BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI-620024
B.Sc. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
CHOICE BASED CREDIT SYSTEM –
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2026 - 2027 onwards)

Sem	Part	Courses	Title	Ins. Hrs.	Credits	Exam. Hours	Maximum Marks		
							Int.	Ext.	Total
I	I	Ability Enhancement Course – I (AEC - I)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –II (AEC - II)	English Course – I	6	3	3	30	70	100
	III	Core Course -1 (CC - 1)	Programming in C and Data Structures	4	4	3	30	70	100
		Core Practical - 1 (CP - 1)	Programming in C and Data Structures Lab	4	4	3	40	60	100
		Allied Course - 1 (MC - 1)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - I (ACP -I)	Any one from the list	2	**	**	**	**	**
	IV	Value Education		2	2	3	30	70	100
		Interdisciplinary Course – 1 (IDC - 1) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**22**	--	--	--	**700**
II	I	Ability Enhancement Course –III (AEC - III)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –IV (AEC - IV)	English Course - II	6	3	3	30	70	100
	III	Core Course- 2 (CC - 2)	Programming in Python	4	4	3	30	70	100
		Core Practical – 2 (CP - 2)	Programming in Python Lab	4	4	3	40	60	100
		Allied Course - 2 (AC - 2)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 2 (ACP - 2)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 1(SEC - 1) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 2 (IDC - 2) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**

III	I	Ability Enhancement Course – V(AEC - V)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –VI (AEC - VI)	English Course - III	6	3	3	30	70	100
	III	Core Course - 3 (CC - 3)	RDBMS and NoSQL	4	4	3	30	70	100
		Core Practical - 3 (CP - 3)	RDBMS and NoSQL Lab	4	4	3	40	60	100
		Allied Course - 3 (AC - 3)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 2 (ACP-II)	Any one from the list	2	**	**	**	**	**
	IV	Skill Enhancement Course - 2 (SEC - 2) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course - 3 (IDC - 3) $$	One Course from Outside Department	2	2	3	30	70	100
		Health & Wellness @		--	1	--			100
	Total			**30**	**23**	--	--	--	**800**
	I	Ability Enhancement Course –VII (AEC - VII)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
IV	II	Ability Enhancement Course –VIII (AEC - VIII)	English Course - IV	6	3	3	30	70	100
	III	Core Course - 4 (CC - 4)	Artificial Intelligence	4	4	3	30	70	100
		Core Practical - 4 (CP - 4)	Artificial Intelligence Lab	4	4	3	40	60	100
		Allied Course - 4 (AC - 4)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 2 (ACP-2)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 3 (SEC - 3) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 4 (IDC - 4) $$	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**
	Summer Internship / Industrial Activity during the Summer Vacation after II Year								

V	III	Core Course - 5 (CC - 5)	Robotics	4	4	3	30	70	100
		Core Course - 6 (CC - 6)	Machine Learning	5	4	3	30	70	100
		Core Course - 7 (CC - 7)	Embedded Systems	5	4	3	30	70	100
		Core Course - 8 (CC - 8)	Artificial Neural Networks	5	4	3	30	70	100
		Core Practical - 5 (CP - 5)	Robotics Lab	5	4	3	40	60	100
	IV	Skill Enhancement Course - 4 (SEC - 4)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 5 (SEC - 5) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Introduction to Disaster Management		2	2	3	30	70	100
		Summer Internship / Industrial Activity @@	(with Viva-Voce)	--	2	--	20	80	100
	Total			**30**	**28**	--	--	--	**900**
VI	III	Core Course - 9 (CC - 9)	Human Computer Interaction	4	4	3	30	70	100
		Core Course - 10 (CC - 10)	Data Warehousing and Data Mining	5	4	3	30	70	100
		Core Course - 11 (CC - 11)	Natural Language Processing	5	4	3	30	70	100
		Core Project Work(CPW) @@	Project Work (with Viva-Voce)	6	4	3	20	80	100
	IV	Value Added Course	General Studies for Competitive Examinations	2	1	--	30	70	100
		Skill Enhancement Course - 6 (SEC - 6)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 7 (SEC - 7) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Environmental Studies		2	2	3	30	70	100
		Gender Studies		2	1	3	30	70	100
		Extension Activities *		--	1	--	--	--	--
	Total			**30**	**25**	**--**	**--**	**--**	**900**
	GrandTotal			**180**	**150**	--	**--**	**--**	**4900**

ALLIED COURSE
(Allied Papers)

First Year Students	Second Year Students
Mathematics	Applied Physics / Electronics

SKILL ENHANCEMENT COURSE (SEC)			
Sl. No.	**Title of paper**	**Sl. No.**	**MANDATORY Naan Mudhalvan Scheme##**
1.	Mobile Application Development	1.	**2nd Semester:**
2.	Big Data Analytics		
3.	Cloud Computing	2.	**3rd Semester:**
4.	Internet of Things		
5.	Open Source Technologies	3.	**4th Semester:**
6.	Virtual Reality and Augmented Reality		
7.	Deep Learning	4.	**5th Semester:**
--		5.	**6th Semester:**

INTERDISCIPLINARY COURSE (IDC) FOR WHO HAVE OPT TAMIL AS PART-I (for other Department Students only)	
1st Semester	Fundamentals of Information Technology
2nd Semester	Working Principles of Internet
3rd Semester	Digital Marketing
4th Semester	Introduction to Artificial Intelligence

INTERDISCIPLINARY COURSE (IDC)# FOR WHO HAVE NOT OPT TAMIL AS PART - I		
Those who have studied Tamil upto10th+2 but opt for other languages in degree	**1st Semester**	Special Tamil - I
	2nd Semester	Special Tamil - II
Those who have not studied Tamil in school level	**1st Semester**	Basic Tamil - I
	2nd Semester	Basic Tamil – II
Those students who opt for either special Tamil (or) Basic Tamil as IDCs, have to choose 2 more IDCs courses in their 3rd and 4th Semester from Outside his/her department.		

INTERDISCIPLINARY COURSE (IDC) $$ FOR NCCCADETS ONLY	
NCC Course is a Compulsory Course for the NCC Cadets in the 3rd Semester:	**NCC Course is a Compulsory Course for the NCC Cadets in the 4th Semester:**
Introduction to NCC	1. Special Subject Army **(or)** 2. Special Subject Navy **(or)** 3. Special Subject Air force
Those students who opt for NCC Courses as IDCs, have to choose 2 more IDCs courses in their 1st and 2nd Semester from Outside his/her department.	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	Credits for each Course	Total Credits	Marks
1.	I	Ability Enhancement Course	4	3	12	400
2.	II	Ability Enhancement Course	4	3	12	400
3.	III	Core Course	11	4	44	1100
4.		Core Practical	5	4	20	500
5.		Allied Course (AC)	4	4	16	400
6.		Allied Course Practical (ACP)	2	4	8	200
7.		Core Project Work (CPW)	1	4	4	100
8.	IV	Skill Enhancement Course (SEC)	7	2	14	700
9.		Interdisciplinary Course (IDC)	4	2	8	400
10.		Value Education	1	2	2	100
11.		Health and Wellness	1	1	1	100
12.		Introduction to Disaster Management	1	2	2	100
13.		Summer Internship / Industrial Activity	1	2	1	100
14.		Value Added Course	1	1	2	100
15.		Environmental Studies	1	2	2	100
16.		Gender Studies	1	1	1	100
17.		**EXTENSIONACTIVITIES** (NCC / NSS / SPORTS / ANTI DRUG CELL / YRC & Any Other Activities	--	1	1	--
Total			**49**	**-**	**150**	**4900**

$ For those who have studied Tami upto10th+2 (Regular Stream)

\+ Syllabus for other Languages should be on par with Tamil at degree level

\# Those who have studied Tamil upto10th+2 but opt for other languages in degree level under Part-I should study special Tamil and those who have not studied Tamil in the school level should study Basic Tamil in Part–IV under the Interdisciplinary Course.

** Examination at the end of the next semester

Naan Mudhalvan Scheme: As per the Naan Mudhalvan Scheme instructions, 5 courses from 2nd to 6th semester should be studied under Skill Enhancement Course.

$$ NCC Course is one of the Choices in the Interdisciplinary Course. Only the NCC Cadets are eligible to choose this course. However, NCC Course is a Compulsory Course for the NCC Cadets.

Health and Wellness: Assessments:

- Use self-reflective worksheets to assess their understanding
- submit the worksheets to internal audit / external audit
- Every student's activity report should be documented and the same have to be assessed by the Physical Director with Mentor. The evaluation should be for 100 marks. No examination is required.

@

Scheme of Evaluation:

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		**100**

Summer Internship / Industrial Activity

Internship will be carried our during the summer vacation after the second year. Viva-Voce will be conducted by the college and Marks shall be send to the University and the same will be included in the 5th semester Mark Statement.

@@ **Summer Internship / Industrial Activity& Project Work**

Scheme of Evaluation:

Description	**Marks**
Report	80
Viva-Voce	20
Total	**100**

* Extension Activities shall be outside instruction hours.

PROGRAMME OUTCOMES

PO 1	**Communication Skill:** Mandatory language courses facilitate to become proficient in communication, culturally aware, and more employable in both Indian and global contexts. Improve presentations skill, debates, and professional communication.
PO 2	**Disciplinary Knowledge:** Learn in-depth complex scientific concepts, demonstrate their ability to explain and apply their knowledge. Consistent in learning by earning extra credits in specialized courses within the science domain and enhance disciplinary knowledge.
PO 3	**Critical thinking:** Field and academic visits will help students to develop observation skills, grasping ability, collect and interpret data and propose models that will help them to understand hypotheses and conclusions.
PO 4	**Analytical Reasoning:** Through the interactions, students will develop skills of critical reading of texts, identifying gaps in knowledge, formulating scientific questions, and on will recognizing the synthesis of new ideas.
PO 5	**Scientific Reasoning:** Skill oriented courses will provide details on principles, conduct of proper calibration and use of scientific instrumentation and appropriate use of scientific techniques in experimental design
PO 6	**Self-directed Learning:** Preparation of field reports helps them to present their results and discussion in a written format that is typically required for their future professions.
PO 7	**Reflective Thinking:** All core courses with laboratory components will provide exposure to a wide range of research techniques, therein enhancing their understanding of the application of techniques in their domain.
PO 8	**Problem Solving:** Students will develop the ability to reason, apply numerical concepts, and equations in their fields of study for interpreting scientific data and drawing relevant scientific conclusions.
PO 9	**Research-related Skills:** Students undertaking a internship will have the opportunity to design, develop and execute their own research ideas in their experiments, thus expanding their knowledge of research methods and laboratory skills.
PO 10	**Lifelong Learning:** Ability to understand the gaps in knowledge and skill, adapt to technological change, engage in self-directed learning.

PROGRAMME SPECIFIC OUTCOMES:

After successful completion of B.Sc. AI &ML program the students are expected to

PSO 1	Apply the concepts and practical knowledge in analysis, design and development of computing systems and applications to multi-disciplinary problems.
PSO 2	Provide a concrete foundation and enrich their abilities to qualify for Employment, Higher studies and Research in Artificial Intelligence and Machine Learning with ethical values.
PSO 3	Understand, analyze and develop essential proficiency in the areas related to artificial intelligence and machine learning in terms of underlying statistical and computational principles.
PSO 4	Learn the basic concepts of AI & ML and apply in various research areas like image processing, speech recognition and Medical diagnostics etc.,
PSO 5	Find solutions to complex AI problems using various AI tools

First Year	CORE COURSE 1	Semester I
Code:	PROGRAMMING IN C AND DATA STRUCTURES (Theory)	Credits: 4

COURSE OBJECTIVES:

This course aims to:

- Identify and Recall the fundamental syntax of C programming while defining the basic concepts of linear and non-linear data structures.
- Explain and interpret the logical flow and the operational mechanics of various linear and non-linear data structures.
- Apply C programming syntax and memory management techniques to implementation of linear and non-linear data structures.
- Analyze and Differentiate complex programming constructs and data structures to optimize memory and data management.
- Evaluate and justify the selection of programming constructs, memory management techniques, and data structures.

UNIT –I: INTRODUCTION

Basic of C: History of C and its importance – Structure of a C program – Data Types – Constants and Variables – Operators and Expressions – Order of Precedence, Evaluating of Arithmetic Expressions – Type Conversion- Decision Statements: if, if-else, and nested if statements.

UNIT –II: LOOPING AND FUNCTIONS

Loops Structures: For Loop, While, Do-while loop – Arrays: - One Dimensional Array, Two-dimensional Arrays, Character Arrays and Strings – Functions: Function with arrays - Function with decision and looping statements - Recursion.

UNIT –III: POINTERS AND STRUCTURES

Pointers: Introduction – Pointer Expressions – Chain of Pointers – Pointers and Arrays – Array of Pointers – Pointers as function arguments – Functions returning

Pointers – Pointers to Functions – Function pointer – Structures - declaration, initialization, Array of Structures – Pointer to structures, Structures and functions – Typed of Enumerated data types, Unions.

UNIT –IV: STRING AND FILES

Strings Processing, Standard string library functions – Files: introduction and files functions – Writing and reading in Text mode – Simple application: Display the contents of a file. Write data to a file. Append data to an existing file – File IO– Reading and writing structures.

UNIT –V: DATA STRUCTURES

Stack: LIFO concept, Stack operations, Array implementation of stack – Queue: FIFO concept, Queue operations, Array implementation of queue – Singly Linked List: concepts, operations – Doubly Linked List: concepts, operations – Trees: General trees, Binary trees.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, New Delhi, Nineth Edition, 2024.
2. ReemaThareja, "Data Structure using C, "Oxford University Press", New Delhi, Third Edition, 2023

REFERENCES:

1. Byron S. Gottfried, "Programming with C", Schaum's Outline Series, Tata-McGraw Hill Edition, New Delhi, 1991.
2. E.Horowitz, S.Sahni and Susan Anderson Freed, "Fundamental Data Structures in C", 2ed, Orient BlackSwan Publisher, 2009
3. E. Karthikeyan, "A Textbook on C Fundamentals, Data Structures and Problem Solving", Prentice-Hall of India Private Limited, New Delhi, 2008.
4. YashavantKanetkar, "Let us C", BPB Publications, Tenth Edition, New Delhi,

2010.

5. Szuhay, Jeff, and Szuhay, Jeff, “Learn C Programming: A Beginner's Guide to Learning C Programming the Easy and Disciplined Way”, Packt Publishing, 2020.
6. Jena, Sisir Kumar, and Jena, Sisir Kumar, “C Programming: Learn to Code”, CRC Press, 2021.

e–Books:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3schools.in/data-structures/intro

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Demonstrate the ability to construct C programs by correctly utilizing basic building blocks
CO2	Design and implement modular software solutions using functions and recursion ad arrays
CO3	Apply pointer arithmetic to manage memory addresses and organize complex information using user-defined data types
CO4	Design and implement modular software solutions using functions and recursion
CO5	Analyze and implement core data structure concepts, including the LIFO/FIFO operations of stacks and queues

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	2	1	-	-	2	-	1	3	2	1	-	-
CO2	2	3	2	3	1	-	-	3	-	1	3	2	3	-	2
CO3	2	3	2	3	3	-	-	2	-	1	3	2	3	1	3
CO4	2	3	2	2	3	2	-	2	-	2	3	2	3	2	2
CO5	2	3	3	3	2	1	-	3	3	1	3	2	3	3	3

3 - Strong, 2 - Medium , 1- Low

First Year **CORE PRACTICAL 1** **Semester I**

Code: **PROGRAMMING IN C AND DATA STRUCTURES LAB** **Credits: 4**

(Practical)

COURSE OBJECTIVES:

This course aims to :

- Identify and define core C programming elements and the structural properties of linear data structures like Arrays and Stacks.
- Demonstrate how to use conditional logic and control structures to solve mathematical logic problems
- Implement fundamental algorithms for data retrieval and organization, specifically performing Linear Search and Bubble Sort
- Analyze and compare the operational mechanisms of various data structures,
- Design and construct modular programs that utilize dynamic memory and pointers to perform complex operations

LIST OF EXERCISES

1. **Input/Output, Arithmetic, and Conditional Logic:**
   Concepts: Basic I/O (printf, scanf), operators, expressions, decision-making (if, switch)
   Write a C Program to compute grade based on marks
2. **Loops and Pattern Printing:**
   Concepts:for, while, do-while loops, nested loops

   Write a C Program to Generate Multiplication Table

3. **Arrays and Strings:**
   Concepts: 1D & 2D arrays, string handling functions

   (a) Write a C Program to Find largest and smallest element in an array
   (b)Write a C Program to count vowels and consonants

4. **Functions and Recursion:**
   Concepts: User-defined functions, parameter passing, recursion

   Write a C Program to Print Fibonacci Series

5. **Structures and File I/O:**
Concepts: Structures, unions (basic idea), file handling (fopen, fread, fwrite)
Write a C Program Student record management using structures

6. **Dynamic Array Implementation:**
Concepts: Dynamic memory allocation (malloc, calloc, realloc, free)
Write a C Program Create dynamic array and perform insertion/deletion

7. **Singly Linked List Operations:**
Concepts: Linked list creation, traversal, insertion, deletion
Write a C Program to Reverse a linked list and count number of nodes

8**. Doubly Linked List Operations:**
Concepts: Forward and backward traversal, insertion, deletion
Write a C Program to Create and display doubly linked list, Forward and backward traversal, insertion, deletion

9. **Searching and Sorting Techniques:**
Concepts: Searching (Linear, Binary) and Sorting Techniques (Bubble, Selection, Insertion, Quick, Merge)
(a) Write a C Program to Implement Linear and Binary Search
(b) Write a C Program to Implement Sorting Techniques

10. **Tree Traversals:**
Concepts: Binary Trees, traversal techniques

Write a C Program to Create a Binary Tree and Counting leaf nodes

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Describe and implement basic control structures to solve mathematical problems
CO2	Apply iterative and conditional logic to perform data validation tasks, such as determining if a number is a palindrome
CO3	Demonstrate the ability to store, traverse, and perform aggregate calculations (sum and average) on data sets using arrays
CO4	Construct and analyze linear data structures by implementing Stack, Queue operations and Singly Linked Lists
CO5	Analyze and execute fundamental algorithms for data organization and retrieval, specifically implementing Linear Search and Bubble Sort

First Year	CORE COURSE 2	Semester II
Code:	PROGRAMMING IN PYTHON (Theory)	Credits: 4

COURSE OBJECTIVES:

This course aims to :

- Identify core language features—including reserved keywords, identifiers, and variables—and interpret
- Explain and apply decision-making constructs, nested loops, and various data types.
- Design modular solutions by defining functions with multiple return values, utilizing recursive logic, and organizing code
- Analyze and implement Object-Oriented principles such as encapsulation, inheritance, and polymorphism
- Construct integrated applications that perform sophisticated text processing

UNIT– I: INTRODUCTION TO PYTHON

Features of Python - How to Run Python - Identifiers - Reserved Keywords - Variables - Comments in Python - Indentation in Python - Multi-Line Statements - Multiple Statement Group (Suite) - Quotes in Python - Input, Output and Import Functions - Operators. Data Types and Operations: Numbers – Strings – List – Tuple – Set – Dictionary – Data type conversion.

UNIT– II: FLOW CONTROL

Decision Making – Loops – Nested Loops – Types of Loops. Functions: Function Definition – Function Calling - Function Arguments - Recursive Functions - Function with more than one return value.

UNIT– III: MODULES AND PACKAGES

Built-in Modules - Creating Modules - import Statement - Locating Modules - Namespaces and Scope - The dir() function - The reload() function - Packages in Python - Date and Time Modules. Python Strings: String operations - Immutable

Strings - Built-in String Methods and Functions - String Comparison - File Handling- Directories in Python.

UNIT– IV: OBJECT-ORIENTED PROGRAMMING

Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes- Destructors in Python – Encapsulation - Data Hiding – Inheritance - Method Overriding- Polymorphism.

UNIT– V: EXCEPTION HANDLING

Built-in Exceptions-Handling Exceptions- Exception with Arguments - Raising Exception - User-defined Exception - Assertions in Python. Regular Expressions: The match() function - The search() function - Search and Replace - Regular Expression Modifiers: Option Flags-Regular Expression Patterns- Character Classes-Special Character Classes - Repetition Cases - findall() method - compile() method.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Reema Thareja, “PYTHON Programming”, Oxford University Press, New Delhi, Third Edition, 2025
2. Jeeva Jose and P. SojanLal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Book Publishing Co, 2016.

REFERENCES:

1. Mark Summerfield. — Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Martin C. Brown, —PYTHON: The Complete Reference‖, McGraw- Hill, 2001
3. Wesley J. Chun, “Core Python Programming”, Prentice Hall Publication, 2006.
4. Timothy A Budd, “Exploring Python”, Tata McGraw Hill, New Delhi, 2011
5. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for

Working with Data", O'Reilly Media, 2016.

6. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016
7. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1 Describe the core features of Python and utilize fundamental syntax

CO2 Apply decision-making constructs and various loop types to manipulate collections

CO3 Design modular applications by implementing recursive functions, custom modules, and hierarchical packages

CO4 Analyze and implement Object-Oriented principles, including inheritance and polymorphism

CO5 Synthesize complex programs that perform advanced text processing using regular expressions

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	1	2	1	2	1	3	3	3	2	1	1
CO2	1	2	2	3	2	1	1	3	1	2	2	3	2	1	1
CO3	1	2	1	2	1	2	1	2	3	3	3	3	3	2	1
CO4	1	3	1	3	2	1	1	2	2	2	3	3	3	2	1
CO5	1	2	1	3	2	1	1	3	2	2	2	3	3	3	2

3 - Strong, 2 - Medium, 1- Low

First Year	**CORE PRACTICAL 2**	**Semester II**
Code:	**PROGRAMMING IN PYTHON LAB** (Practical)	**Credits: 4**

COURSE OBJECTIVES:

This course aims to :

- Identify and define core Python elements, including reserved keywords, identifiers, variables,
- Explain the mechanics of decision-making statements and iterative loops used to solve computational problems
- Implement functional programming by creating reusable code blocks and recursive functions
- Analyze and organize code using Object-Oriented principles—including inheritance and polymorphism.
- Construct comprehensive applications that integrate file handling for persistent storage with regular expressions

LIST OF EXERCISES:

1. Basic Syntax & Input/Output
2. Flow Controls & Loops
3. Lists & Iterables
4. Functions and Recursive Functions
5. Build in Modules
6. String Operations
7. Lists, Tuples, & Sets
8. Exception Handling
9. Object-Oriented Programming (OOP) – Inheritance, Polymorphism
10. Basic File I/O & Error Handling
11. Regular expression Modifiers
12. Advanced File & Data Handling (Eg. Directory Tree Generator, JSON Configuration Parser)

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Apply fundamental control structures to solve simple computational problems
CO2	Construct algorithms to perform mathematical operations, including calculating the sum of natural numbers
CO3	Analyze text data to perform pattern-based checks, such as identifying palindromes and categorizing characters into vowels or consonants
CO4	Design and implement recursive functions to solve complex mathematical problems
CO5	Synthesize file-handling techniques to process external data, specifically calculating metrics

Second Year	**CORE COURSE 3**	**Semester III**
Code:	**RDBMS AND NoSQL** (Theory)	**Credits: 4**

COURSE OBJECTIVES:

This course aims to :

- Recall the limitations of relational databases and identify the primary types of NoSQL databases
- Explain the principles of the ER model, including entities, attributes, and relationship sets.
- Apply SQL commands and aggregate functions to perform complex data queries and set operations.
- Analyze relational schemas to identify redundancies using functional dependencies and perform decomposition through normal forms
- Design comprehensive database systems for real-world applications such as E-commerce or Big Data systems

UNIT – I: DATABASE SYSTEMS & ER MODEL

Overview of Database Systems- Managing Data – File System vs DBMS – Structure of DBMS – Schema and Instances. Database Design and ER Model: Entities, Attributes, Entity Sets Relationships and Relationship Sets – ER Diagrams – Extended ER Features. Introduction to NoSQL: Need for NoSQL – Limitations of Relational Databases – Types of NoSQL Databases.

UNIT – II: RELATIONAL MODEL & DESIGN

Relational Model: Structure of Relational Databases – Keys – Integrity Constraints – Relational Algebra – Relational Calculus. ER to Relational Mapping – Views – Schema Design – Materialized Views. Aggregate Models – Column-family concept – Schemaless Databases.

UNIT – III: SQL & TRANSACTION MANAGEMENT

SQL Queries: Basic SQL Queries – INSERT, UPDATE, DELETE – SELECT – Set Operations – Nested Queries – Aggregate Functions – NULL Values- Constraints –

Triggers – Views – Active Databases.- ACID Properties – Transactions and Schedules – Lock-based Protocols – Crash Recovery.

UNIT – IV: NORMALIZATION, SECURITY & APPLICATIONS

Schema Refinement and Normal Forms: Functional Dependencies – Normal Forms (1NF, 2NF, 3NF, BCNF) – Decomposition – Normalization in Database Design. Security and Authorization: Database Security – Access Control. Applications: Big Data Systems – E-commerce – Content Management Systems – Real-time Analytics.

UNIT – V: NoSQL DATABASES & DISTRIBUTED CONCEPTS

No SQL Data Models- Key-Value Stores – Document Databases – Column-Family Stores – Graph Databases – Features and Use Cases. Examples of No SQL Systems: Mongo DB, Cassandra

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned **.**

Recommended Books:

1. Database System Concepts, Sixth edition, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill-2010.
2. Jagdish Chandra Patni, Hitesh Kumar Sharma, Ravi Tomar, AvitaKatal., "Database Management System: An Evolutionary Approach", CRC Press, 2022.

REFERENCES:

1. Abraham Silberschatz, Hendry F. Korth, S Sudharshan," Database System Concepts", 6th Edition, McGraw Hill International, 2019.
2. Blokdyk, Gerardus, and Blokdyk, Gerardus, "RDBMS Relational Database Management System a Complete Guide", 2020 Edition, Emereo Pty Limited, 2019.
3. WilfriedLemahieu, SeppevandenBroucke, Bart Baesens, "Principles of Database Management: The Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.
4. C.J. Date, "An Introduction to Database Systems" Addison Wesley, 2000.

5. NoSQL Distilled by Pramod J. Sadalage

e-Books:

1. https://tutorialspoint.dev/computer-science/dbms
2. https://tutorialspoint.dev/computer-science/NoSQL

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Distinguish between traditional file systems and DBMS structures, while identifying the core necessity and types of NoSQL databases
CO2	Construct comprehensive Entity-Relationship (ER) diagrams and map them into relational schemas
CO3	Perform complex data manipulations using SQL queries, set operations, and aggregate functions
CO4	Analyze and refine database schemas by applying normalization techniques (1NF through BCNF) to eliminate redundancies
CO5	Design secure, scalable data solutions by integrating NoSQL models (like MongoDB and Cassandra) with distributed concepts

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	2	-	2	2	1	1	1	2
CO2	1	3	2	3	-	-	1	2	-	2	3	2	2	1	2
CO3	2	3	2	3	1	-	1	3	-	2	3	2	2	2	3
CO4	1	3	1	3	2	1	2	3	-	2	2	2	2	1	2
CO5	1	3	2	3	2	1	1	2	2	3	3	3	3	3	3

3 - Strong, 2 - Medium, 1- Low

Second Year	**CORE PRACTICAL 3**	**Semester III**
Code:	**RDBMS AND NoSQL LAB** (Practical)	**Credits: 4**

COURSE OBJECTIVES:

This course aims to :

- Identify and define the foundational components of database management systems,
- Explain the core principles of data modeling through ER diagrams and interpret the significance of ACID properties
- Implement practical data solutions by mapping ER models to relational schemas and performing CRUD operations
- Analyze and refine database structures using normalization (1NF to BCNF) and extract complex insights from datasets
- Design and construct integrated, secure data-driven applications that utilize views, indexes, and distributed concepts

LIST OF EXERCISES:

1. Create a table STUDENT with the following fields: ID (Primary Key), NAME,AGE, DEPARTMENT

   Perform the following operations:

   a) Insert at least 5 records

   b) Display all records

   c) Update age of a student

   d) Delete a record

   e) Display students whose age is greater than 18

2. Create two tables EMPLOYEE and DEPARTMENT and perform:

   a) Insert records

   b) Apply INNER JOIN

   c) Use GROUP BY to count employees in each department

   d) Find maximum salary

e) Create a VIEW for employee details

3. Write SQL queries for the following:

   a) Use aggregate functions (SUM, AVG)
   b) Write a subquery to find highest value
   c) Use ORDER BY
   d) Apply constraints (PRIMARY KEY, UNIQUE)
   e) Create and drop a table

4. Using MongoDB:

   a) Create a database and collection
   b) Insert 5 documents
   c) Display all documents
   d) Update a document
   e) Delete a document

5. Perform the following operations in MongoDB:

   a) Use query operators ($gt, $lt)
   b) Retrieve specific records
   c) Perform aggregation using group
   d) Create index
   e) Display sorted output

6. Design a simple application using NoSQL:

   a) Create collection (Product/Student)
   b) Insert multiple records
   c) Perform update and delete
   d) Use aggregation
   e) Compare with RDBMS (write 3 points)

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Identify the core necessity relational databases and NoSQL
CO2	Design comprehensive Entity-Relationship (ER) diagrams and implement them as structured SQL
CO3	Perform complex data retrieval and modification using SQL (Joins, Subqueries) and NoSQL
CO4	Refine database schemas through normalization (1NF to BCNF) and analyze data distributions using aggregate functions
CO5	Construct integrated data-driven applications that utilize database views, security access controls

Second Year **CORE COURSE 3** **Semester IV**

Code: **ARTIFICIAL INTELLIGENCE** **Credits: 4**
(Theory)

COURSE OBJECTIVES:

This course aims to:

- Understand the fundamental concepts of Artificial Intelligence, including problem formulation, state space representation, and search techniques.
- Apply heuristic search methods and analyze different knowledge representation techniques to solve complex AI problems.
- Develop logical reasoning skills using predicate logic and implement rule-based systems for knowledge representation and inference.
- Analyze and apply methods for reasoning under uncertainty, including probabilistic models and non-monotonic reasoning.
- Understand and utilize various knowledge representation structures such as semantic networks, frames, scripts, and conceptual dependency.

UNIT - I: ARTIFICIAL INTELLIGENCE:

AI Problems – Underlying Assumption – AI Technique – Level of the Model – Criteria of Success – Some General References. Problems, Problem Spaces and Search: Defining the Problem as a State Space Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the Design of Search Programs.

UNIT – II: HEURISTIC SEARCH TECHNIQUES:

Generate and Test – Hill Climbing – Best - First Search – Problem Reduction – Constraint Satisfaction – Means - ends Analysis. Knowledge Representation Issues: Representations and Mappings – Approaches to Knowledge Representation – Issues in Knowledge Representation – The Frame Problem.

UNIT - III: USING PREDICATE LOGIC:

Representing Simple Facts in Logic – Representing Instance and ISA Relationships – Computable Functions and Predicates – Resolution–Natural Deduction - Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge – Logic Programming – Forward Versus Backward Reasoning – Matching– Control Knowledge**.**

UNIT - IV: SYMBOLIC REASONING UNDER UNCERTAINTY:

Introduction to Non- monotonic Reasoning – Logics for Non-monotonic Reasoning – Implementation Issues – Augmenting a Problem-solver – Implementation Depth First Search – Implementation Breadth FirstSearch. Statistical Reasoning: Probability and Bay's Theorem–Certainty Factors and

Rule-based Systems–Bayesian Networks – Dempster - Shafer Theory – Fuzzy Logic.

UNIT - V: WEAK SLOT-AND-FILLER STRUCTURE:
Semantic Nets - Frames – Strong Slot-and-Filler Structure: Conceptual Dependency – Scripts – CYC – Knowledge Representation Summary: Syntactic - Semantic Spectrum of Representation – Logic and Slot-and-Filler Structures – Other Representational Techniques.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned

RECOMMENDED BOOKS:

1. Kevin Night, Elaine Rich and NairB., "Artificial Intelligence", McGraw Hill, 2017.
2. Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, Pearson, 4th Edition (2020)
3. M.Tim Jones Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers Inc.; First Edition, 2008.

REFERENCES:

1. Nils J.Nilsson - The Quest for Artificial Intelligence, Cambridge University Press, 2009.
2. Gerhard Welss – Multi Agents Systems, Second Edition, 2013
3. David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
4. Dan W. Patterson,"Introduction to AI and ES", Pearson Education, 2007

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

CO1	To Explain the fundamental concepts of Artificial Intelligence, problem formulation, and state space search techniques.
CO2	To Apply heuristic search algorithms and problem-solving strategies to various AI problems.
CO3	To Analyze and represent knowledge using predicate logic and rule-based systems for logical reasoning.
CO4	To Evaluate different methods for reasoning under uncertainty, including probabilistic, Bayesian, and fuzzy approaches.
CO5	To Design and develop knowledge representation models using semantic networks, frames, scripts, and conceptual dependency structures.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	1	1	1	3	1	1	3	2	1	1	1
CO2	2	3	3	3	2	2	1	3	1	2	3	3	2	1	1
CO3	1	3	3	3	2	1	1	3	2	2	3	3	2	1	1
CO4	1	3	3	3	3	2	1	3	3	3	2	3	3	2	2
CO5	1	3	2	3	2	1	3	3	3	3	3	3	3	3	3

3 - Strong, 2 - Medium, 1- Low

Second Year **CORE PRACTICAL 4** **Semester IV**

Code: **ARTIFICIAL INTELLIGENCE LAB** **Credits: 4**

(Practical)

COURSE OBJECTIVES:

This course aims to:

- implement various search strategies.
- analyze classical AI problem-solving techniques.
- understand heuristic and optimization approaches and evaluate their effectiveness in improving search performance.
- explore knowledge representation and inference mechanisms through Predicate Logic and Forward Chaining techniques.
- apply AI concepts to real-world problem models, including Constraint Satisfaction Problems (Map Coloring) and probabilistic reasoning using Bayes' Theorem.

LIST OF EXERCISES:

1. Develop a solution using the Hill Climbing algorithm.
2. Design and implement a solution for the Towers of Hanoi problem.
3. Develop a solution for the Missionaries and Cannibals problem.
4. Design and implement a solution to the 8-Queens problem.
5. Implement and demonstrate the A Search algorithm.*
6. Implement and demonstrate the Breadth-First Search (BFS) algorithm.
7. Implement and demonstrate the Depth-First Search (DFS) algorithm.
8. Develop a predicate logic-based reasoning system.
9. Implement and demonstrate the Best-First Search algorithm.
10. Solve a Map Coloring problem using Constraint Satisfaction techniques.
11. Demonstrate Forward Chaining in a rule-based system.
12. Apply Bayes' Theorem to solve a simple probabilistic reasoning problem.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

CO1	Solve various kinds of problems using AI techniques.
CO2	Solve basic AI based problems using any programming language.
CO3	Understand to implement the various kinds of AI based algorithms.
CO4	To understand problems related to AI.
CO5	Apply AI techniques to real-world problems to develop intelligent systems.

Third Year	**CORE COURSE 5**	**Semester V**
Code:	**ROBOTICS** (Theory)	**Credits: 4**

COURSE OBJECTIVES

This course aims to

- understand the functions of the basic components of a Robot.
- study the use of various types of End of Effectors and Sensors.
- analyse working principles of Robot drive systems.
- familiarize students with the various machine vision applications in Robot.
- impart knowledge in Robot Kinematics and Programming.

UNIT – I: Fundamentals of Robot

Robot - Definition - basic components of robots, laws of robotics, Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Technical Specification in Robotics, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UINT – II: **Robot Drive Systems and End Effectors**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT – III: Sensors and Machine Vision

Introduction to Sensor, Requirements of a sensor, Types of sensors, Principles and Applications : Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT – IV: **Robotics Kinematics and Programming**

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2

Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT – V: Implementation and Robot Economics

RGV, AGV, Implementation of Robots, Hazards of Robot, Industrial Robots, Safety Considerations for Robot Operations - Economic Analysis of Robots.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned

RECOMMENDED BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003. (Unit 1 : Chapter 1 & 2, Unit II: Chapter 4, Unit III: Chapter 5, Unit IV: Chapter 3 & 8, Unit V: Chapter 9)
2. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.

REFERENCES:

1. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 1994.
3. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.
4. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill, 1995.
5. Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.

COURSE OUTCOMES:
Upon successful completion of this course, the students would be able to:

CO1	To Understand the fundamentals of robots.
CO2	To Know the concepts of sensors and machine vision.
CO3	To Understand navigation controls for operating robotics.
CO4	To Understand the planning and navigation of obstacle avoidance.
CO5	To Understand the implementation of robot economics.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	2	1	1	2	1	1	3	2	2	1	1
CO2	1	3	2	3	3	1	2	2	2	1	3	2	3	3	2
CO3	1	2	2	3	2	1	2	3	2	1	3	2	2	2	3
CO4	1	2	3	3	2	1	2	3	2	1	3	2	2	3	3
CO5	2	2	1	2	1	2	1	2	1	3	2	3	1	1	2

3 - Strong, 2 - Medium, 1- Low

Third Year	**CORE COURSE 6**	**Semester V**
Code:	**MACHINE LEARNING** (Theory)	**Credits: 4**

COURSE OBJECTIVES

This course aims to:

- understand the fundamental concepts and applications of Machine Learning.
- learn probabilistic models and Bayesian learning techniques.
- study supervised learning algorithms for prediction and classification.
- explore unsupervised learning techniques and dimensionality reduction methods.
- evaluate machine learning models using appropriate performance metrics.

UNIT - I: INTRODUCTION

Introduction, easy for human hard for machines, a simple predicting machine, classifying is not very different from predicting, training a simple classifier, one classifier is not enough, Types of machine learning, Applications of Machine Learning, Perspectives and issues in machine learning.

UNIT - II: PROBABILISTIC AND STOCHASTIC MODELS

Bayesian Learning – Bayes theorem, Concept learning, Maximum likelihood, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Expectation maximization and Gaussian Mixture Models, Hidden Markov models

UNIT - III: SUPERVISED LEARNING

Introduction, Regression, Linear regression, Classification: Decision trees, k-Nearest Neighbours, Support Vector Machine, Logistic regression, Random Forest. Artificial Neural Network: Introduction, Perceptron's, multi-layer networks and back propagation.

UNIT - IV: UNSUPERVISED LEARNING

Introduction, Supervised vs Unsupervised Cluster Analysis, K-means clustering, Hierarchical clustering. Dimension reduction: Principal Component Analysis, Linear Discriminant Analysis

UNIT - V: MODELLING AND EVALUATION

Building the model, Training a model, evaluating a model, improving a model. Performance metrics - accuracy, precision, recall, sensitivity, specificity, AUC, RoC, Bias Variance decomposition.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, —Machine Learning, Pearson Education, 2018.
2. Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.

REFERENCES:

1. Tariq Rashid, "Make your own neural network", Create Space Independent Publishing Platform, US 2016, ISBN:978-1-5308-2660-5
2. Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2015
3. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer, 2013
4. Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press, 2014.
5. C. Bishop, "Pattern Recognition and Machine Learning", Springer,2006
6. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", Packt Publishing, Third Edition, 2019

COURSE OUTCOMES

Upon successful completion of this course, students would be able to:

CO1: explain the basic concepts and applications of Machine Learning.
CO2: apply probabilistic models such as Bayesian learning.
CO3: implement supervised learning algorithms for classification.
CO4: apply clustering & dimensionality reduction techniques to analyse data.
CO5: evaluate machine learning models using performance metrics

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean CO
CO1	1	3	1	2	2	1	1	1	0	2	2	2	2	1	1	1.47
CO2	1	3	2	3	2	1	1	3	1	2	3	3	3	2	2	2.13
CO3	1	3	3	3	3	1	1	3	2	2	3	3	3	3	2	2.40
CO4	1	3	3	3	2	1	1	3	2	2	3	3	3	2	3	2.33
CO5	1	3	3	3	3	1	1	3	2	3	3	3	3	3	3	2.53
	1.0	3.0	2.4	2.8	2.4	1.0	1.0	2.6	1.4	2.2	2.8	2.8	2.8	2.2	2.2	2.17

3 - Strong, 2 - Medium, 1- Low

Third Year	**CORE COURSE 7**	**Semester V**
Code:	**EMBEDDED SYSTEMS** (Theory)	**Credits: 4**

COURSE OBJECTIVES

This course aims to:

- provide a fundamental understanding of Embedded Systems, their characteristics, classifications, and applications.
- gain knowledge of embedded system architecture, including processors, memory, sensors, actuators, and communication interfaces.
- familiarize students with core components, firmware design, and debugging techniques in embedded systems.
- introduce RTOS concepts, task scheduling, and communication/synchronization mechanisms for practical implementation.
- analyze task communication, synchronization techniques, device drivers, and challenges in hardware-software integration for embedded systems.

UNIT - I: Introduction to Embedded Systems

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded System, Major Application Areas, Purpose of Embedded Systems, Characteristics of Embedded Systems, Quality Attributes of Embedded Systems.

UNIT - II: Typical Embedded System

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT - III: Embedded Firmware

Embedded Firmware Design Approaches - Embedded Firmware Development Languages - Embedded System Development Environment - IDE, Compiler, Linker - Types of File Generated on Cross Compilation-Simulator, Emulator and Debugging- Fundamental issues in Hardware Software Co-design- Integration and Testing of Embedded Hardware and Firmware.

UNIT - IV: RTOS Based Embedded System Design

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT - V: T**ask Communication**

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned**.**

RECOMMENDED BOOKS:

1. Shibu K.V, "Introduction to Embedded System", Tata McGraw-Hill, 2014.
2. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, Addison Wesley, 2001.
3. Embedded Systems – Raj Kamal, McGraw-Hill Education, 4th Edition.

REFERENCES:

1. Embedded System Design – Frank Vahid, Tony Givargis, John Wiley.
2. Embedded Systems – Lyla, Pearson, 2013
3. An Embedded Software Primer – David E. Simon, Pearson Education

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	To understand the fundamentals and applications of embedded systems.
CO2	To analyze and select processors, memory, sensors, actuators and communication interfaces for embedded system design.
CO3	To develop and debug embedded firmware using modern development tools.
CO4	To apply RTOS concepts, task scheduling and multitasking in embedded applications.
CO5	To implement task communication and synchronization techniques, including shared memory, message passing and device drivers.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	2	1	2	2	1	-	2	3	2	1	1	1
CO2	1	3	2	3	3	1	2	3	1	1	3	3	2	3	1
CO3	1	3	1	3	3	3	2	3	3	1	3	3	2	2	1
CO4	1	3	2	3	3	3	2	3	1	1	3	3	3	3	1
CO5	1	3	2	3	3	3	2	3	3	1	3	3	3	3	3

3 - Strong, 2 - Medium, 1- Low

Third Year **CORE COURSE 8** **Semester V**

Code: **ARTIFICIAL NEURAL NETWORKS** **Credits: 4**
(Theory)

COURSE OBJECTIVES:
This course aims to:

- To introduce the fundamental concepts, architecture, and applications of artificial neural networks.
- To develop an understanding of pattern classification and pattern association using neural network models.
- To familiarize students with competitive learning networks and self-organizing neural architectures.
- To provide knowledge of learning algorithms used in various neural network models.
- To enable students to understand and implement backpropagation networks for solving real-world problems.

UNIT – I: INTRODUCTION

Introduction- neural networks and now - neural net - Neural nets being used – Neural networks uses- developing Neural networks – beginning of Neural nets

UNIT – II: PATTERN CLASSIFICATION

Simple neural nets for pattern classification – general discussion – Hebb net – perceptron - Adaline

UNIT – III: PATTERN ASSOCIATION

Pattern association – training algorithms – heter associative Memory neural network – auto associative net – iterative auto associative net – bidirectional associative memory

UNIT – IV: NEURAL NETS

Neural networks based on competition – fixed weight competitive nets – Korhonen self- organizing maps – counter propagation. – learning vector quantization – counter propagation.

UNIT – V: BACKPROPAGATION

Backpropagation neural net – standard backpropagation – variations – theoretical results.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned

RECOMMENDED BOOKS

1. Fauset, L.V (1993), Fundamen tals of neural networks: Architectures, algorithms and applications.
2. Rajasekaran.S., & Paj , G. A. V , (2007) Neural Networks, fuzzy logic , and genetic algorithms: Synthesis and applications. New Delhi: Prentice hall.

REFERENCES:

1. Haykin, S. S (1994). Neural networks: A comprehensive foundation. Macmillan.
2. Valluru, S. K & Rao, T. N.(2010) Introduction to neural networks, fuzzy logic & genetic Algorithms. Jaico Publishing House.
3. Yegnanarayana . B (2006) Artificial Neural networks-Second Edition . Prentice –Hall of India Private Limited

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

CO1: Explain the basic concepts and applications of artificial neural networks.

CO2: Apply pattern classification techniques using Hebb Net, Perceptron, and Adaline models.

CO3: Analyze and implement associative memory networks for pattern tasks.

CO4: Demonstrate the principles of competitive learning using Kohonen Self-Organizing Maps, and Counter Propagation Networks.

CO5: Design and evaluate neural network models using the backpropagation learning algorithm and its variations.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	2	1	1	2	1	1	2	2	3	2	1
CO2	1	3	2	3	2	2	2	3	2	2	3	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	1	3	2	3	2	3
CO4	1	3	2	3	3	1	2	2	2	1	2	2	3	3	2
CO5	1	3	3	3	2	1	2	3	2	2	3	3	3	2	3

3 - Strong, 2 - Medium, 1- Low

Third Year	**CORE PRACTICAL 5**	**Semester V**
Code:	**ROBOTICS LAB** (Practical)	**Credits: 4**

COURSE OBJECTIVES:

This course aims to:

- Impart Practical Training related to Artificial Intelligence and Robotics and various movements of robots through hands on training.
- Explore Open source platforms used to experiment the kinematics.
- Implement autonomous functions such as navigation and obstacle avoidance.
- Integrate sensors and vision systems for object detection and identification.
- Perform robotics tasks execution using computer vision.

LIST OF EXPERIMENTS:

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system,
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place & simulation for Colour identification.
5. Robot programming and simulation for Shape identification.
6. Robot programming and simulation for machining (cutting, welding).
7. Writing practice robot programming.
8. Robot programming and simulation for any industrial process (Packaging, Assembly).
9. Robot programming and simulation for Obstacle Avoidance and Multi process.
10. Implement autonomous Robot navigation logic.
11. Interfacing sensors with robotic system.
12. Implement Vision-based object detection using camera.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Understand various graphical function for Robot functioning and Gain training on robot movement programming.
CO2	Understand the implementation of open source platforms.
CO3	Implement the robotics tasks execution.
CO4	Implement kinematics based experiment and know any robotic simulation.
CO5	Software to model the different types of robots and calculate work volume for different robots.

Third Year **CORE COURSE 9** **Semester VI**

Code: **HUMAN COMPUTER INTERACTION** **Credits: 4**

(Theory)

COURSE OBJECTIVES:

This course aims to:

- introduce the fundamental concepts, principles, and frameworks of Human-Computer Interaction (HCI).
- understand human cognitive, perceptual, and emotional factors that influence interaction with computer systems.
- familiarize students with user-centered design processes, usability engineering, and evaluation techniques.
- develop knowledge of universal design principles and user support systems for diverse user groups.
- provide an understanding of various interaction models and their application in designing effective interactive system

Unit – I: Foundation of HIC

Human-input –output channels- memory- thinking- emotion - Difference and similarities between them– Models of interaction– frame works - Ergonomics – styles – elements- interactivity - context .

Unit – II: Design and software process

Interactive design basic – process - HCI in software process: software life cycle – usability engineering – prototyping in practice- design rational. Design rules: principles, standards, guidelines, rules. -Evaluation – goals of evaluation - evaluation trough expert analysis.

Unit – III: Universal Design

Universal design principles – multimodal systems –user support – requirements – requirements- approaches – designing user support systems

Unit – IV: Models

Cognitive model – hierarchical model – linguistic model – physical and device model- - communication and collaboration models

Unit – V: Models of System

Models of the system- standard formalisms – interaction models – continuous behaviour

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned**.**

RECOMMENDED BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale – Human computer Interaction, 3rdEdition, Pearson Education, 2004.
2. Human- computer Interaction: Fundamentals and Practice, Gerard Jounghyun Kim, CRC Press , 2015

REFERENCES:

1. M.G. Helander, Handbook of Human-Computer Interaction, Elsevier Science, 2014
2. Biele, Cezary, Human Movements in Human –Computer Interaction (HCI), Springer International Publishing, 2021
3. Congnitive Behaviour and Human Computer Interaction Based on Machine learning algorithm, Wiley, 2021

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

CO1: Explain the fundamentals of Human-Computer Interaction, including human capabilities, interaction frameworks, and ergonomics.

CO2: Apply interactive design principles, usability engineering concepts, and evaluation methods in the development of user interfaces.

CO3: Analyze user requirements and design accessible, user-friendly systems based on universal design principles.

CO4: Interpret and utilize cognitive, linguistic, physical, and collaborative models in interface design and evaluation.

CO5: Evaluate interaction models and formal methods to design and improve interactive systems with continuous user interaction.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	2	1	1	2	1	1	2	2	3	2	1
CO2	1	3	2	3	2	2	2	3	2	2	3	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	1	3	2	3	2	3
CO4	1	3	2	3	3	1	2	2	2	1	2	2	3	3	2
CO5	1	3	3	3	2	1	2	3	2	2	3	3	3	2	3

3 - Strong, 2 - Medium, 1- Low

Third Year **CORE COURSE 10** **Semester VI**

Code: **DATA WAREHOUSING AND DATA MINING** **Credits: 4**
(Theory)

COURSE OBJECTIVES

This course aims to:

- understand the basic concepts of data warehousing and data mining.
- learn data pre-processing techniques for preparing data.
- study association, classification, and clustering methods.
- apply data mining algorithms to analyse data.
- evaluate the performance of data mining models.

UNIT – I: INTRODUCTION TO DATA WAREHOUSE

Introduction to Data warehouse, Difference between operational database systems and data warehouses, Data warehouse Characteristics, Data warehouse Architecture and its Components, Extraction-Transformation-Loading, Logical (Multi-Dimensional), Data Modelling, Schema Design, Star and Snow-Flake Schema, Fact Constellation, Fact Table, OLAP Cube, OLAP Operations, OLAP Server Architecture.

UNIT – II: INTRODUCTION TO DATA MINING

Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or Data Warehouse System, Major issues in Data Mining. Data Pre-processing: Need for Pre-processing the Data, Data Cleaning, Data Integration &Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT – III: ASSOCIATION RULES

Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIOIRI Algorithm

UNIT– IV: CLASSIFICATION:

Problem Definition, General Approaches to solving a classification problem, Evaluation of Classifiers , Classification techniques, Algorithm for Decision tree

Induction ; Naive-Bayes Classifier, K- Nearest neighbor classification-Algorithm and Characteristics. Prediction: Accuracy and Error measures, Evaluating the accuracy of classifier or a predictor, Ensemble methods

UNIT – V: CLUSTERING:

Clustering Overview, A Categorization of Major Clustering Methods, Partitioning Clustering-K-Means Algorithm, Hierarchical Clustering-Agglomerative Methods and divisive methods, Outlier Detection.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Data Mining- Concepts and -Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
2. Introduction to Data Mining, Psng-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

REFERENCES

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Warehousing Fundament's, PualrajPonnaiah, Wiley Student Edition. Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques', Cambridge University Press, 2019.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

CO1	Understand the basic concepts and the functionality of the various data mining and data warehousing component
CO2	Know the concepts of Data mining system architectures
CO3	Analyze the principles of association rules
CO4	Get analytical idea on Classification and prediction methods.
CO5	Gain knowledge on Cluster analysis and its methods

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	1	2	1	1	1	2	3	2	2	1	1
CO2	1	3	2	3	2	2	1	2	1	2	3	2	3	1	2
CO3	1	2	3	3	2	1	1	3	2	1	2	1	3	2	3
CO4	1	2	3	3	3	1	2	3	2	1	3	2	3	3	3
CO5	1	2	3	3	2	1	2	3	2	1	3	2	3	2	3

3 - Strong, 2 - Medium, 1- Low

Third Year **CORE COURSE 11** **Semester VI**

Code: **NATURAL LANGUAGE PROCESSING** **Credits: 4**
(Theory)

COURSE OBJECTIVES

This course aims to:

- introduce NLP concepts using Python (NLTK)
- understand text processing, linguistic structures, and corpora
- apply classification, tagging, and parsing techniques
- develop practical NLP applications
- gain hands-on experience with real datasets

UNIT – I: INTRODUCTION TO NLP

Overview of Natural Language Processing- Applications of NLP- Challenges in NLP- Basic Text Processing Techniques- Introduction to Python for NLP

UNIT – II: TEXT PREPROCESSING

Tokenization- Stop Words Removal- Stemming and Lemmatization- Regular Expressions- Text Normalization.

UNIT – III: LANGUAGE MODELING

N-gram Models- Probability Basics- Smoothing Techniques- Evaluation of Language Models.

UNIT – IV: MACHINE LEARNING FOR NLP

Feature Extraction (Bag of Words, TF-IDF)- Classification Algorithms- Naive Bayes and Logistic Regression- Model Evaluation Metrics.

UNIT – V: DEEP LEARNING IN NLP

Introduction to Neural Networks- Word Embeddings (Word2Vec, GloVe)- Recurrent Neural Networks (RNN)- LSTM and GRU Transformers and BERT

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned

RECOMMENDED BOOKS

1. Jurafsky, D., & Martin, J. H. (2025). Speech and language processing: An introduction to natural language processing, computational linguistics, and speech recognition (3rd ed.). Pearson.
2. Bird, S., Klein, E., & Loper, E. (2023). Natural language processing with Python (Updated ed.). O'Reilly Media.

REFERENCES

1. Sarkar, D. (2024). Text analytics with Python: A practical real-world approach to gaining actionable insights from text data (3rd ed.). Apress.
2. Eisenstein, J. (2019). Introduction to natural language processing. MIT Press.
3. Aggarwal, C. (2023). Neural networks and deep learning: A textbook (2nd ed.). Springer.
4. Lewis, M. (2024). Deep learning for natural language processing. CRC Press.

COURSE OUTCOMES

Upon successful completion of this course, the students would be able to:

CO1	explain the fundamental concepts, applications & Challenges of NLP.
CO2	apply text pre-processing techniques such as tokenization& stemming.
CO3	analyse language models using N-gram techniques.
CO4	Implement machine learning techniques for text classification.
CO5	Apply deep learning models and Transformers, for NLP tasks.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	2	1	1	1	0	2	2	2	2	1	1
CO2	1	3	2	2	2	1	1	3	1	2	3	2	2	2	1
CO3	1	3	3	3	2	1	1	3	1	2	3	3	3	2	2
CO4	1	3	3	3	3	1	1	3	2	2	3	3	3	3	2
CO5	1	3	3	3	3	1	1	3	2	3	3	3	3	3	3

3 - Strong, 2 - Medium, 1- Low

Third Year **PROJECT WORK** **Semester VI**

Code: **Credits: 4**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University.

The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

1. PROJECT REPORT EVALUATION (Both Internal & External)

I. Plan of the Project	- 20 marks
II. Execution of the Plan/collection of Data / Organisation of Materials / Hypothesis, Testing etc. and presentation of the report.	- 45 marks
III. Individual initiative	- 15 marks
2. Viva-Voce / Internal & External	- 20 marks
TOTAL	**- 100 marks**

PASSING MINIMUM:

Project	**Dissertation 80 Marks**– 40% out of 80 marks (i.e. 32 marks)	**Viva-Voce (20 Marks)** – Project 40% out of 20 Marks (i.e. 8 Marks)

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

SKILL ENHANCEMENT COURSE **Semester**

Code: **1. MOBILE APPLICATION DEVELOPMENT** **Credits: 2**

(Theory)

- Gain a comprehensive understanding of the basic concepts of mobile app using Android Platform
- Learn the detail framework of Android Platform
- Acquire the knowledge on the design aspects in Creating intuitive, reliable mobile apps using the android services and components
- Explore the various additional features of mobile app development
- Impart skills on Graphical features to design attractive web apps

UNIT – I: ANDROID PLATFORM

Introducing the Android Software Development Platform: Understanding Java SE and the Dalvik Virtual Machine-The Directory Structure of an Android Project-Common Default Resources Folders-The Values Folder- Leveraging Android XML-Screen Sizes-Desktop Clocks- Using Android Application Resources-Launching Application: The Android Manifest.xml File - Creating Your First Android Application

UNIT – II: ANDROID FRAMEWORK

Android Framework Overview: The Foundation of OOP: The Object-The Blue print for an Object: The Class-Providing Structure for Classes: Inheritance-Defining an Interface Bundling Classes-An overview of XML- The APK File-Android Application Components Android Activities- Android Services - Broad cast Receivers - Content Providers - Android Manifest XML.

UNIT – III: WORKING WITH SCREEN LAYOUTS

Screen Layout Design- Android View Hierarchies - Nesting Views-Defining Screen Layouts - Editing the main.xml File-Using Relative Layouts- Sliding Drawers-Using Padding and Margins with Views and Layouts.

UNIT – IV: WORKING WITH BUTTONS, MENUS, AND DIALOGS

UI Design: Buttons, Menus, and Dialogs: Using Common UI Elements- Adding an Image Button to Your Layout-Defining Multistate Image Button - Replacing the Default Background- Adding a Text to Your Layout- Adding an Image-Using Menus

in Android-Creating the Menu Structure with XML- Running the Application in the Android Emulator

UNIT – V: GRAPHICS IN ANDROID

An Introduction to Graphics Resources in Android: Introducing the Drawables-Implementing Images - Creating Animation in Android- Tween Animation in Android-Using Transitions

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned

RECOMMENDED BOOKS:

1. Jackson W, "Android Apps for Absolute Beginners", 1st Edition, Apress.

REFERENCES

1. Barry Burd **and** John Paul Mueller,Android Application Development All-in-One
   For Dummies, 3rd Edition, 2020
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2011.
3. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd,2010
4. Mark L Murphy, "Beginning Android3", Apress Publications, 2011.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Recall the elements of software development platform to build android programming
CO2	Understand the UI-component layouts, event handling, and screen orientations to develop mobile applications
CO3	Apply the Screen Layout and UI Design in Android Framework to implement the android apps
CO4	Organize the various resources and examine the parameter passing mechanism among them
CO5	Design and evaluate the user interfaces to support mobile application development

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	1	2	1	2	1	2	3	2	1	2	1
CO2	1	3	3	3	2	2	1	3	2	2	3	2	2	2	3
CO3	2	3	2	2	1	2	1	2	1	2	3	1	1	2	2
CO4	1	3	2	3	2	2	1	3	2	2	3	2	2	2	3
CO5	3	2	2	2	1	3	2	2	2	3	3	3	1	2	2

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE **Semester**

Code: **2. BIG DATA ANALYTICS** **Credits: 2**
(Theory)

COURSE OBJECTIVES:
This course aims to:

- Explain the concepts and applications of Big Data.
- Describe Big Data technologies and business applications.
- Apply data collection, storage, and management techniques.
- Use Hadoop & distributed processing frameworks for Big Data.
- Analyse data using machine learning, and visualization tools.

UNIT – I: INTRODUCTION

Concepts and Terminology – Big Data Characteristics – Different Types of Data –case study

UNIT – II: BIG DATA ADOPTION AND PLANNING CONSIDERATIONS

Data Identification – Data Acquisition and Filtering – Data Extraction – Data validation and cleansing – Data Aggregation and Representation

UNIT – III: ENTERPRISE TECHNOLOGIES AND BIG DATA BUSINESS INTELLIGENCE:

Online Transaction and Processing (OLTP) – Online Analytical Processing (OLAP) – Extract Transform Load (ETL) – Data Warehouses – Data Marts.

UNIT – IV: BIG DATA PROCESSING CONCEPTS

Distributed Data Processing – Hadoop – Processing Workloads – Cluster – Processing in Batch Mode – Map – Combine – Partition – Shuffle and Sort.

UNIT – V: BIG DATA STORAGE TECHNOLOGY

On-Disk Storage Devices – NoSQL Database – In- Memory Storage Device

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Paul Buhler, Wajid Khattak and Thomas Erl, "Big Data Fundamentals: Concepts, Drivers & Techniques", Prentice Hall Publications, 1st Edition, January 2016.
2. Dr. A.V.K. Shanthi, Dr. Praveen Kumar Misra, Dr. BramahHazela, Dr.Saptarshi Gupta, published a book "Big Data Analytics- Discovering, Analysying, Visualizing and Presenting Data", by Scientific International Publishing House.

REFERENCES

1. DT Editorial Services, "Big Data (Hadoop 2, Map Reduce, Hive, YARN, Pig, R and Data Visualization) Black Book", 1st Edition, Dreamtech Press, 2016.
2. Soumendra Mohanty, Madhu Jagadeesh, and Harsha Srivatsa, "Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics", Apress Media, 2013.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly Media, 2012
4. https://hadoop.apache.org/docs/r1.2.1/hadoop-project-dist/hadoop-common/GettingStarted.html.
5. https://www.pdfdrive.com/big-data-fundamentals-e187420663.html.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Recall the basics of Big Data and its applications
CO2	Know about OLTP, OLAP and ETL,
CO3	Apply the cutting – edge tools and technologies to analyze Big Data
CO4	Analyse various bigdata tools and techniques
CO5	Evaluate various storage and analytical techniques.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	1	1	1	-	1	-	1	2	1	2	1	1
CO2	1	3	2	2	2	1	1	2	1	1	2	1	2	1	2
CO3	1	3	3	3	3	2	2	3	2	2	2	2	3	2	3
CO4	1	3	3	3	2	2	2	3	2	2	3	2	3	2	3
CO5	1	3	3	3	2	2	2	3	3	2	3	2	3	2	3

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE **Semester**

Code: **3. CLOUD COMPUTING** **Credits: 2**
(Theory)

COURSE OBJECTIVES:

This course aims to:

- Understand the concept of cloud computing, its evolution, importance, characteristics, and benefits in modern computing.
- Understand different cloud service models (SaaS, PaaS, IaaS) and deployment models of cloud computing.
- Understand different types of scalability, load balancing, and scalability design techniques in cloud computing.
- Explain virtualization concepts and identify different types such as server, desktop, and data storage virtualization.
- Understand cloud security, data storage, disaster recovery, business continuity, and security threats in cloud computing.

UNIT – I: INTRODUCTION TO CLOUD COMPUTING

Evolution of Cloud Computing – Meaning of Cloud Computing – Need for Cloud Computing - Characteristics of Cloud Computing - Benefits of Cloud Computing.

UNIT – II: SERVICE MODELS

Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) - Deployment Models: Public Cloud, Private Cloud, Community Cloud and Hybrid Cloud.

UNIT – III: TYPES OF SCALABILITY

Horizontal Scalability, Vertical Scalability - Load Balancing -Designing for Scalability: Scale out, Scale in – Capacity Planning Vs Scalability.

UNIT – IV: VIRTUALIZATION TECHNOLOGY

Understanding Virtualization, History of Virtualization - Types of virtualizations: Server Virtualization, Desktop Virtualization, Data Storage Virtualization.

UNIT – V: SECURING THE CLOUD

General Security - Understanding Data Storage – Disaster Recovery and Business Continuity in the Cloud – Understanding the Threats.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Kris Jamsa, "Cloud Computing SaaS, Paas, IaaS, Virtualization Business Models, Mobile, Security and more", Published by Jones & Bartlet Learning, 2012.
4. A. Srinivasan and J.Suresh, "Cloud Computing – A Practical Approach for Learning and Implementation", Pearson India Publications, 2014.

REFERENCES

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley India Publication, 2012.
2. Rajkumar Buyya & Co., "Cloud Computing Principles and Paradigms", John Wiley & Sons Publications, 2011.
3. Anthony T. Velte , Toby J. Velte Robert Elsenpeter, "Cloud computing a practical approach", TATA McGraw- Hill , New Delhi – 2010.
4. Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, "Cloud computing for dummies", Wiley Publishing, Inc, 2010.
5. Comer, Douglas, The Cloud Computing Book: The Future of Computing Explained, CRC Press, 2021.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1 Describe the meaning, need, characteristics, evolution, and benefits

of cloud computing.

CO2 Identify and classify cloud service models and identify different cloud deployment models such as Public, Private, Community, and Hybrid Cloud.

CO3 Examine horizontal and vertical scalability, load balancing, and compare capacity planning with scalability.

CO4 Illustrate virtualization concepts and identify different types such as server, desktop, and data storage virtualization.

CO5 Analyze cloud security concepts, data storage, disaster recovery, and identify threats in cloud environments.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	1	1	1	1	-	1	2	2	1	1	1
CO2	1	3	2	3	2	1	1	2	-	1	3	2	2	1	2
CO3	1	3	2	3	3	2	1	3	2	2	3	2	2	1	3
CO4	2	3	2	2	2	2	1	2	2	2	3	2	2	2	3
CO5	1	3	1	2	2	1	1	2	1	2	2	2	1	1	2

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE **Semester**

Code: **4. INTERNET OF THINGS** **Credits: 2**

(Theory)

COURSE OBJECTIVES

This course aims to:

- Understand the fundamental concepts, architecture, technologies, and applications of the Internet of Things (IoT).
- Analyse IoT communication models, M2M systems, network management protocols, and enabling technologies.
- Apply IoT design methodologies to develop domain-specific IoT solutions.
- Develop IoT applications using Python programming and Raspberry Pi-based embedded systems.
- Explore cloud computing platforms and web services for IoT data storage, processing, and application deployment.

UNIT - I: INTRODUCTION

Definition & characteristics of IoT - physical design of IoT - logical design of IoT - IoT enabling Technologies - IoT levels & Deployment templates.

UNIT - II: DOMAIN SPECIFIC IOT

Home Automation - cities - Environment - Energy - retail - logistics - Agriculture - Industry Health and life style.

UNIT – III: IoT and M2M

Deference between IoT and M2M - SDN and NFV for lot - IoT systems management - SNMP - YANG – NETOPEER.

UNIT-III: IoT SPECIFICATION

IoT platforms design Methodology - Domain model specification - Information model specification - IoT level specification - functional view specification - Application Development.

UNIT-IV: LOGICAL DESIGN USING PYTHON

Logical design using python - IoT physical devices and Endpoints, building blocks of IoT device- Raspberry Pi-Linux on Raspberry Pi - Raspberry Pi interfaces.

UNIT-V: IoT AND CLOUD COMPUTING

IoT physical servers & cloud computing-WAMP-Xively cloud for IoT- python Web application framework-Amazon web services for IoT.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned**.**

RECOMMENDED BOOKS:

1. Bahga, A., & Madisetti, V. K. (2015). Internet of things: A hands-on approach. Universities Press.
2. Srinivasa, K. G., Siddesh, G. M., & Raju, R. H. (2018). Internet of things. Cengage Learning India.

REFERENCES:

1. Greengard, S. (2015). The Internet of things. MIT Press.
2. Tripathy, B. K., & Anuradha, J. (2017). Internet of things (IoT): Technologies, applications, challenges and solutions. CRC Press.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1: Explain the basic concepts, characteristics, and architecture of IoT.

CO2: Identify IoT applications in various domains such as smart homes, cities, agriculture, and healthcare.

CO3: Describe IoT communication, management concepts, and related protocols.

CO4: Apply IoT design methodologies and specifications to develop IoT solutions.

CO5: Develop simple IoT applications using Python, Raspberry Pi, and cloud platforms

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.93
CO2	3	3	2	2	2	1	1	3	2	2	3	2	2	3	2	2.20
CO3	3	3	3	2	2	1	1	2	2	2	3	3	2	2	2	2.20
CO4	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.40
CO5	3	3	2	3	2	2	1	3	2	2	3	3	3	3	2	2.47
Average	3.00	3.00	2.40	2.40	2.00	1.20	1.00	2.60	1.80	2.00	3.00	2.60	2.20	2.60	1.80	2.24

3 - Strong, 2 - Medium, 1 – Low

SKILL ENHANCEMENT COURSE **Semester**

Code: **5. OPEN SOURCE TECNOLOGIES** **Credits: 2**

(Theory)

COURSE OBJECTIVES:

This course aims to

- explain the need and importance of open source software.
- gain knowledge of the Linux operating system, including its architecture, processes, scheduling, and development environment.
- explore MySQL database management, including database creation, queries, and data manipulation operations.
- implement PHP programming concepts for web development, including variables, data types, functions, OOP, and file handling.
- explore Perl programming with file and data handling.

UNIT - I: INTRODUCTION

Introduction to open sources – Need of open sources–advantages of open sources – application of open sources. Open Source vs Commercial Software.

UNIT - II: OPEN SOURCE OPERATING SYSTEMS

LINUX: Introduction – general overview – Kernel mode and user mode – process– advanced concepts – scheduling–personalities – cloning – signals–development with Linux.

UNIT - III: MySQL

Introduction to MY SQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.

UNIT - IV: PHP

Introduction–programming in web environment–variables- constants–data types – operators –statements – functions – arrays – OOP – string manipulations and regular expression – file handling and error handling.

UNIT - V: PEARL

Pearl back grounder – pearl overview – pearl parsing rules–variables and data statements and control structures– subroutines, packages and modules– working with files– data manipulation.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOK:

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, James Lee and Brent Ware, Dorling Kindersley (India) Pvt. Ltd, 2008.

REFERENCES:

1. Remy Card, Eric and Frank Mevel ,The Linux Kernel Book, ,Wiley Publications, 2003 Steve Suchring, John, MySQL Bible, Wiley, 2002.
2. Rasmus Lerdorf and Levin Tatroe, Programming PHP, O Reilly, 2002
3. Wesley J. Chun, Core Python Programming, Prentice Hall, 2001
4. Martin C. Brown, Perl: The Complete Reference,2ndEdn, TMH, 2009
5. Vikram Vaswani, MySQL: The Complete Reference, 2ndEdn,TMH,2009

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

CO1	To understand the fundamentals of open source software.
CO2	To Demonstrate knowledge of Linux operating system concepts.
CO3	To apply database concepts using MySQL to create, manage, and manipulate databases using SQL queries including join and data operations.
CO4	To develop web-based applications using PHP.
CO5	To analyze and implement scripting solutions using Perl.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	1	2	1	1	-	2	2	2	1	1	1
CO2	1	3	2	2	2	2	1	2	1	2	3	2	2	1	2
CO3	1	3	2	3	2	1	1	3	1	2	3	2	2	1	2
CO4	2	3	2	3	2	2	1	3	1	2	3	3	2	1	3
CO5	1	3	3	3	2	2	1	3	2	2	3	2	2	1	3

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE **Semester**

Code: **6. VIRTUAL REALITY AND AUGMENTED REALITY** **Credits: 2**

(Theory)

COURSE OBJECTIVES:

This course aims to:

- understand the basic concepts and evolution of Virtual Reality (VR) and Augmented Reality (AR).
- identify the hardware and software components used in VR and AR systems.
- understand the design and development aspects of VR and AR applications.
- explore the current trends and future scope of immersive technologies.
- examine the applications of VR and AR in various domains.

UNIT – I: INTRODUCTION TO VR AND AR

Definition and concepts of Virtual Reality and Augmented Reality – Types of VR and AR – History and evolution – Technology hype cycle.

UNIT – II: VR AND AR TECHNOLOGIES

VR and AR hardware – Head-mounted displays and controllers – Features and functionalities – Current challenges and adoption trends.

UNIT – III: DESIGN AND DEVELOPMENT OF VR AND AR

Consumer-grade VR and AR systems – Design principles for immersive environments – Planning and development of VR/AR applications.

UNIT – IV: FUTURE OF VR AND AR

Emerging trends in VR and AR – Social experiences in virtual environments – Future opportunities and challenges.

UNIT – V: APPLICATIONS OF VR AND AR

Applications in Education, Entertainment, Tourism, Retail, Healthcare, Real Estate, and Marketing – Mobile AR applications such as Google Translate, Amazon AR View.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Jonathan Linowes, Augmented Reality for Developers: Build Practical Augmented Reality Applications with Unity, ARCore, ARKit, and Vuforia, 2nd Edition, Packt Publishing, 2023.

2. Tony Parisi, Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, 2nd Edition, O'Reilly Media, 2024.

REFERENCES

1. Steve Aukstakalnis, Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR, Addison-Wesley Professional, 2022.

2. Paul Mealy, "Virtual & Augmented Reality For Dummies" Published by: John Wiley & Sons, Inc., John Wiley & Sons, Inc., 2018.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1 Explain the fundamentals and evolution of VR and AR.

CO2 Identify the key hardware and software components of VR and AR.

CO3 Apply basic design principles for VR and AR applications.

CO4 Analyse VR and AR applications in various domains.

CO5 Evaluate current trends and future challenges in VR and AR technologies.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	1	2	1	1	1	-	1	2	2	1	3	1
CO2	1	3	3	3	2	1	2	3	2	1	3	2	2	3	3
CO3	2	2	3	2	1	2	2	3	2	2	3	2	2	2	3
CO4	1	3	2	3	3	2	1	2	3	2	3	2	3	2	3
CO5	3	2	2	2	1	3	2	1	1	2	2	2	1	2	2

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENTCOURSE **Semester**

Code: **7. DEEP LEARNING** **Credits: 2**

(Theory)

COURSE OBJECTIVES:

This course aims to:

- remember machine learning fundamentals.
- introduce the fundamental concepts in deep learning
- provides the massive datasets and affordable computing
- explore new applications in computer vision and natural language processing.
- design, implement and train models to solve real world problems.

UNIT – I: NEURAL NETWORK

The neural network – building intelligent machines – Limits of traditional computer programs – Mechanics of Machine learning – Neuron – Expressing Linear perceptrons – feed –forward neural networks- types of neurons –liner neurons – sigmoid, Tanh and ReLU neurons – softmax output layers

Unit – II: PyTorch

Introduction – tensors – Gradients in PyTorch- PyTorch nn module – PyTorch Datasets and Dataloaders.

UNIT –III: CONVOLUTIONAL NEURAL NETWORK

Human vision - feature selection – filters and feature maps – Full Descritpion of the convolutional layer- max pooling – full architectural Description of convolution networks –building a convolutional network - visualizing learning in convolutional networks.

UNIT –IV: RECURRENT NEURAL NETWORKS

Long short-term memory units – PyTorch primitives for RNN models- implementing a sentiment analysis model- Memory Augmented Neural network- Neural Turing machines- attention based memory access- NTM memory addressing mechanisms.

UNIT –V: DEEP REINFORCEMENT LEARNING

Deep Reinforcement Learning – reinforcement learning – Markov Decision Process – Explore Vs Exploit – Pole –cart with policy gradients- Q-learning

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Nikhil Buduma, Nicholas Locascio – Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms. O' Reilly Media, 2017.
2. Lan Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive computation and Machine Learning seriesI MITPress, 2017

REFERENCES:

1. Gibson, Adam, and Patterson, Josh, Deep Learning: A Practitioner's Approach, O' Reilly Media, 2017.
2. Charniak, Eugene, Introduction to Deep Learning, MITPress, 2019.
3. Locascio, Nicholas, and Buduma Nikhil, Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms. O' Reilly Media, 2017.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able:

CO1	Understand the convolution, recurrent and other neural network architecture for deep learning
CO2	Implement deep learning models in phthon using the PyTorch library and train them with real world datasets
CO3	Gain knowledge on various tools used for deep learning and its applications.
CO4	Understand the recurrent neural networks with attention mechanisms for natural language classification, generation and translation.
CO5	Understand how to evaluate the performance of different deep learning models.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	3	2	2	2	1	1	2	1	1	2	2	3	2	1
CO2	1	3	2	3	2	2	1	3	2	2	3	3	2	2	3
CO3	1	3	1	2	2	2	1	2	1	2	2	2	2	3	2
CO4	2	3	2	3	2	1	1	2	2	1	2	2	3	3	2
CO5	1	2	3	3	2	1	2	3	2	2	3	2	3	2	3

3 - Strong, 2 - Medium, 1- Low

First Year	INTERDISCIPLINARY COURSE 1	Semester I
Code:	FUNDAMENTALS OF INFORMATION TECHNOLOGY (Theory)	Credits: 2

COURSE OBJECTIVES

This course aims to:

- Understand the fundamental concepts and evolution of computers.
- Learn the components of computer systems.
- gain knowledge of software, operating systems, and database systems.
- understand computer networks, the Internet, email, and web technologies.
- explore applications and computer security concepts.

UNIT – I: INTRODUCTION TO COMPUTERS

Introduction to Computers - Generation of Computers - Classification of Digital Computer - Anatomy of Digital Computer.

UNIT – II: COMPUTER HARDWARE

CPU and Memory - Secondary Story Devices - Input Devices - Output Devices.

UNIT – III: COMPUTER SOFTWARE

Introduction to Computer Software - Programming Language-Operating System - Introduction to Database Management System.

UNIT – IV: NETWORKS

Computer Networks - WWW and Internet - Email - Web Design

UNIT – V: APPLICATIONS AND SECURITY

Computers at Home, Education, Entertainment, Science, Medicine and Engineering - Introduction to Computer Security - Computer Viruses, Bombs, Worms.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned

RECOMMENDED BOOKS:

1. Alexis Leon and Mathews Leon, Fundamentals of Information Technology, Vikas Publishing House Pvt. Ltd, 2009
2. Fundamentals of Computers and Information Technology, M.N Doja,2005

REFERENCES:

1. Ramesh Bangia,"Computer Fundamentals and Information Technology", Laxmi Publications Pvt Limited, 2008.
2. Bharihoke, "Fundamentals of Information Technology", Excel Books, 2009.
3. Ralph Stair, George Reynolds, "Fundamentals of Information Systems" Cengage Learning, 2015

COURSE OUTCOMES

Upon successful completion of this course, students will be able to:

CO1: Explain the basic concepts, generations, classifications, and architecture of computers.
CO2: Describe the functions of CPU, memory, input devices, output devices, and storage devices.
CO3: Explain computer software, programming languages, operating systems, and database management systems.
CO4: Demonstrate knowledge of computer networks, the Internet, email, and web design concepts.
CO5: Analyse the applications of computers and identify common security threats such as viruses, worms, and malware.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean CO
CO1	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.9
CO2	3	3	2	2	2	1	1	3	2	2	3	2	2	3	2	2.2
CO3	3	3	3	2	2	1	1	2	2	2	3	3	2	2	2	2.2
CO4	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.4
CO5	3	3	2	3	2	2	1	3	2	2	3	3	3	3	2	2.5
	3.0	3.0	2.4	2.4	2.0	1.2	1.0	2.6	1.8	2.0	3.0	2.6	2.2	2.6	1.8	2.3

3 - Strong, 2 - Medium, 1- Low

First Year **INTERDISCIPLINARY COURSE 2** **Semester II**

Code: **WORKING PRINCIPLES OF INTERNET** **Credits: 2**
(Theory)

COURSE OBJECTIVES

This course aims to:

- Understand the fundamentals and architecture of the Internet.
- Learn various methods of Internet connectivity and online communication.
- Explore the World Wide Web and common Internet tools.
- Understand multimedia, e-commerce, and intranet applications.
- Gain awareness of Internet security and safe online practices.

UNIT – I: INTRODUCTION TO THE INTERNET

Basics of Internet – Internet Architecture – Basic Internet Services.

UNIT – II: INTERNET CONNECTIVITY AND COMMUNICATION

Connecting to the Internet – Internet Service Providers – E-mail – Online Communication Tools.

UNIT – III: WORLD WIDE WEB

How the World Wide Web Works – Web Browsers – Search Engines – Common Internet Tools.

UNIT – IV: INTERNET APPLICATIONS

Multimedia on the Internet – Intranet – E-Commerce and Online Shopping.

UNIT – V: INTERNET SECURITY

Internet Security Basics – Safe Browsing Practices – Cyber Threats – Privacy and Data Protection.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOK

1. Xavier, C. (2021). Fundamentals of Internet and emerging technologies (1st ed.). New Age International Publishers.

REFERENCES

1. Comer, D. E. (2018). The Internet book: Everything you need to know about computer networking and how the Internet works (5th ed.). CRC Press.
2. Fox, R., & Hao, W. (2017). Internet infrastructure: Networking, web services, and cloud computing. CRC Press.

COURSE OUTCOMES

Upon successful completion of this course, students will be able to:

CO1: Explain the basic concepts and architecture of the Internet.

CO2: Use Internet services and communication tools effectively.

CO3: Demonstrate the use of the World Wide Web and common Internet tools.

CO4: Apply Internet-based services such as multimedia applications and online shopping.

CO5: Identify Internet security threats and adopt safe online practices.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean CO
CO1	2	3	2	2	2	2	1	1	1	1	2	3	2	2	1	1.8
CO2	3	3	2	2	2	2	1	1	2	2	3	3	3	3	2	2.3
CO3	3	3	3	1	2	3	2	3	3	2	3	2	2	2	1	2.3
CO4	3	3	3	3	3	2	2	3	1	2	3	3	3	3	2	2.6
CO5	3	3	1	3	2	3	1	2	2	3	3	3	2	2	2	2.3
	2.8	3.0	2.2	2.2	2.2	2.4	1.4	2.0	1.8	2.0	2.8	2.8	2.4	2.4	1.6	2.3

3 - Strong, 2 - Medium, 1 – Low

Second Year **INTERDISCIPLINARY COURSE 3** **Semester III**

Code: **DIGITAL MARKETING** **Credits: 2**
(Theory)

COURSE OBJECTIVES

This course aims to:

- Understand the fundamentals of digital marketing and e-business.
- Learn the components of the online marketing mix.
- Explore digital media channels and online promotional strategies.
- Analyse online consumer behaviour and website characteristics.
- Evaluate digital branding concepts and brand performance metrics.

UNIT – I: INTRODUCTION TO DIGITAL MARKETING

Digital Marketing – Transition from Traditional Marketing to Digital Marketing – Growth of E-Concepts – Growth of E-Business.

UNIT – II: ONLINE MARKETING MIX

Online Marketing Mix – E-Product – E-Promotion – E-Price – E-Place.

UNIT – III: DIGITAL MEDIA CHANNELS

Digital Media Channels – Search Engine Marketing (SEM) – Electronic Public Relations (ePR) – Affiliate Marketing – Interactive Display Advertising.

UNIT – IV: ONLINE CONSUMER BEHAVIOR

Online Consumer Behavior – Factors Influencing Online Consumers – Cultural Implications of Key Website Characteristics**.**

UNIT – V: DIGITAL BRAND ANALYSIS

Digital Brand Analysis – Meaning – Benefits – Components – Brand Share Dimensions – Brand Audience Dimensions.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Chaffey, D., & Ellis-Chadwick, F. (2024). Digital marketing: Strategy, implementation and practice (9th ed.). Pearson Education.
2. Ryan, D. (2024). Understanding digital marketing: Marketing strategies for engaging the digital generation (6th ed.). Kogan Page.

REFERENCES

1. Kingsnorth, S. (2022). Digital marketing strategy: An integrated approach to online marketing (3rd ed.). Kogan Page.
2. Tuten, T. L., & Solomon, M. R. (2024). Social media marketing (5th ed.). Sage Publications.

COURSE OUTCOMES

Upon successful completion of this course, students will be able to:

CO1: Explain the concepts of digital marketing, e-business, and online business models.

CO2: Apply the online marketing mix elements in digital business environments.

CO3: Analyse the role of digital media channels and online promotional strategies.

CO4: Evaluate online consumer behaviour and website characteristics influencing customer decisions.

CO5: Assess digital brand performance using brand share and audience dimensions.

Mapping with Programme Outcomes and Programme Specific Outcomes

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean CO
CO1	2	3	2	2	2	2	1	1	1	1	2	3	2	2	1	1.8
CO2	3	3	2	2	2	2	1	1	2	2	3	3	3	3	2	2.3
CO3	3	3	3	1	2	3	2	3	3	2	3	2	2	2	1	2.3
CO4	3	3	3	3	3	2	2	3	1	2	3	3	3	3	2	2.6
CO5	3	3	1	3	2	3	1	2	2	3	3	3	2	2	2	2.3
	2.8	3.0	2.2	2.2	2.2	2.4	1.4	2.0	1.8	2.0	2.8	2.8	2.4	2.4	1.6	2.3

3 - Strong, 2 - Medium, 1 – Low

Second Year **INTERDISCIPLINARY COURSE 4** **Semester IV**

Code: **INTRODUCTION TO ARTIFICIAL INTELLIGENCE** **Credits: 2**

(Theory)

COURSE OBJECTIVES:

This course aims to:

- Understand the fundamentals of Artificial Intelligence, including Machine Learning, Deep Learning, and types of AI.
- Develop problem-solving skills using intelligent agents, search methods, and knowledge-based systems.
- explore the principles, types, and working mechanisms of prompt engineering and its role in improving communication with large language models.
- examine emerging trends in AI, including ethical issues, AI services, expert systems, and the integration of AI with IoT.
- understand how AI is applied across various industries such as healthcare, finance, retail, agriculture, education, and transportation.

UNIT – I: Introduction to Artificial Intelligence

Artificial Intelligence, How Does AI Work?, Advantages and Disadvantages of Artificial Intelligence, History of Artificial Intelligence, Types of Artificial Intelligence, Weak AI, Strong AI, Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness. Machine Learning and Deep Learning.

UNIT – II: Meaning of Intelligence

Human Intelligence vs Machine Intelligence – Agents and their Environment (basic concepts with examples) – Introduction to Problem Solving in AI – Basic Concepts of Search Methods – Simple Search (Uninformed) – Smart Search (Informed) – Introduction to Knowledge in AI – Knowledge-Based Systems (basic idea) – Types of Knowledge (facts and rules).

UNIT – III: Introduction to Prompt Engineering

Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work?, The Advantages of Prompt Engineering, The Future of LLM Communication.

UNIT – IV: Trends in AI

AI and Ethical Concerns, AI as a Service (AIaaS), Recent trends in AI, Expert System, Internet of Things, Artificial Intelligence of Things (AIoT).

UNIT –V: Industrial Applications of AI
Application of AI in Healthcare, Application of AI in Finance, Application of AI in Retail, Application of AI in Agriculture, Application of AI in Education, Application of AI in Transportation, AI in Experimentation and Multi-disciplinary research.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, Artificial Intelligence, McGraw Hill Education.
2. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024.

REFERENCES:

1. Reema Thareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023.
2. Ajantha Devi Vairamani and Anand Nayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319).

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1 understand the fundamentals of Artificial Intelligence.

CO2 learn the concept of intelligence by comparing human and machine intelligence, and understand agents, environments, and basic problem-solving techniques in AI.

CO3 gain knowledge of search strategies, knowledge representation, and basic concepts of knowledge-based systems.

CO4 understand the concept of prompt engineering and its role in interacting with modern AI systems and large language models.

CO5 explore recent trends in AI and its applications across various industries along with ethical considerations.

Mapping with Programme Outcomes and Programme Specific Outcomes

(COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	2	1	1	1	-	2	2	3	3	2	2
CO2	1	3	3	3	2	1	1	3	1	2	2	3	3	2	3
CO3	1	3	3	3	2	1	1	3	1	2	3	3	3	2	3
CO4	2	3	2	2	1	2	1	2	1	3	2	3	2	1	3
CO5	2	3	2	2	2	2	1	2	2	3	3	3	3	3	3

3 - Strong, 2 - Medium, 1- Low