**MODULE V:Introduction to Django**- Setting Up Django- URL Routing and Views:URL configuration (urls.py)-Creating views (views.py)-Mapping URLs to views-Returning HTML response-**Models and Database**-Introduction to Django ORM-Defining models in models.py-Running migrations-Performing CRUD operations using the admin panel- **Forms and User Input**-Handling forms with forms.py or basic HTML-Validating and processing form data-**Git Integration**-Initializing a Django project with Git-Committing changes and pushing to GitHub-Collaborative development via pull requests	**12**	**CO5**

TEXT BOOKS:

1. " Producing Opem Source Software" by Karl Fogel, ,2005, O'Reilly –**MODULE I**
2. "Pro Git" by Scott Chacon & Ben Straub, second edition, 2014,Apress-**MODULE I**
3. "The Linux Command Line by William Shotts,2019,No Starch Press –**MODULE II**
4. "The Well Grounded Rubyist" by David A.Black, second edition, Manning Pubns-**MODULE III**
5. "Web Development with Django" by Ben Shaw, Saurabh Badhwar, Andrew Bird,2021,Packt Publishing -**MODULE IV & MODULE V**
6. "Django for Beginners" by William S. Vincent,2020,welcometocode publisher-**MODULE V**

REFERENCE BOOKS:

1. Producing Open Source Software by Karl Fogel

2. Richard L. Petersen, “The Complete Reference LINUX”, McGraw Hill.
3. "The Ruby Programming Language" by David Flanagan & Yukihiro Matsumoto – O'Reilly
4. The Linux Web Server with LAMP by Muhammad A. Moniem- Programming Ruby: The Pragmatic Programmer’s Guide (a.k.a. “Pickaxe Book”)by Dave Thomas, Chad Fowler, and Andy Hunt.
5. Using SQLite by Jay A. Kreibich (O'Reilly)

E-REFERENCES:

1. producingoss.com
2.https://docs.github.com
3. http://www.kobo.com/in/en/ebook/linux-command-line-and-shell-scripting-bible-3
4.https://sqlite.org/docs.html
5.https://www.ruby-lang.org
6. https://learndjango.com/courses/django-for-beginners/

CORE IX

Course Title: INTRODUCTION TO DATA MINING

Course Code :	**Credits : 04**
L:T:P:S: 4:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To make students understand the concepts of Data Mining
- To apply the Data Mining concept in the real world scenario
- To encourage the students to do research in Data Mining

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the basics of Data Mining Learn about databases in Data Mining Learn about knowledge discovery in Data Mining
CO2	Learn about data and its types Understand about Data Preprocessing
CO3	Learn about frequent itemsets and find patterns Apply Apriori Algorithm for frequent itemset mining
CO4	Understand classification concepts Learn and apply decision tree and rule based algorithms for prediction
CO5	Learn about clustering methods Apply outlier detection methods to identify outliers

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	3	3	3	3	2	3	2	3
CO2	3	3	3	2	3	3	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	2	3	3	3	3	3

CORRELATION:3-STRONG 2-MEDIUM 1-LOW

S.No	**CONTENTS OF MODULE**	**Hrs**	**Cos**

1	**MODULE I**: Data Mining: Introduction- Data Mining - Kinds of Data -Kinds of Patterns -Technologies Used – Applications -Major Issues in Data Mining	**15**	**CO1**
2	**MODULE II**: Getting to Know Your Data- Data Objects and Attribute Types- Data Preprocessing: Data Cleaning - Data Integration- Data Reduction: Histograms-clustering-sampling.	**15**	**CO2**
3	**MODULE III**: Mining Frequent Patterns, Associations, and Correlations: Basic Concepts - Frequent Itemset Mining Methods: Apriori Algorithm - Generating Association Rules from Frequent Itemsets - Improving the Efficiency of Apriori- Mining Closed and Max Patterns.	**15**	**CO3**
4	**MODULE IV**: Classification: Basic Concepts - General Approach to Classification - Decision Tree Induction - Rule-Based Classification	**15**	**CO4**
5	**MODULE V**: Cluster Analysis: Overview of Basic Clustering Methods- Partitioning Methods: k-Means- k-Medoids-Outlier Detection: Outliers- Types of outliers - Outlier Detection Methods: Supervised, SemiSupervised, and Unsupervised Methods.	**15**	**CO5**

TEXT BOOKS:

1. Jiawei Han & Micheline Kamber, “Data Mining Concepts & Techniques”, 2011, 3 rd Edition.
2. K.P. Soman , Shyam Diwakar, V.Ajay ,2006, Insight into Data Mining Theory and Practice, Prentice Hall of India Pvt. Ltd - New Delhi.

REFERENCE BOOKS:

1. Margaret H.Dunbam, “Data Mining Introductory and Advanced Topics”, Pearson Education 2003.
2. ”Introduction to Data Mining” by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar.

E-REFERENCES:

1. NPTEL & MOOC courses titled Data Mining 1.https://nptel.ac.in/courses/106105174/
2. https://www.coursera.org

CORE PRACTICAL V
Course Title: WEB PROGRAMMING WITH PHP LAB

Course Code :	**Credits : 02**
L:T:P:S : 0:1:3:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 50**

LEARNING OBJECTIVESS:

- To explain basics PHP variables, constants and controls
- To demonstrate the use of String, math and date functions.
- To demonstrate the creation of arrays and type of arrays
- To explain user defined functions and the concepts of class.
- To demonstrate the creation cookies and sessions
- To facilitate the creation of Database and validate the user inputs

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Build web pages using HTML and PHP.
CO2	Handle forms, sessions, and cookies using PHP.
CO3	Use PHP to interact with MySQL databases.
CO4	Create a web-based CRUD application with validation.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	2	3	2	2	2	2
CO2	3	2	2	3	2	2	3	3	2	2	2
CO3	3	3	2	3	3	2	3	2	2	2	2
CO4	3	3	3	3	3	2	3	2	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

LAB EXERCISES:

1. Using Variables and constants
2. Using Conditional Statements Statement
3. Using Operators
4. Using Switch-case statement
5. Using Looping statements
6. Writing Files
7. Reading Files
8. Using String functions
9. Using Numeric array
10. Using Associative array
11. Using Array with forms
12. Using OOP Concepts
13. Using Advanced Concepts 14. Using Exception Handling
15. Working with MySQL Database
16. Inserting Data into Database
17. Retrieving Data from the Database with Specific Criteria
18. Accessing Your MySQL Database from the Web

TEXT BOOKS:

1. Luke Welling, Laura Thomson (2024), PHP and MYSQL Web Development, Fourth Edition, Developer's Library

REFERENCE BOOKS:

1. Mike Mcgrath(2021), PHP– in – easy – steps, Fourth Edition
2. Jon Duckett (2022), PHP and MySQL: Server Side Web Development,

E-REFERENCES:

1. http://www.w3schools.com/php/
2. http://www.codingModule.com/php-tutorial-language-introduction

CORE PRACTICAL VI
Course Title: OPEN SOURCE TECHNOLOGIES LAB

Course Code :	**Credits : 02**
L:T:P:S : 0:1:3:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 50**

LEARNING OBJECTIVES:

- To provide hands-on experience with **Linux operating systems**, **shell scripting**, and the use of **Linux tools** that aid in software development and system management.
- To provide an in-depth understanding of **Ruby programming** language fundamentals, including variables, data types, condition structures, and methods, and applying these concepts to build functional programs.
- To teach students how to work with **back-end web development technologies**, focusing on setting up the **LAMP stack**, understanding **SQLite database**.
- To enable students to **develop dynamic web applications** using Django, integrate it with **Git for version control**, and understand deployment basics for real-world projects.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Use basic and advanced Linux commands.
CO2	Write shell scripts for automation.
CO3	Use Git for version control and collaboration.
CO4	Utilize open-source IDEs and package managers.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2	2	3	2	2	2	2
CO2	3	3	2	2	3	2	3	2	2	2	2
CO3	3	3	2	3	3	2	3	3	2	2	2
CO4	3	3	2	3	3	2	3	3	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

LAB EXERCISES:

1. Create a GitHub account and push your first repo
2. Clone, modify, and create a pull request on a sample open-source repo
3. Write shell scripts to automate:
   i. File operations (copy, rename, search)
   ii. Loop over directory contents
   iii. Simple calculator with functions
4. Write a Ruby script for:
   i. Input/output with user
   ii. Array and hash operations
   iii. Conditional logic (if, unless, case)
   iv. Create methods and test scope
   v. Build a simple CLI app (e.g., a quiz or contact book)
5. Set up a SQLite database and run queries
   i. Basic CRUD app using Django (form-based)
6. Build a contact form using Django Forms
   i. Create models and use the admin panel for CRUD
   ii. Initialize a Git repo, commit changes, push to GitHub

TEXT BOOKS:

1. " Producing Opem Source Software" by Karl Fogel, ,2005, O'Reilly
2. "Pro Git" by Scott Chacon & Ben Straub, second edition, 2014,Apress
3. "The Linux Command Line by William Shotts,2019,No Starch Press
4. "The Well Grounded Rubyist" by David A.Black, second edition, Manning Pubns
5. "Web Development with Django" by Ben Shaw, Saurabh Badhwar, Andrew Bird,2021,Packt Publishing
6. "Django for Beginners" by William S. Vincent,2020,welcometocode publisher

REFERENCE BOOKS:

1. Producing Open Source Software by Karl Fogel
2. Richard L. Petersen, "The Complete Reference LINUX", McGraw Hill.
3. "The Ruby Programming Language" by David Flanagan & Yukihiro Matsumoto – O'Reilly
4. The Linux Web Server with LAMP by Muhammad A. Moniem- Programming Ruby: The Pragmatic Programmer's Guide (a.k.a. "Pickaxe Book")by Dave Thomas, Chad Fowler, and Andy Hunt.
5. Using SQLite by Jay A. Kreibich (O'Reilly)

E-REFERENCES:

1. producingoss.com
2.https://docs.github.com
3. http://www.kobo.com/in/en/ebook/linux-command-line-and-shell-scripting-bible-3
4.https://sqlite.org/docs.html
5.https://www.ruby-lang.org
6. https://learndjango.com/courses/django-for-beginners/

DISCIPLINE SPECIFIC ELECTIVE III(A)

Course Title: SOFTWARE ENGINEERING CONCEPTS

Course Code	**:**	**Credits**	**: 03**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 100**

LEARNING OBJECTIVES:

- To introduce the students to a branch of study associated with the development of a software product.
- To gain basic knowledge about the pre-requisites for planning a software project.
- To gain knowledge about the project scheduling concept in software engineering.
- To learn how to design of software.
- To enable the students to perform testing of a software.

Course outcomes: At the end of course, the student will be able to:

CO1	• Recognize Software Engineering Principles Identify Different Types Of Process Models
CO2	• Compare Metrics With The Process Summarize Cost Estimation Model
CO3	• Sketch Out Basic Design Principles • Articulate The Coupling And Cohesions
CO4	• Teach Risk Management For Handling Risks • Use Formal Technical Reviews for Quality Assurance
CO5	• Categorize Testing Types • Illustrate Software Configuration Management

Mapping of Course outcomes to program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	3	2	2	2	2	3	1	1	1	-
CO 2	3	2	2	2	3	3	1	1	-	1
CO 3	2	2	2	2	2	2	-	2	1	2
CO 4	2	3	2	2	3	2	1	1	2	2
CO 5	3	3	2	2	2	3	1	2	1	1

CORRELATION: 3: STRONG 2: MEDIUM 1: LOW -: NO CORRELATION

Sl. No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction to Software Engineering: Software Characteristics - Software Applications – Software: A Crisis on the Horizon? – A Process Framework Software Engineering: A layered technology - Process models: The waterfall model– Incremental process models– Prototyping–The Spiral model.	**12**	**CO1**
2	**MODULE II**: Project Management: The Management Spectrum – The People–The Product– The Process– The Project–The W5HH Principle. Metrics in the Process and Project Domains: Metrics in the Process and Project Domains–Process Metrics and Project Metrics – Software measurement-Size-oriented metrics – Functionoriented metrics. - Empirical Estimation Model: COCOMO Model. Project Scheduling: Defining task set and a task network–Scheduling–Timeline charts – Tracking the Schedule.	**12**	**CO2**
3	**MODULE III**: Software Design: Design Concepts-Abstraction–Architecture Modularity. Basic Design Principles: Component-level Design GuidelinesCohesion–Coupling-Designing Conventional Components-Graphical Design Notation – Tabular Design Notation –Program Design Language– Comparison of notations.	**12**	**CO3**
4	**MODULE IV**: Risk Management: Reactive and Proactive risks–Software risks–Risk identification–Risk Projection-Risk Refinement – Risk mitigation, monitoring and management – The RMMM plan. Software Quality Assurance: Quality Concepts – Software Reviews –Formal Technical Reviews (FTR).	**12**	**CO4**
5	**MODULE V**: Software Testing: Definition- Verification and validation – Test strategies – Module Testing – Integration Testing – Validation testing – System Testing – The Art of Debugging. Software Configuration Management (SCM): Baselines – Software Configuration Items - The SCM Process	**12**	**CO5**

TEXT BOOKS:

1. Roger S. Pressman (2023), "*Software Engineering a Practitioner's Approach*", Ninth Edition, Tata McGraw Hill

REFERENCE BOOKS:

1. Titus Winters, Hyrum Wright (2020), Software Engineering at Google: Lessons Learned from Programming Over Editions, First Edition
2. Gergely Orosz(2023)**,** The Software Engineer's Guidebook: Navigating Senior, Tech Lead, and Staff Engineer's Positions at Tech Companies and Startups

E-REFERENCES:

1. http://nptel.iitm.ac.in/courses/Webcoursehttp://nptel.iitm.ac.in/courses/Webcourse-contents/IIT Kharagpur/Soft Engg/contents/IIT%20Kharagpur/Soft%20Engg/New_index1.html
2. http://it-ebooks.info/book/2609/

DISCIPLINE SPECIFIC ELECTIVE III(B)

Course Title: FUNDAMENTALS OF SOFTWARE PROJECT MANAGEMENT

Course Code	**:**	**Credits**	**: 3**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 100**

LEARNING OBJECTIVES:

- To define and highlight importance of software project management.
- To formulate and define the software management.
- To evaluate metrics & strategy in managing projects.
- To understand the risk management in software projects.
- To plan and estimate software projects.
- To understand the importance of Quality Assurance.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Remember the basic concepts of software project management.
CO2	Understanding domain processes in project management.
CO3	Apply task and activities.
CO4	Evaluate issues in resource management.
CO5	Implement quality requirements.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	2	3	3	2	3	3	3	2	1	-
CO2	3	3	3	2	3	3	2	3	2	2	1
CO3	2	2	3	2	3	2	2	1	1	2	2
CO4	2	3	3	2	3	3	3	2	2	2	1
CO5	3	2	2	3	3	2	2	2	3	-	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW -: NO CORRELATION

	CONTENTS OF MODULE	**Hrs**	**COs**

1	**MODULE I:** Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.	**12**	**CO1**
2	**MODULE II:** Managing Domain Processes - Project Selection Models -Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.	**12**	**CO2**
3	**MODULE III:** Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning -Project Roles and Skills Needed.	**12**	**CO3**
4	**MODULE IV:** Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM Levelling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	**12**	**CO4**
5	**MODULE V:** Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	**12**	**CO5**

TEXT BOOKS:

1. Robert T. Futrell, Donald F. Shafer, Linda I. Safer, ―Quality Software Project Management‖, Pearson Education Asia 2002.

REFERENCE BOOKS:

1. PankajJalote, ―Software Project Management in Practice‖, Addison Wesley2002.
2. Hughes, ―Software Project Management‖, Tata McGraw Hill 2004, 3rdEdition.

E-REFERENCES:

1. NPTEL & MOOC courses titled Software Project Management
https://nptel.ac.in/courses/106/105/106105218/

DISCIPLINE SPECIFIC ELECTIVE III(C)

Course Title: SOFTWARE TESTING TECHNIQUES

Course Code	**:**	**Credits**	**: 03**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03 Hours**	**ESE Marks**	**: 100**

LEARNING OBJECTIVES:

- Equip students with the knowledge and skills to systematically identify the report defects in software applications
- Ensuring the quality of the final product by validating that it meets all specified requirements
- Ultimately delivering a reliable user experience

Course outcomes: At the end of course, the student will be able to

CO 1	Understand The Principles in Software Testing Identify The Bugs and Its Types. Recall The Software Testing Methodologies.
CO 2	Describe The Domain Testing and Knowledge Summarize Domain Errors And Strategy
CO 3	Illustrate Verification and Validation. Use Various Levels of Testing. Demonstrate Testing Approaches.
CO 4	Sketch Out Test Model. Interpret The Defect Management. Discuss About Acceptance Testing And Special Test.
CO 5	Organize Performance Testing Tools, Management Testing Tools and Open Source Testing Tools.

Mapping of Course Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	2	3	3	2	3	2	2	2	1	-
CO2	3	3	3	2	3	3	2	3	2	2	1
CO3	2	2	3	2	3	2	3	2	2	2	2
CO4	2	3	3	2	3	3	2	2	2	-	1
CO5	3	2	2	3	3	2	2	2	2	2	-

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW -: NO CORRELATION

Sl.No.	CONTENTS OF MODULE	Hrs.	COs.
1	**MODULE I:** Introduction: Purpose – Productivity and Quality in Software – Testing Vs Debugging Model for Testing – Bugs – Types of Bugs – Software Testing Development Life- cycle. Requirement Traceability matrix-Work Bench. Principles of software testing, Salient features of Good Testing-Challenges in Testing-Software Testing Methodologies.	**12**	CO1
2	**MODULE II:** Domain Testing: Domain Knowledge – Skills Required for Domain Testing – Domain Errors – Domain Testing Strategy – Domain Testing Example	**12**	CO2
3	**MODULE III:** Software Testing Process-Verification and Validation-Levels of Testing-Testing Approaches-Types of Testing-Test Plan.	**12**	CO3
4	**MODULE IV:** Test Model- Defect Management-Levels of Testing-Acceptance Testing-Special Tests-Test Planning.	**12**	CO4
5	**MODULE V:** Software Testing Tools Overview- Selenium-Test Engine-Selenium Reports- Selenium Scripts- Performance Testing Tools-Load Runner Tool. Testing Management ToolsTest Director-GUI Testing-Silk Test- Open Source Testing Tool-Jmeter.	**12**	CO5

TEXT BOOKS:

1.B. Beizer (2002), *Software Testing Techniques*, Second Edition, DreamTechIndia, New Delhi.(Module 1 and 2)

2.K.V.K.K. Prasad (2024). *Software Testing Tools*, DreamTech. , India, NewDelhi.(Module 3,4 and 5)

REFERENCE BOOKS:

1.Dorothy Graham, Rex Black (2020), Foundations of Software Testing, 4th Edition, ISTQB Certification.

2. Paul C. Jorgensen and Byron DeVries(2021), Software Testing: A Craftsman's Approach, Fifth Edition

E-REFERENCES:

1.http://awards.istqb.org/award-winner/boris-beizer.html

2.http://www.testingreferences.com/testinghistory.php

3.http://www.swquality.com/users/pustaver/Books/books.htm

4.http://www.bullseye.com/coverage.html

5.https://www.tutorialspoint.com/software_testing/

6.https://lecturenotes.in/subject/129/software-testing-st

MULTI-DISCIPLINARY ELECTIVE –MDE I(A)

Course Title: BIOINFORMATICS DATABASES

Course Code :	**Credits : 03**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Understand bioinformatics and its relation to data science.
- Apply data science techniques to analyze biological data.
- Use bioinformatics tools for data analysis and visualization.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Upon successful completion of the course, students will be able to:
CO2	Analyze biological data using data science techniques (cleaning, visualizing, and interpreting).
CO3	Use machine learning for genomic data analysis (classification, clustering).
CO4	Work with bioinformatics databases and tools to analyze DNA, RNA, and protein data.
CO5	Use sequence alignment and assembly methods to study genomes.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	3	2	2	3	2	1	2	3	2
CO2	3	3	2	2	3	2	2	2	2	2
CO3	2	3	1	3	2	2	2	3	3	2
CO4	2	3	3	3	3	2	2	2	2	2
CO5	2	3	3	3	3	1	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction to Bioinformatics and Data Science-What is bioinformatics? How it connects to data science. Biological data: DNA, RNA, and proteins. Cleaning and organizing biological data. Introduction to key biological databases (GenBank, UniProt, PDB). Basic statistical analysis for biological data (e.g., hypothesis testing, p-values).	**12**	CO1
2	**MODULE II**:Machine Learning and Data Mining in Bioinformatics-Introduction to machine learning for bioinformatics. Supervised learning: Classification techniques (e.g., SVM, Random Forest). Unsupervised learning: Clustering methods (e.g., K-means). Reducing data complexity (e.g., PCA). Finding patterns in biological data.	**12**	CO2
3	**MODULE III**: Sequence Analysis and Genome Informatics-Sequence alignment: BLAST, FASTA. Multiple sequence alignment: ClustalW, MAFFT. Genomewide studies for diseases (GWAS). Gene annotation using bioinformatics tools.	**12**	CO3
4	**MODULE IV**: Structural Bioinformatics and Applications-Protein structures: primary, secondary, tertiary. Understanding protein folding and molecular docking. Visualizing protein structures (e.g., PyMOL, Chimera).Using bioinformatics for drug discovery and biological research.	**12**	CO4
5	**MODULE V:** Functional Genomics and Multi-Omics Analysis-Gene expression analysis using RNA-seq and microarrays. Analyzing genes and pathways (Gene Ontology). Combining genomics, transcriptomics, and proteomics data. Using bioinformatics tools like Galaxy and Bioconductor	**12**	CO5

TEXT BOOKS:

1. Pevzner, P. A. (2014). Bioinformatics: Algorithms and Applications (2nd ed.). Springer.
2. Lesk, A. M. (2019). Introduction to Bioinformatics (5th ed.). Oxford University Press.
3. Xia, Y., & Li, Y. (2015). Bioinformatics: A Machine Learning Approach. Springer.

REFERENCES BOOKS:

1. Mount, D. W. (2004). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press.

2.Baxevanis, A. D., & Ouellette, B. F. F. (2005). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (2nd ed.). Wiley-Liss.

E-REFERENCES:

1. https://r.search.yahoo.com/_ylt=AwrPrCJ5m1JoEwIA.au7HAx.;_ylu=Y29sbwNzZzMEcG9zAzEEdnRpZAMEc2VjA3Ny/RV=2/RE=1751453818/RO=10/RU=https%3a%2f%2fmicrobenotes.com%2fbioinformatics-databases-software-tools%2f/RK=2/RS=uotTUjKkg0TYrp8LJ0QNZFjRB0Q-

2. https://r.search.yahoo.com/_ylt=AwrPrCJ5m1JoEwIABqy7HAx.;_ylu=Y29sbwNzZzMEcG9zAzMEdnRpZAMEc2VjA3Ny/RV=2/RE=1751453818/RO=10/RU=https%3a%2f%2fbiologynotesonline.com%2fdatabases-in-bioinformatics-types-functions-examples-tools%2f/RK=2/RS=2kM6GngoSqhSr9ClTfHwuTLVbtY-

MULTI-DISCIPLINARY ELECTIVE –MDE I(B)

Course Title: BIOINFORMATICS SEQUENCE ANALYSIS

Course Code :	**Credits : 03**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To provide a comprehensive introduction to bioinformatics and its relevance in sequence analysis, focusing on biological data storage, retrieval, and sequence comparison.
- To enable students to perform sequence alignment (both pairwise and multiple), construct phylogenetic trees, and understand the different tools and algorithms used for sequence analysis.
- To explore various approaches for interpreting genomic data, including gene prediction, motif identification, and functional annotation of sequences.
- To understand and apply sequence analysis techniques in practical scenarios like drug discovery, personalized medicine, and genome-wide association studies (GWAS).
- To train students to work with biological databases (e.g., NCBI, EMBL) and computational tools (e.g., BLAST, ClustalW) for sequence retrieval, alignment, and analysis.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Apply Bioinformatics Tools for Sequence Analysis Use bioinformatics software and tools to analyze biological sequences, including alignment and phylogenetic tree construction.
CO2	Perform Sequence Alignments Perform pairwise and multiple sequence alignment using popular algorithms (Needleman-Wunsch, Smith-Waterman, ClustalW) and understand their applications.
CO3	Interpret Genomic Data Analyze genomic data for gene prediction, annotation, and identification of functional elements in DNA/RNA sequences.
CO4	Identify Genetic Variations and Motifs Conduct motif searches and understand genetic variations such as SNPs (Single Nucleotide Polymorphisms) and their role in diseases.
CO5	Apply Sequence Analysis in Real-World Scenarios Utilize sequence analysis techniques in practical bioinformatics applications such as drug design, evolutionary studies, and personalized medicine.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	2	3	2	1	2	3	2
CO2	3	3	2	2	3	2	2	2	2	2
CO3	2	3	1	3	2	2	2	3	3	2
CO4	2	3	3	3	3	2	2	2	2	2
CO5	2	3	3	3	3	1	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I: Introduction to Bioinformatics and Sequence Data** Overview of Bioinformatics-Types of Biological Data: DNA, RNA, and Protein SequencesBiological Databases: NCBI, EMBL, DDBJ-Sequence Formats (FASTA, GenBank, GFF)-Sequence Retrieval Tools (BLAST, BLAT, FASTA)	**12**	CO1
2	**MODULE II: Sequence Alignment-**Introduction to Sequence Alignment-Pairwise Sequence Alignment -Global Alignment: Needleman-Wunsch Algorithm-Local Alignment: Smith-Waterman Algorithm-Scoring Matrices: PAM, BLOSUM-Multiple Sequence Alignment (MSA) : Algorithms: ClustalW, MUSCLE, T-CoffeePhylogenetic Tree Construction from Sequence Data	**12**	CO2
3	**MODULE III: Genomic Sequence Analysis-**Gene Prediction Techniques-Genome Assembly and Annotation-Motif Search: Identifying Functional Domains-Sequence Search and Comparison Tools: BLASTP, BLASTN-Tools for Gene Prediction: GENSCAN, AUGUSTUS	**12**	CO3
4	**MODULE IV: Protein Sequence Analysis-**Protein Sequences and Structure-Function Relationship-Sequence Alignment for Protein Data (BLASTP)-Secondary Structure Prediction-Homology Modeling and 3D Structure Prediction-Tools for Protein Analysis: InterPro, Pfam, PROSITE	**12**	CO4
5	**MODULE V: Advanced Sequence Analysis Techniques and Applications** Genomic Data Interpretation: SNPs and Mutations-Applications of Sequence Analysis in Drug Discovery-Sequence Analysis for Personalized Medicine-Metagenomic Sequence Analysis-Case Studies: Cancer Genome Analysis, GWAS	**12**	CO5

TEXT BOOKS:

1. Arthur M. Lesk**,** "Introduction to Bioinformatics," Oxford University Press, 2019.

2. T. K. Attwood, D. J. Parry-Smith**,** "Introduction to Bioinformatics," Pearson Education, 2018.
3. David W. Mount**,** "Bioinformatics: Sequence and Genome Analysis," Cold Spring Harbor Laboratory Press, 2004.

REFERENCE BOOKS:

1. S. C. Rastogi, N. Mendiratta, P. Rastogi, "Bioinformatics: Methods and Applications," Prentice Hall, 2004.
2. Nicolas R. Smale**,** "Bioinformatics for Dummies," Wiley, 2013.
3. J. M. Keith**,** "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins," Wiley-Interscience, 2004.

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1. https://r.search.yahoo.com/_ylt=Awr1SanpmlJoEAIAaUa7HAx.;_ylu=Y29sbwNzZzMEcG9zAzUEdnRpZAMEc2VjA3Ny/RV=2/RE=1751453673/RO=10/RU=https%3a%2f%2fomicstutorials.com%2fbioinformatics-tools-for-sequence-analysis%2f/RK=2/RS=MInrQe6Iv8uQFuaw7DoaX7WcqjM-

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MULTI-DISCIPLINARY ELECTIVE –MDE I(C)
Course Title: BIOETHICS AND BIODIVERSITY

Course Code :	**Credits : 03**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Understand bioethics principles and their relevance to data science applications in healthcare and biotechnology.
- Learn about biodiversity and its conservation using data-driven approaches.
- Explore ethical issues in AI, big data, and genomics.
- Analyze biodiversity datasets to study environmental changes and species conservation.
- Examine case studies involving bioethics and biodiversity from a data science perspective.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain key bioethical concepts and their role in data-driven biological research.
CO2	Discuss ethical challenges in AI, machine learning, and big data applications in healthcare and genetics.
CO3	Analyze biodiversity trends using data science tools and techniques.
CO4	Evaluate policies and regulations related to biodiversity and bioethics in the digital era.
CO5	Apply data-driven methods to address ethical and conservation challenges.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	3	2	2	3	2	1	2	3	2
CO2	3	3	2	2	3	2	2	2	2	2
CO3	2	3	1	3	2	2	2	3	3	2
CO4	2	3	3	3	3	2	2	2	2	2
CO5	2	3	3	3	3	1	2	3	3	3

CORRELATION:3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I:** Introduction to Bioethics and Data Science-Fundamentals of bioethics and its importance in data science -Ethical considerations in AI, big data, and genomics-Case studies: Privacy concerns in genetic databases (e.g., 23and Me, Human Genome Project)-Ethical challenges in medical AI and personalized medicine.	**12**	CO1
2	**MODULE II:** Ethical Issues in AI and Biotechnology-Machine learning biases in healthcare data-Data privacy, security, and informed consent in bioinformaticsGenetic engineering (CRISPR) and its ethical implications-Ethical AI in drug discovery and medical research-Role of regulatory frameworks (GDPR, HIPAA, UNESCO guidelines)	**12**	CO2
3	**MODULE III:** Biodiversity and Data Science Applications-Introduction to biodiversity and its importance-Data-driven biodiversity monitoring (e.g., remote sensing, species tracking)-AI and machine learning for species identification and conservation-Using big data to analyze biodiversity loss and climate change impacts	**12**	CO3
4	**MODULE IV:** Biodiversity Laws, Policies, and Data Governance-International conventions on biodiversity (CBD, Nagoya Protocol)-Environmental data regulations and governance-Ethical data collection and sharing in biodiversity research-Citizen science and crowdsourced biodiversity data.	**12**	CO4
5	**MODULE V:** Case Studies and Future Trends-Case studies: AI for wildlife conservation, data-driven deforestation monitoring-The role of deep learning in species classification and ecosystem Management-Ethical dilemmas in biodiversity data Ownership-Emerging trends: AI-driven biodiversity forecasting, blockchain for bioethics.	**12**	CO5

TEXT BOOKS:

1. Dignum, V. (2019). Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way. Springer.
2. Sutherland, W.J., Freckleton, R.P., & Godfray, H.C.J. (2013). Biodiversity: Science and Solutions for the Future. Cambridge University Press.

REFERENCES BOOKS:

1. Russell, S., & Norvig, P**.** (2020). Artificial Intelligence*: A Modern Approach*, Pearson.
2. CBD Secretariat. (2000). Global Biodiversity Outlook. UNEP.

E-REFERENCES:

1. https://nabt.org/Resource-Links-Bioethics
2. https://www.dupont.com/position-statements/bioethics-and-biodiversity.html

SIXTH SEMESTER

CORE X

Course Title: ARITIFICIAL INTELLIGENCE

Course Code :	**Credits : 4**
L:T:P:S : 4:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Understand the fundamentals of Artificial intelligence principles
- Develop dynamic and responsive AI techniques for real time applications.
- To access the applicability, strengths and weakness of the AI
- Integrate Real time applications to AI and learning methods in solving real world complexities.
- Apply problem solving, knowledge base representations in applications.
- To develop intelligent systems by assembling solutions to concrete computational problems.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Evaluate Artificial Intelligence(AI) methods and describe their foundations.
CO2	Analyse and illustrate how search algorithm play vital role in problem solving.
CO3	Demonstrate knowledge of reasoning and knowledge representation of solving real world problems.
CO4	Having analytical ability to apply learning techniques in solving real time complexities
CO5	To Illustrate the concept of NLP and expert system.

Mapping of Course Outcomes Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3	3	3	2	2	3	2
CO2	3	3	3	2	3	2	3	3	2	3	2
CO3	2	3	3	3	3	2	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3	3	3	2
CO5	2	3	3	3	3	3	2	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction to AI-The foundations of AI-The history of AI Applications of AI-Intelligent Agents: Agents & environments -Good behaviour-The Nature of environments-The structure of agents.	15	CO1
2	**MODULE II**: Learning systems -Forms of Learning types -Supervised-Unsupervised-Reinforcement learning - Learning decision system.	15	CO2
3	**MODULE III**: Problem solving by Search-Well defined problem and Solutions Real world Problems-Problem space- Heuristic functions-Local search algorithm an optimization problem-Knowledge based systems-Logical system-Constraint satisfaction problem-Syntax and semantics of First order logic functions	15	CO3
4.	**MODULE IV:** NLP Natural Language Processing- Introduction to NLP and its Importance - Text Processing – Tokenization – Stemming –Lemmatization Stopword Removal	15	CO4
5.	**MODULE V:** Stages in the development of expert system - Probability of expert system-probability expert system tools - Difficulties in developing expert system - Applications of expert systems.	15	CO5

TEXT BOOKS:

1. Poole, D, and Mackworth, A. T Artificial Intelligence: Foundations of Computational Agents, Third Edition, 2023 Cambridge University.
2. Russell, S. and Norvig, Artificial Intelligence: A Modern Approach fourth Edition 2020

REFERENCE BOOKS:

1. Rich, E., Knight K and Shankar, B. Artificial Intelligence, 3rd edition, Tata Mc Graw Hill.
2. Luger, G.F. Artificial Intelligence-Structures and Strategies for complex Problem Solving 6th edition, Pearson.

E-REFERENCES:

1. https://www.guvi.in/blog/best-websites-to-learn-generative-ai/
2. https://microsoft.github.io/AI-For-Beginners/
3. https://www.edx.org/learn/artificial-intelligence

CORE XI

Course Title: INTRODUCTION TO DATA SCIENCE

Course Code :	**Credits : 4**
L:T:P:S : 4:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To study the basics of data science.
- To study the process of data analysis
- To study the Hadoop framework.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Review the fundamental concepts of data science Understand the data science process
CO2	Learn different research goals Understand the concept of data analysis
CO3	Evaluate the techniques for modelling process Analyze machine learning algorithms.
CO4	Learn the Hadoop framework Learn the NOSQL concepts
CO5	Explore research goals Case study – prediction of disease.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	3	2	3	2	3	3	3	2	2
CO3	2	3	3	3	3	2	2	3	3	2	2
CO4	3	3	3	3	3	2	2	2	3	2	3
CO5	2	3	3	3	3	3	3	3	3	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	**Contents of Module**	**Hrs**	**COs**

1	**MODULE I**:Introduction to Data Science – Benefits and uses – Facets of data – Data science process – Big data Ecosystem and data science	**15**	CO1
2	**MODULE II:** The Data science process – Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building	**15**	CO2
3	**MODULE III:** Algorithms - Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised -Semi-supervised	**15**	CO3
4	**MODULE IV:** Introduction to Hadoop – framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE –types	**15**	CO4
5	**MODULE V:** Case Study – Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration -Disease profiling presentation and automation	**15**	CO5

TEXT BOOKS:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications 2016.

REFERENCE BOOKS:

1. Roger Peng, "The Art of Data Science", lulu.com 2016.
2. MurtazaHaider, "Getting Started with Data Science – Making Sense of Data with Analytics", IBM press, E-book.
3. Davy Cielen, Arno D.B. Meysman, Mohamed Ali,"Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press 2016.
4. Lillian Pierson, "Data Science for Dummies", 2017, 2nd Edition.

E-REFERENCES:

1.NPTEL online course– Data Science for Engineers - https://nptel.ac.in/courses/106106179

CORE XII
Course Title: FOUNDATIONAL MACHINE LEARNING

Course Code :	**Credits : 4**
L:T:P:S : 4:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To understand basic concepts of machine learning
- Understand how to evaluate models generated from data
- Discover how to build machine learning algorithms, prepare data, and use different techniques using Python

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Implement different machine learning algorithm techniques.
CO2	Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems.
CO5	Compose the association rules to find the patterns

Mapping of Course Outcomes, Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	3	2	3	3	3	3	3	3	2	2
CO2	3	3	3	2	2	3	3	3	2	3	3
CO3	3	3	2	3	3	3	3	3	2	2	3
CO4	3	2	2	3	3	3	3	2	2	3	3
CO5	3	2	2	3	3	3	2	3	3	3	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	**CONTENTS OF MODULE**	**Hrs**	**COs**

1	**MODULE I: Introduction:** Machine Learning Foundations – Overview – Design of a Learning System – Types of Machine Learning – Supervised Learning and Unsupervised Learning – Applications of Machine Learning – Overview of ML Tools.	**15**	CO1
2	**MODULE II: Supervised Learning – I:** Simple Linear Regression – Multiple Linear Regression – Polynomial Regression – Ridge Regression – Lasso Regression – Evaluating Regression Models – Model Selection – Bagging – Ensemble Methods.	**15**	CO2
3	**MODULE III: Supervised Learning – II:** Classification – Logistic Regression – Decision Tree Regression and Classification – Random Forest Regression and Classification – Support Vector Machine Regression and Classification - Evaluating Classification Models.	**15**	CO2
4	**MODULE IV: Unsupervised Learning:** Clustering – K-Means Clustering – Density-Based Clustering – Dimensionality Reduction – Collaborative Filtering.	**15**	CO3
5	**MODULE V: Association Rule Learning :** Association Rule Learning – Concepts related to ARL – ARL Algorithms - Apriori – Eclat – Concepts and Algorithms	**15**	CO4

TEXT BOOKS:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Machine Learning For Absolute Beginners: A Plain English Introduction Third Edition =Oliver Theobald

REFERENCE BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
2. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
3. Sebastian Raschka, Vahid Mirjilili,” Python Machine Learning and deep learning”, 2nd edition, kindle book, 2018
4. Carol Quadros,” Machine Learning with python, scikit-learn and Tensorflow”, Packet Publishing, 2018
5. Gavin Hackeling,” Machine Learning with scikit-learn”, Packet publishing, O'Reilly, 2018

E- REFERENCES:

1. https://www.tensorflow.org/resources/learn-ml

CORE PRACTICAL VII
Course Title: FOUNDATIONAL MACHINE LEARNING LAB

Course Code :	**Credits : 2**
L:T:P:S: 0:1:3:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 50**

LEARNING OBJECTIVES:

- Understand the mathematical and statistical perspectives of machine learning algorithms through python programming.
- Understand the basic concepts of deep neural network models and design the same.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Use basic and advanced Linux commands.
CO2	Write shell scripts for automation.
CO3	Use Git for version control and collaboration.
CO4	Utilize open-source IDEs and package managers.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2	2	3	2	2	2	2
CO2	3	3	2	2	3	2	3	2	2	2	2
CO3	3	3	2	3	3	2	3	3	2	2	2
CO4	3	3	2	3	3	2	3	3	2	2	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

LAB EXERCISE

1. Write a program to implement the Simple and Multiple Linear Regression
2. Write a program to implement the Polynomial Regression
3. Write a program to implement the Bagging Technique
4. Write a program to implement the Adaboost Methods
5. Write a program to implement Logistic Regression algorithm
6. Write a program to demonstrate the workflow of Decision Tree Classification
7. Write a program to implement the Random Forest Classification

8. Write a program to implement the SVM Classification
9. Write a program to perform the K Means Clustering
10. Write a program to perform the Density based Clustering
11. Write a program to implement the Apriori algorithm for market basket analysis
12. Write a program to compare the Supervised Machine Learning algorithms.

TEXT BOOKS:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Machine Learning For Absolute Beginners: A Plain English Introduction Third Edition =Oliver Theobald

REFERENCE BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
2. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
3. Sebastian Raschka, Vahid Mirjilili,” Python Machine Learning and deep learning”, 2nd edition, kindle book, 2018
4. Carol Quadros,” Machine Learning with python, scikit-learn and Tensorflow”, Packet Publishing, 2018
5. Gavin Hackeling,” Machine Learning with scikit-learn”, Packet publishing, O'Reilly, 2018

E- REFERENCES:

1. https://www.tensorflow.org/resources/learn-ml

DISCIPLINE SPECIFIC ELECTIVE IV(A)
Course Title: MONGODB WITH NoSQL

Course Code :	**Credits : 3**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks :** 100

LEARNING OBJECTIVES:

- To introduce students to NoSQL concepts and their differences from traditional RDBMS.
- To enable hands-on experience with MongoDB for data modeling and CRUD operations.
- To Develop skills to design scalable and high-performance database solutions using MongoDB.
- To understand advanced features of MongoDB like aggregation, indexing, and replication.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the characteristics and benefits of NoSQL databases over traditional RDBMS
CO2	Demonstrate basic operations like CRUD, indexing, and queries in MongoDB
CO3	Design NoSQL schemas using MongoDB's flexible document model.
CO4	Use aggregation framework for data processing and analytics in MongoDB
CO5	Develop and deploy simple MongoDB-based applications with real-world datasets

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	-	-	3	3	3	3	3
CO2	3	3	-	-	3	3	3	2	3	3
CO3	3	3	3	-	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	2	3

CORRELATION: 3-STRONG 2 MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I:** Introduction to NoSQL and MongoDB Evolution of Databases-SQL vs. NoSQL: Key Differences-Types of NoSQL databases (Document, Key-Value, Column, Graph)Introduction to MongoDB: Features and Use Cases - MongoDB Architecture	12	CO1
2	**MODULE II:** CRUD Operations in MongoDB Creating and Inserting Documents Reading Documents with Queries-Updating and Deleting Documents-Data Types and BSON	12	CO2
3	**MODULE III:** Data Modeling and Schema Design Schema-less Nature of MongoDB- module Embedding vs Referencing-Designing for Read/Write Optimization-Case Studies	12	CO3
4	**MODULE IV:** Indexing and Aggregation Framework Types of Indexes: Single field, Compound, Text, Geospatial-Aggregation Pipeline Basics-Operators: $match, $group, $sort, $project, $lookup	12	CO4
5	**MODULE V:** Advanced Concepts & Integration Data Replication and Sharing (Overview)-Backup & Restore-MongoDB Security Essentials- Integrating MongoDB with Node.js or Python	12	CO5

TEXT BOOKS

1. MongoDB: The Definitive Guide by Kristina Chodorow 3rd Edition (or latest available), O'Reilly Media
2. Mastering MongoDB 6.x: Expert techniques to run high-volume and fault-tolerant database solutions using MongoDB 6 by Alex Giamas 3rd Edition (2023), Packt Publishing
3. MongoDB basics: Peter Membrey, Eelco Plugge, and David Hows, 2nd Edition, Apress publications

REFERENCE BOOKS

1. MongoDB Applied Design Patterns by Rick Copeland, O'Reilly Media publications,1st edition
2. MongoDB Performance Tuning by Guy Harrison, Addison-Wesley Professional publications,1st Edition
3. Data Modelling for MongoDB: Steve Hoberman, 1st edition, Technics Publications.

E- REFERENCES

1. MongoDB University Courses (free online)
2. MongoDB Documentation: https://docs.mongodb.com

DISCIPLINE SPECIFIC ELECTIVE IV(B)
Course Title: POSTGRESQL

Course Code :	**Credits : 3**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Demonstrate knowledge of Database terminology and how applied using SQL.
- Develop a PostGre SQL based on problem description
- Develop an Event Planning Chart based on problem description based on specific events
- Develop an Algorithm to verify processing is accurate
- Develop and debug applications using Postgre SQLthat runs under any operating system

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To understand database concepts of Postgre SQL.
CO2	To develop Programming Paradigms using program coding and control structures.
CO3	To Demonstrate of Schema design and Normalization using of stored procedures.
CO4	To Create Tables, Attributes, Implementing Subqueries and Usage of Grid Control report.
CO5	To Implement of Error Handling and importance of OLE.

Mapping of Course Outcomes Program Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	3	3	3	3	3	3	2	2	3	2
CO2	3	3	3	2	3	2	3	3	2	3	2
CO3	2	3	3	3	3	2	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3	3	3	2
CO5	2	3	3	3	3	3	2	2	3	3	3

CORRELATION: 3-STRONG 2 MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Introduction to SQL - datatypes - CRUD operations (INSERT, SELECT, UPDATE, DELETE)- Constraints (Primary key, Foreign key) - Not Null - Unique - Check- Indexes.	12	CO1
2	**MODULE II**: Advanced SQL-Joins-Subqueries-Window functions Aggregate Functions- Set operations (Union, Interset, Except)JSON & JSONB Handling	12	CO2
3	**MODULE III**: Core concepts - Installations and setups - psql commandline tool-Database creation & Management-Schema & Tables	12	CO3
4.	**MODULE IV**: Database design-Normalization/De-normalization ER diagram-Relationships (1:1, 1:N, ,N:N) PL/PG SQL - Functions and Stored procedures – Triggers - Custom datatypes - Error handling -Transactions.	12	CO4
5.	**MODULE V**: Security & Access Control - Roles & permissions GRANT, REVOKE - SSL Setup - Row level security.	12	CO5

TEXT BOOKS:

1. "PostgreSQL Up and Running" by Regina O.Obe abd Leo Hsu 3rd Edition.
2. "Learn PostgreSQL " by Luca Ferrari, Enrico Pirozzi , 2nd edition

REFERENCE BOOKS:

1. "Cover of Beginning databases with PostgreSQL", 2nd edition 2025by Neil Mathew.
2. "PostgreSQL 16 administration " by Gianni Ciolli, Borris mejiies, published in December 2023.

E-REFERENCES:

1. https://www.postgresql.org/docs/current/index.html
2. https://www.postgresql.org/docs/current/biblio.html
3. https://www.postgresql.org/

DISCIPLINE SPECIFIC ELECTIVE IV(C)
Course Title: MARIADB

Course Code :	**Credits : 03**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Mastering Database Transactions and Isolation Levels
- Implementing Replication and High Availability Solutions
- Optimizing Performance and Query Execution

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understanding Database Fundamentals and MariaDB Setup Mastering Basic SQL Queries and Operations in MariaDB
CO2	Mastering Advanced SQL Operations and Query Optimization Understanding and Managing Indexes, Keys, Views, and Stored Procedures
CO3	Understanding Transactions, Replication, and High Availability Performance Optimization and Query Tuning
CO4	Securing MariaDB and Implementing Data Security Database Backup, Restore, and Data Migration
CO5	Use Managed Cloud Services for MariaDB Design and Implement a Complete Database System Using MariaDB

Mapping of Course Outcomes Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	2	2	3	3	3	3	2
CO2	3	3	2	3	3	2	2	2	3	2	2
CO3	3	3	2	3	3	3	3	3	3	2	2
CO4	3	3	2	3	3	3	3	3	3	2	3
CO5	3	3	2	3	3	3	3	3	3	3	2

CORRELATION: 3-STRONG 2 MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I** : Introduction to Databases: Overview of Databases-What is a database-Types of databases: Relational, NoSQL, In-memory, Database management systems (DBMS)-Introduction to SQL and MariaDB Installing MariaDB-Setting up MariaDB on various platforms.	**12**	CO1
2	**MODULE II:** Advanced SQL in MariaDB: Subqueries and Nested QueriesSubqueries in SELECT, INSERT, UPDATE, DELETE-Correlated subqueries-Set Operations-UNION, INTERSECT, EXCEPT-Indexes and Keys-Creating and managing indexes-Primary and foreign keysUnique indexes and full-text indexes	**12**	CO2
3	**MODULE III:** MariaDB Advanced Features: Transactions and Isolation Levels-What are transactions and why they are important-ACID propertiesIsolation levels in MariaDB: READ COMMITTED, REPEATABLE READ, SERIALIZABLE-Using COMMIT, ROLLBACK, and SAVEPOINT	**12**	CO3
4	**MODULE IV:** Security in MariaDB: User Management-Creating and managing users and roles-Granting and revoking permissions-Database encryption-Backup and Restore-Backup strategies: Logical backups, physical backups-Using mysqldump.	**12**	CO4
5	**MODULE V:**MariaDB in the Cloud: MariaDB in the Cloud EnvironmentMariaDB on cloud services (AWS, Google Cloud, Azure)-Managed MariaDB services: Amazon RDS, Google Cloud SQL-Using MariaDB with Docker and Kubernetes- Project Work and Real-World Applications – Sample Projects	**12**	CO5

TEXT BOOKS:

1. MariaDB: Introduction and administrator by Daniel Batholomew- 2nd edition, Open source, PACKT Publisher
2. MariaDB Essential by Emilien Kenler and Federico Razzoli, Open Source, PACKT Publisher
3. Building a web application with PHP and MariaDB: A Reference guide by Sai Srinivasan,2nd edition, PACKT Publisher

REFERENCE BOOKS:

1. Learning a MySQL and MariaDB: Heading the right direction with MySql and MariaDB By Rassell J.T.Dyer , 2nd edition ,O'Reilly Media Publisher
2. Sql for Mysql Developer by David S.Linthican, 5th edition , PEARSON Publication
3. Learning Mysql and MariaDB ,2nd Edition, PEARSON Publication

E-REFERENCES:

1.https://mariadb.com/kb/en/documentation/
2. https:// mariadb.com/kb/en/database-links/
3. https:// mariadb.com/kb/docs/server/sql

DISCIPLINE SPECIFIC ELECTIVE V(A)
Course Title: BLOCK CHAIN TECHNOLOGY

Course Code :	**Credits : 3**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To understand the evolution and nature of digital and physical money.
- To explain blockchain principles, architecture, and its business relevance.
- To analyze decentralization and how blockchain enables it.
- To study Bitcoin technology and related innovations.
- To explore blockchain applications including smart contracts and industry use-cases.

CO1	Understand the evolution of money and digital currencies.
CO2	Describe the architecture and functionality of blockchain technology.
CO3	Analyse the methods and platforms of decentralization through blockchain.
CO4	Examine the Bitcoin ecosystem and evaluate its technical elements.
CO5	Apply blockchain concepts to real-world use cases and smart contracts.

Mapping of Course Outcomes Program Outcomes to Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	2	2	3	2	2	1	1
CO2	3	3	2	3	3	2	3	3	2	2	2
CO3	3	3	2	3	3	3	3	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	3	3	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs

1	**MODULE I**: Money- Physical and Digital Money, How do we define money, History, Gold Standards, Fiat Currency and Intrinsic Value, Legal Tender, Currency Pegs, Quantitative Easing, How Are Interbank Payments Made?, E-Money Wallets, Cryptocurrencies, Digital Tokens	12	CO1
2	**MODULE II:** Introduction to Blockchain Technology - Growth, Distributed Systems, History, Types, Consensus, CAP theorem, How Blockchain Works, "What Makes a Blockchain Suitable for Business?", Propelling Business with Blockchains, Recognizing Types of Market Friction, Moving Closer to Friction-Free Business Networks, What Are Blockchains Good For?, Initial Coin Offerings, Investing	12	CO2
3	**MODULE III:** Decentralization using Blockchain, Methods of Decentralization, Routes to Decentralization, Blockchain and full ecosystem decentralization, Decentralized Organizations, Platforms for decentralization	12	CO3
4	**MODULE IV:** Introducing Bitcoin – Bitcoin, Digital keys and addresses, Transactions, Blockchain, Mining, The bitcoin network, wallets, payments, innovation, installation	12	CO4
5	**MODULE V:** Blockchain in Action: Use Cases, Smart Contracts, Hyperledger, blockchain in healthcare, supply chain, IoT, and finance.	12	CO5

TEXT BOOKS:

1. Antony Lewis, The Basics of Bitcoins and Blockchains, Published by Mango Publishing Group, a division of Mango Media Inc., 2018
2. Mastering Blockchain, Second Edition, Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir, Packt Publishing, 2018
3. Dr. Ravindhar Vadapallin, BLOCKCHAIN FUNDAMENTALS TEXT BOOK, Research Gate
4. Daniel Drescher, Blockchain basics a non-technical introduction in 25 steps, Apress publications, 2017

REFERENCE BOOKS:

1. Koshik Raj, Foundations of Blockchain: The pathway to cryptocurrencies and decentralized blockchain applications Paperback – 1 January 2019, Ingram Publishers
2. Bellaj Badr , Richard Horrocks , Xun (Brian) Wu, Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger Paperback – 30 November 2018, Packt Publishing Limited
3. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015

E-REFERENCES:

1. https://blockchainhub.net

2. https://blog.todotnet.com/2019/03/solving-real-world-problems-with-distributed-ledgerhttps://blog.todotnet.com/2019/03/solving-real-world-problems-with-distributed-ledger-technology/technology/
3. https://www.velmie.com/
4. https://www.udemy.com/course/build-your-blockchain-az/

DISCIPLINE SPECIFIC ELECTIVE V(B)
Course Title: DESIGN PRINCIPLES OF INTERNET OF THINGS(IoT)

Course Code :	**Credits : 3**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- Understanding of the Internet of Things (IoT), focusing on the core concepts, architectural frameworks, communication technologies.
- Understanding the design principles necessary for building connected devices and systems
- Implementing IoT systems that integrate seamlessly into enterprise and real-world applications.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the basic concepts of IoT, including its framework, architecture, and enabling technologies. Identify real-world applications and examples of Internet of Things (IoT) and Machine to-Machine (M2M) communication.
CO2	Analyze and apply design principles and standardization techniques IoT/M2M systems and communication technologies.
CO3	Evaluate web and message communication protocols Apply them to connect devices through gateways.
CO4	Demonstrate understanding of IP-based communication, addressing, Understanding application layer protocols is essential for IoT systems.
CO5	Acquire, organize, and analyze IoT data using analytics tools, understand integration with enterprise systems for knowledge management.

Mapping of Course Outcomes to Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	2	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3
CO3	3	2	3	2	3	2	3	3	2	3	3
CO4	3	3	2	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	2	1	2	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Internet of Things: An Overview: Internet of things-IoT conceptual framework-IoT Architectural View-Technology Behind IoT-Sources of IoT-M2M Communication -Examples of IoT.	12	CO1
2	**MODULE II:** Design Principles for Connected Devices: Introduction IoT/M2M System layer Design and Standardisation- communication Technology.	12	CO2
3	**MODULE III:** Design Principles for Web Connectivity: Introduction-web communication protocols and connected devices -Message communication protocols and connected devices-Web Connectivity for Connected-Devices Network using Gateway.	12	CO3
4	**MODULE IV:** Internet Connectivity Principles: Internet ConnectivityInternet Based Communication-IP Adress in the IoT-media Access Control -Application layer protocols.	12	CO4
5	**MODULE V:** Data Acquiring, Organising, Processing and Analytics: data Acquiring and storage-Organising the Data -Transactions, Business Processes, Integration and Enterprise System-Analytics-Knowledge Acquiring, managing and storage process.	12	CO5

TEXT BOOKS:

1. Dr.Dr. Raj Kamal, INTERNET OF THINGS Architecture and Design Principles– McGraw Hill Education (India) Private Limited,2nd edition,2022.
2. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
3. Olivier Hersent, David Boswarthick, and Omar Elloumi, ― "The Internet of Things: Key Applications and Protocols", WileyPublications

REFERENCE BOOKS:

1. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

2. Vijay Madisetti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

3. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

E- REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs65/preview
2. https://github.com/connectIOT/iottoolkit

DISCIPLINE SPECIFIC ELECTIVE V(C)
Course Title: PRINCIPLES OF CLOUD COMPUTING

Course Code :	**Credits : 3**
L:T:P:S : 3:1:0:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 100**

LEARNING OBJECTIVES:

- To make students understand the concepts of Cloud.
- To apply the tools and technologies of cloud computing.
- To make the students learn about cloud security.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To learn the basics of cloud To learn the types of cloud
CO2	To learn cloud computing Technologies To learn the architecture of Cloud
CO3	To learn the concepts of virtualization To learn the cloud modelling and Design To learn Grid, Cloud virtualization
CO4	To learn cloud data storage To learn cloud computing services
CO5	To learn various cloud applications To understand Amazon cloud services, Cloud computing services

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	3	3	3	3	2	2	3	2	2	2	1
CO 2	3	3	2	3	2	2	2	3	3	3	2
CO 3	2	3	3	3	3	1	3	2	3	3	2
CO 4	2	3	2	2	3	1	2	3	2	3	2
CO 5	3	3	3	3	3	3	2	2	3	3	3

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

Sl No.	CONTENTS OF MODULE	Hrs	COs
1	**MODULE I**: Cloud Computing Foundation: Introduction to Cloud Computing –pros and Cons of cloud computing- Types of Cloud: Private and Public Cloud– Cloud Infrastructure Working of Cloud Computing : Service models-cloud Deployment model	**12**	CO1
2	**MODULE II:** Cloud Computing Architecture: Cloud Lifecycle model – Cloud Architecture: Cloud Computing Logical Architecture– Cloud Deployment Model –Cloud Modeling and design: Cloud computing Basic Principles-Model for Federated cloud computing-cloud ecosystem Model.	**12**	CO2
3	**MODULE III:** Virtualization: Foundation – Types of Virtualization – The Virtualization Architecture- Virtualization Application – Grid Cloud and Virtualization: virtualization Grid-virtualization in cloud-virtualization in cloud computing: Anatomy of Cloud Infrastructure**.**	**12**	CO3
4	**MODULE IV:** Data Storage and Cloud Computing: Data storage Management - File system-cloud Data Stores Cloud -Data Storage –Cloud Storage: overview cloud Storage–Data management for Storage-Data-intensive Technology for cloud Computing.	**12**	CO4
5	**MODULE V:** Cloud Computing Elements: overview of Amazon Web Services (AWS)-cloud services: cloud types and services -Software as a Service-Platform as a Services-Infrastructure as a Services-other cloud Service-cloud computing Tools-Apache Hadoop.	**12**	CO5

TEXT BOOKS:

1. A.Srinivasan and J.Suresh, "Cloud Computing – A Practical Approach for Learning and Implementation", Pearson India Publications 2014.
2.Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
3. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

REFERENCE BOOKS:

1. Rajkumar Buyya, James Broberg, Andrzej , "Cloud Computing: Principles and Paradigms", Wiley India Publications 2011.

2. Arshdeep Bahga and Vijay Madisetti ,"Cloud Computing – A Hands on Approach", Universities Press (India) Pvt Ltd. 2014.

3. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010

E-REFERENCES:

1. https://nptel.ac.in/courses/106105167/
2. https://www.techtarget.com/searchcloudcomputing/definition/cloud-computing

CORE PROJECT
Course Title: MINI PROJECT

Course Code :	**Credits : 2**
L:T:P:S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03 Hours	**ESE Marks : 50**

LEARNING OBJECTIVES:

- Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum.
- Develop software applications
- Record the research results for a given problem
- Identify, formulate and implement computing solutions.
- Design and conduct experiments, analyze and interpret data.
- Analyze a system, component or process as per needs and specification.
- Work on multidisciplinary tasks and will be aware of the new and emerging disciplines. Demonstrate skills to use modern tools, software and equipment's to analyze problems.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Demonstrate a sound technical knowledge, skills and attitude of their selected project topic.
CO2	Understand problem identification, formulation and solution.
CO3	Design solutions to complex problems utilizing a systems approach.
CO4	Communicate with engineers and the comm Moduley at large in written and oral forms.
CO5	Demonstrate proficiency in using development tools, databases and version control systems for project implementation.

Mapping of Course Outcomes to Program Outcomes to Program Specific Outcomes:

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	2	3	3	2	3	2
CO2	3	2	3	1	2	2	3	3	2	2	2
CO3	3	2	3	2	2	2	3	2	2	2	3
CO4	3	2	3	2	3	2	3	2	2	3	3
CO5	3	3	3	2	2	2	3	3	2	3	3

CORRELATION :3-STRONG 2-MEDIUM 1-LOW

Procedure:

- The Head of the Department will assign an Internal Guide for each student
- As soon as the student gets project, the student should submit the contact details of the organization to their guide.
- During regular intervals, student should report about his/her progress of the project work.
- After the submission of the final report, an external examiner will evaluate the project document and conduct the viva voce examinations.

Appendix A

OUTCOME-BASED EDUCATION (OBE)

Outcome-Based Education (OBE) is a student-centric teaching and learning methodology in which the course delivery, assessments are planned to achieve stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opport Moduleies, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation.

Program Educational Objectives (PEOs)

The Program Educational Objectives of a program are the statements that describe the expected achievements of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after graduation.

Program Outcomes (POs)

Program outcomes are finer statements that designate what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

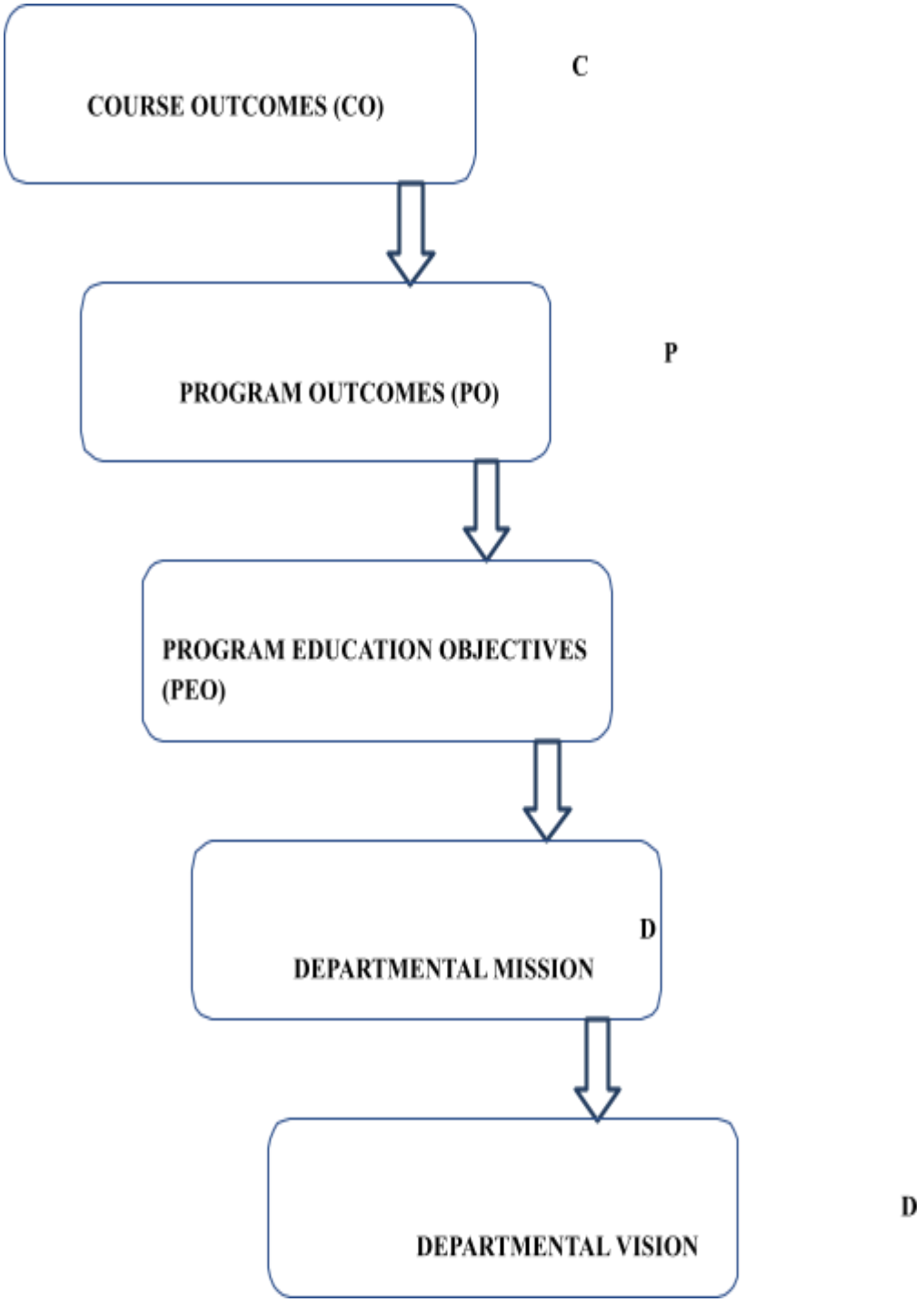
Program Specific Outcomes (PSO)

Program Specific Outcomes are what the students should be able to do at the time of graduation with reference to a specific discipline.

Course Outcome (CO)

Course outcomes are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course.

MAPPING OF OUTCOMES



Appendix B

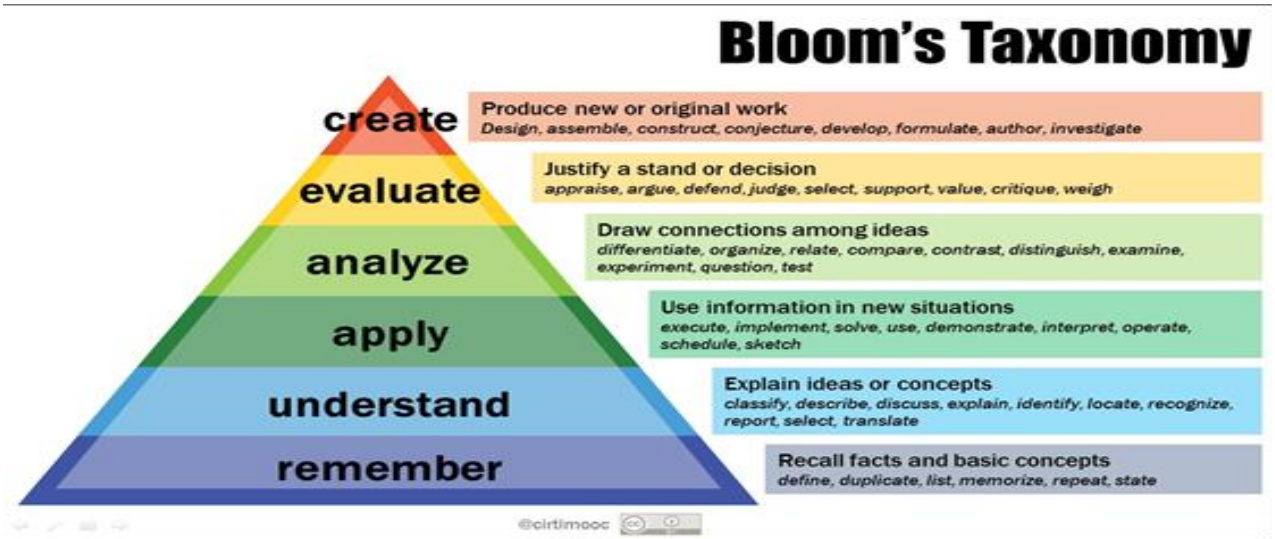
PROGRAM OUTCOMES IN RELATION TO GRADUATE ATTRIBUTES

S.No	GRADUATE ATTRIBUTES	PROGRAMME OUTCOMES
1.	**Knowledge**	Capability of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an postgraduate programme of study
2.	**Critical Thinking**	Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
3.	**Problem Solving**	Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
4.	**Usage of modern tools**	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
5.	**Communication**	Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
6.	**Life-long Learning**	Ability to acquire knowledge and skills, including 'learning how to learn', that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
7.	**Ethical Practices and Social Responsibility**	Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work.
8.	**Independent and Reflective Learning**	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society

Appendix C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (Modules, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. [eduglosarry.org]



Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

Level	Parameter	Description
K1	Knowledge	It is the ability to remember the previously learned material/information
K2	Comprehension	It is the ability to grasp the meaning of material
K3	Application	It is the ability to use learned material in new and concrete situations
K4	Analysis	It is the ability to break down material/concept into its component parts/subsections so that its organizational structure may be understood
K5	Synthesis	It is the ability to put parts/subsections together to form a new whole material/idea/concept/information
K6	Evaluation	It is the ability to judge the value of material/ concept/statement/creative material /research report) for a given purpose