Master of Computer Applications

Syllabus

AFFILIATED COLLEGES

Program Code: 38M

2025 – 2026

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The **M.C.A.** programme describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	To emerge as a System Analyst/ Software Engineer/ Data Analyst.
PEO2	The students can come up with a good solution for Business Models
PEO3	Design and Development of solutions to System Security
PEO4	Emerge as a Good Teacher and Researcher.

Program Specific Outcomes (PSOs)	
After the successful completion of **MCA** programme, the students are expected to:	
PSO1	Obtain sound knowledge in the basic concepts of computer science including theory and programming familiar with relevant trends in computer science domains.
PSO2	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PSO3	Acquire professional skills in software design process and practical competence in broad range of open source programming languages to withstand technological change and provide solutions to new ideas and innovations.
PSO4	Able to pursue careers in IT industry/ consultancy/ research and development, teaching and allied areas related to computer applications.
PSO5	Provide various computing skills like analysis, design and development of innovative software products to meet the industry needs with legal, ethical and social acceptable solutions for computer based technical problems.

Program Outcomes (POs)	
On successful completion of the **M.C.A.** programme	
PO1	Develop creativity and problem-solving skills with knowledge of computing and mathematics.
PO2	Ability to develop and carry out experiments, interpret and infer data.
PO3	Design algorithms and develop software to aid solutions to industry and governments.
PO4	Review the latest technology and tool handling mechanism.
PO5	Analyze the outcome to solve global environment related issues.
PO6	Apply the knowledge in lifelong learning journey to equip themselves.
PO7	Identify the perspective of business practices, risks and limitations.
PO8	Work with professional and ethical values.
PO9	Formulate the responsibilities of human rights and entrepreneurial spirit.
PO10	Understand the methods to communicate effectively and work collectively.

BHARATHIAR UNIVERSITY, COIMBATORE 641 046

M.C.A. (CBCS PATTERN)

(Affiliated Colleges)

(For the students admitted for the academic year 2025 – 26 & onwards)

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
	Core I: OOPS with Java Programming	4	4	-	25	75	100
	Core II: Advanced Database Management System	4	4	-	25	75	100
	Core III: Computer Networks	4	4	-	25	75	100
	Core IV: Operating Systems	4	4	-	25	75	100
	Elective I	4	4	-	25	75	100
	Practical I: Java Programming Lab	3	-	5	40	60	100
	Practical II: DBMS Lab	3	-	5	40	60	100
	Total	**26**	**20**	**10**	**205**	**495**	**700**
SECOND SEMESTER							
	Core V: Data Mining and Data Analytics	4	4	-	25	75	100
	Core VI: Python Programming	4	4	-	25	75	100
	Core VII: Operations Research	4	4	-	25	75	100
	Core VIII: Software Project Management	4	4	-	25	75	100
	Elective II	4	4	-	25	75	100
	Practical III: Data Mining Lab	3	-	4	40	60	100
	Practical IV: Python Programming Lab	3	-	4	40	60	100
	Practical V: Web Application Development and Hosting	2	-	2	20	30	50
	Total	**28**	**20**	**10**	**225**	**525**	**750**
THIRD SEMESTER							
	Core IX: Open-Source Computing	4	4	-	25	75	100
	Core X: Artificial Intelligence and Machine Learning	4	4	-	25	75	100
	Core XI: Network Security and Cryptography	4	4	-	25	75	100
	Core XII: Cloud Computing	4	4	-	25	75	100
	Elective III	3	3	-	25	75	100
	Practical VI: Open-Source Computing Lab	3	-	4	40	60	100

	Practical VII: Artificial Intelligence and Machine Learning Lab	3	-	4	40	60	100
	Practical VIII: Mini Project	2	-	2	50	50	*100
	Health Wellness	1	1	-	100	-	100
	Total	**28**	**20**	**10**	**355**	**545**	**900**
FOURTH SEMESTER							
	Main Project	8			100	100	**200
	Total	8					
	Grand Total	**90**			**100**	**100**	**2550**
ONLINE COURSES							
1.	# SWAYAM – MOOC – Online Course	2					
2.	**#Job Oriented Certificate Course**	2					

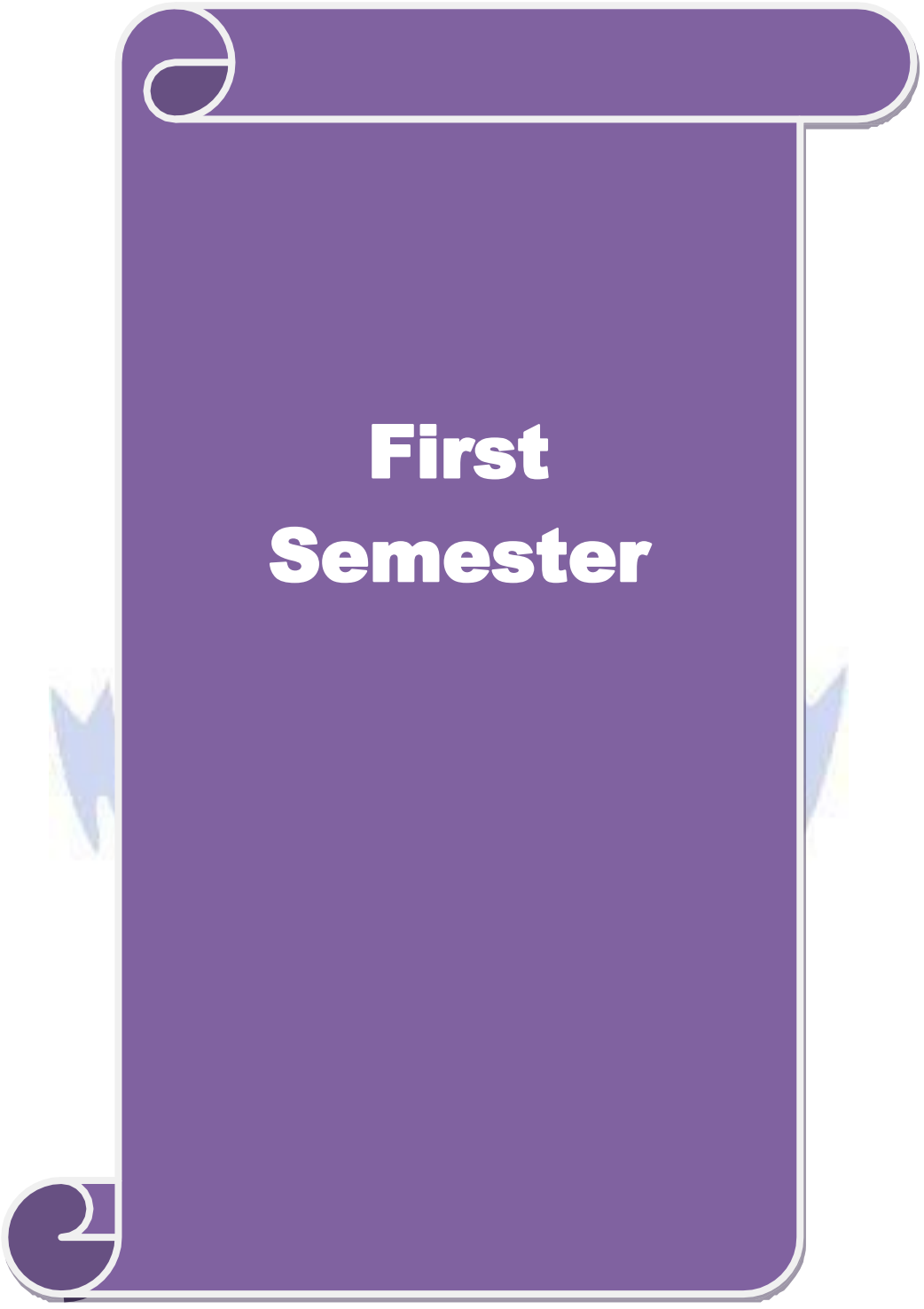
* Mini Project report - 80 marks, Viva-voce – 20 marks
  - Internal - 50 marks [Project Report - 40 Marks] + [Viva-voce - 10 Marks]
  - External - 50 marks [Project Report - 40 Marks] + [Viva-voce -10 Marks]

** Major Project report - 160 marks; Viva-voce – 40 marks
  **Internal -100 marks [Project Report - 80 Marks] + [Viva-voce - 20 Marks]
  **External - 100 marks [Project Report - 80 Marks] + [Viva-voce - 20 Marks]

During II or III Semester (Optional)

LIST OF ELECTIVES

- .NET Programming
- Mobile Computing
- Deep Learning
- Embedded Systems
- Web Services
- Natural Language Processing
- Virtual and Augmented Reality
- Internet of Things
- PHP Programming
- Digital Image Processing
- Cyber Security
- Advancements in Industry 4.0


First
Semester

Course code		OOPS WITH JAVA PROGRAMMING	L	T	P	C
Core/ Elective / Supportive		Core	4			4
Pre-requisite		Basic knowledge of programming logic and structured programming.	Syllabus		2025 - 26	

Course Objectives:

The main objectives of this course are:

1. To provide foundational knowledge in Java programming syntax, control structures, and data types.
2. To enable students to implement object-oriented programming concepts such as classes, inheritance, and polymorphism.
3. To develop skills in utilizing Java utilities including collections, generics, multithreading, and exception handling.
4. To equip students with the ability to build GUI-based applications using JavaFX.

Course Outcomes:

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

1	Recall and explain Java fundamentals including operators, control structures, arrays, and I/O mechanisms.	K1, K2
2	Apply object-oriented concepts such as classes, constructors, inheritance, and interfaces in Java programs.	K3, K4
3	Analyze and handle Java utilities like Strings, Collections, Generics, and Exceptions in real-time scenarios.	K4
4	Evaluate and implement multithreaded applications using Java's concurrency features.	K5
5	Design and develop interactive GUI applications using JavaFX controls and menus.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	JAVA FUNDAMENTALS	12 Hours

Introduction: History of Java, Java Class Libraries - Basics of a Typical Java Environment - **Operators:** Arithmetic, Equality, Relational, Assignment, Increment, Decrement, Logical - **Control Structures:** if, if-else, while, for, switch, do-while, break, continue - **Primitive Data Types** - **Arrays:** Single and Multidimensional - References and Reference Parameters - Passing Arrays to Methods – **I/O Basics**: Reading Console Input – Writing Console Output

Unit:2	OBJECT-ORIENTED PROGRAMMING IN JAVA	12 Hours

Methods: Definitions, Overloading, Scope Rules - **Classes and Objects:** Class Structure and Scope, Access Control to Members, Creating and Using Objects, Constructors and Overloaded Constructors - **Inheritance and Polymorphism:** Member Access and Inheritance, Using super, Creating a Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Using final with Inheritance, Abstract Classes and Methods, Compile-time and Runtime Polymorphism - **Interfaces:** Defining and Implementing Interfaces - **Packages:** Defining a Package, Importing a Package, User Defined Packages.

Unit:3	JAVA UTILITIES AND EXCEPTION HANDLING	12 Hours

String Constructors and Methods: length(), charAt(), getChars(), hashCode(), valueOf(), intern() - Substrings and String Concatenation - StringBuffer and StringTokenizer Classes - **Collections Framework:** List, Set, Map Interfaces and Implementations - **Generics:** Generic Methods and Classes - **Multithreading Basics:** Creating Threads, Runnable Interface, Synchronization - **Exception Handling:** Types of Exceptions, Try-Catch-Finally Blocks, Multiple Catch Clauses, Throw and Throws, Creating User-Defined Exceptions

Unit:4	I/O STREAMS AND BASICS OF JAVA FX	11 Hours
I/O Streams: Byte Streams - Character Streams – File I/O **Introducing GUI Programming with JavaFX**: JavaFX Basic Concepts - A JavaFX Application Skeleton - Compiling and Running a JavaFX Program - A Simple JavaFX Control: Label - Using Buttons and Events - Drawing Directly on a Canvas.		
Unit:5	**GUI PROGRAMMING WITH JAVAFX**	**11 Hours**
Exploring JavaFX Controls: Using Image and ImageView – ToggleButton – RadioButton – CheckBox – ListView – ComboBox - TextField – ScrollPane – TreeView - Introducing Effects and Transforms. **Introducing JavaFX Menus**: Menu Basics - An Overview of MenuBar, Menu, and MenuItem - Create a Main Menu - Add Mnemonics and Accelerators to Menu Items - Add Images to Menu Items - Use RadioMenuItem and CheckMenuItem - Create a Context Menu - Create a Toolbar.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 Hours**

Text Books	
1	Deitel and Deitel, “Java How to Program”, 9 th Edition, Pearson, New Delhi, 2012.
2	Schildt Herbert, “Java – The Complete Reference”, 9th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014
3	E. Balagurusamy, “Programming with Java– A Primer”, 7th Edition, TMH, 2022.
Reference Books	
1	C.Xavier, “Programming with Java 2”, SciTech Publications (India) P. Ltd.
2	Deitel and Deitel, “Java How to Program: An Objects-Natural Approach”, 12th Edition, Pearson, New Delhi, 2019
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/java-programs
2	https://www.tutorialspoint.com/java/index.htm
3	https://nptel.ac.in/courses/106/105/106105191/
4	https://spring.io/projects/spring-boot
5	https://www.geeksforgeeks.org/advance-java/spring-boot/

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

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

Course code		ADVANCED DATABASE MANAGEMENT SYSTEMS	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basic knowledge about database	Syllabus Version		2025 - 26	

Course Objectives:

The main objectives of this course are to:

1. To enable the students to understand the basics of SQL and NoSQL databases.
2. To enable the students to learn the MySQL basics.
3. To enable the students to apply MySQL database concepts like Queries, index, clause, joins and aggregations.
4. Make the students to understand the fundamentals of MongoDB with simple example.
5. To enable the students to apply MongoDB concepts like index, aggregations, pipeline & replication.

Expected Course Outcomes:

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

1	Understood the basic principles of databases, SQL & NoSQL databases	K1, K2
2	Gained knowledge over various database models, SQL and NoSQL statements	K1, K2
3	Construct Logical database design	K2, K3
4	Apply the concepts CRUD, Indexing, Filters, Documents and collections for the real-time tasks.	K2, K3, K4, K6
5	Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a SQL and NoSQL databases.	K2, K3, K4, K5

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6**– Create

Unit:1	INTRODUCTION TO SQL AND NoSQL DATABASE	12Hours

Introduction to database : Need of a database – Different types of database – Relational vs. Non-relational database – Different types of SQL databases – Introduction of MySQL – MySQL Features – MySQL Advantages – MySQL installation –Introduction to NoSQL databses : Introduction to NoSQL Databases – NoSQL features, Different types of NoSQL databases.

Unit:2	MySQL BASICS,USERS,DATABASE, TABLE, VIEWS & CONSTRAINTS	12 Hours

MySQL architecture: Data types, variables, storage engines (InnoDB, MyISAM). User Management: Create user – Drop user – Show users. Databases: Create Database – Select Database – Show Database – Drop Database. Tables and Views: MySQL Create table – Alter table – Show table – Drop table – Truncate table – Copy table – MySQL views. Constraints: Primary key – Foreign key – Unique key – Composite key.

Unit:3	MySQL QUERIES,INDEX,CLAUSE, JOINS AND AGGREGATION	12Hours

MySQL queries: Insert – Select – Update – Delete- sub queries and correlated sub queries. MySQL Indexes: Create Index – Show Index – Drop Index – MySQL Clustered Vs. Non-Clustered Index.MySQL Clauses: Where- AND-OR-LIKE-LIMT-Order By – Group By – Having – Distinct – Union – Union All. MySQL Joins: Inner –Outer – Cross – Self. MySQL Aggregate functions: sum() – avg() – count() – min() – max() – first() – last().

Unit:4	MongoDB Basics, DOCUMENTS AND COLLECTIONS & CRUD	12 Hours

Introduction to MongoDB - MongoDB architecture- MongoDB : Data modelling in MongoDB - Advantages of MongoDB over RDBMS - Mongo Shell - Configuration file in MongoDB - Documents and collections : JSON File format for storing documents - Introduction to Documents, Collections. Database Commands in Mongodb - Inserting and Saving Documents - Inserting multiple documents. CRUD operation : Updating Documents - Removing Documents - Document Replacement - Operator and Modifiers.

Unit:5	INDEXING, AGGREGATION, PIPELINE & REPLICATION	10 Hours
Indexing : Indexing in MongoDB - Single index - Finding index - Multikey index - Aggregation : Aggregation Framework - Pipeline Operations- $match, $sort , $group, $project, $unwind , $limit, $skip, MapReduce - Aggregation commands. Database operations: Backup and restore - Export and import of data - Importing from JSON file - Replication : Advantages of replication - Implementation of replication - Managing Configuration File in MongoDB - Setting up replica set in MongoDB.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 Hours**

	Text Books
1	Hugh E. Williams, Seyed M. M. Tahaghoghi, “Learning MySQL”, O’Reilly, 2006
2	Kristina Chodorow ,"MongoDB: The Definitive Guide", O’Reilly, Third Edition.
	Reference Books
1	Elmasri, Navathe, “Fundamentals of Database Systems”, Third Edition, Pearson Education Asia.
2	Nilesh Shah, “Database Systems using Oracle”, 2002, Prentice Hall of India.
3	Simon Holmes, “Getting MEAN with Mongo, Express, Angular, and Node” Manning Publications, First Edition 2015.
4	Mithun Satheesh, “Web development with MongoDB and Node JS” Packt Publishing Limited, Second Revised Edition 2015.
5	Paul DuBois , MySQL Cookbook: Solutions for Database Developers and Administrators, O'Reilly Media, 3rd Edition, 2014.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.javatpoint.com/what-is-rdbms
2	https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
3	https://nptel.ac.in/courses/106/105/106105175/
4	www.MongoDB.com
5	www.openmymind.net/2011/3/28/The-Little-MongoDB-Book/

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

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

Course code		COMPUTER NETWORKS	L	T	P	C
Core/Elective/Supportive		Core	4	-	-	4
Pre-requisite		Basics of Networks	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are:

1. To make the students understand the basics of computer networks and its importance in communication and resource sharing.
2. To enable the students to understand OSI reference model and related models.
3. To enable the students to learn and apply algorithms related to network scheduling and error detection and correction.
4. To enable the students to understand and apply the design issues in construction of computer networks.

Expected Course Outcomes:

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

1	Understand the basics knowledge about computer networks.	K1,K2, K3
2	Understand the basics of physical layer and public switched telephone networks.	K1,K2
3	Understand the fundamentals of elementary data link protocol and sliding window protocols	K1,K2, K3
4	Apply various operations of algorithms in networks	K2,K3, K4
5	Analyze about various types of protocol and layers	K2,K3,K 4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 hours

Introduction: Use of computer networks – Network Hardware – Network software – Reference models – Example of networks.

Unit:2	PHYSICAL LAYER	12 hours

The Physical Layer: The Theoretical basis for data communication – Guided transmission Media – Wireless transmission – Communication satellites – The Public switched Telephone network – Cable Television - Mobile telephone system.

Unit:3	DATA LINK LAYER	12 hours

Data link layer: Data link layer design issues – Error detection and correction – Elementary data link protocols – Sliding window protocols – Protocol Verification - Example data link Protocols.

Unit:4	NETWORK LAYER	12 hours

Network layer : Network layer design issues – Routing algorithms – Congestion, Control

algorithms – Quality of service – Internetworking – Network layer in the internet. Transport layer: The transport service – Elements of transport protocol – A simple transport protocol - The internet Transport Protocols : UDP – The Internet Transport Protocols : TCP - Performance issues.		
Unit:5	**SESSION LAYER**	**10 hours**
Session layer : Design issues, synchronization - Presentation layer : Design issues, cryptography – Application layer : Design issues, file transfer, E-mail.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Andrew S. Tanenbaum, "Computer Networks", IV Edition, PHI/Pearson Education
2	P. Green – Computer Network Architectures and Protocols, Plenum Press, 1982.
3	Harry Katzan – An Introduction to "Distributed Data Processing", A Petrocelli Book, New York / Princeton.
4	Godbole – Data Communication & Networking, TMH.
Reference Books	
1	Leon Garcia – Communication Networks : Fundamental Concepts & Key Architecture, TMH.
2	Hari & Barani, "Projects in Networking", 2005, SCITECH Publications
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/computer-network-tutorial
2	https://www.geeksforgeeks.org/computer-network-tutorials/
3	https://nptel.ac.in/courses/106/106/106106091/
Course Designed By:	

Mapping with Programming Outcomes

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

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

Course code		OPERATING SYSTEMS	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basic knowledge about various operating systems (DOS, Windows)	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Enable the students to understand operating systems, process management, CPU scheduling, memory management and secondary storage management.
2. To enable the students to learn and apply the concepts using LINUX operating system.
3. To enable students to understand and analyze shell programming.

Expected Course Outcomes:

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

1	Understand the design issues associated with operating systems	K1,K2
2	Master various process management concepts like scheduling, deadlock management	K1,K2, K3
3	Analyze on memory management	K1,K2, K4
4	Analyze about the disk performance optimization and file systems	K1,K2, K4
5	Analyze on Linux operating system	K1,K2, K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 Hours

INTRODUCTION: Definition of OS-Mainframe System-Desktop Systems-Multi processor System-Distributed-Clustered-Real time Systems-Handheld Systems-Operating System Structure-System Components-Services-System Calls-System Programs-System Design and Implementation.

Unit:2	PROCESS MANAGEMENT	12 Hours

PROCESS MANAGEMENT: Concepts-Process Scheduling-Operations on Processes-Cooperating Processes-Inter Process Communication-CPU Scheduling-Scheduling Concepts Criteria-Scheduling Algorithms-Multiprocessor Scheduling-Real time Scheduling.

Unit:3	PROCESS SYNCHRONIZATION	12 Hours

PROCESS SYNCHRONIZATION: Critical Section-Synchronization Hardware Semaphores-Problems of Synchronization-Critical Regions-Monitors-Deadlocks Characterization-Handling Deadlocks-Deadlock Prevention – Avoidance-Detection-Deadlock Recovery.

Unit:4	MEMORY MANAGEMENT	12 hours

MEMORY MANAGEMENT: Storage Hierarchy-Storage Management Strategies Contiguous-

Non Contiguous Storage Allocation-Single User-Fixed Partition-Variable Partition Swapping-Virtual Memory-Basic Concepts-Multilevel Organization-Block Mapping-PagingSegmentation-Page Replacement Methods-Locality-Working Sets.		
Unit:5	**I/O AND FILE SYSTEMS**	**10 Hours**
I/O AND FILE SYSTEMS: Disk Scheduling-File Concepts-File System Structure-Access Methods-Directory Structure-Protection-Directory Implementation-Allocation Methods-Free Space Management **Case Study:** Linux Operating System – Commands, Shell Programming, Report writing		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 Hours**

Text Books	
1	Silberschatz and Galvin, Operating System Concepts, 6th Edition, John Wiley & Sons, Inc., 2004.
2	Milankovic M., Operating System Concepts and Design, 2nd Edition, McGraw Hill, 1992.
Reference Books	
1	P.C.Bhatt, An Introduction to Operating Systems-Concepts and Practice, Prentice Hall of India, 2004.
2	H.M.Deitel, An Introduction to Operating Systems, 2nd Edition, Pearson Education, 2002.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/os-tutorial
2	https://www.tutorialspoint.com/operating_system/index.htm
3	https://nptel.ac.in/courses/106/106/106106144/
Course Designed By:	

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

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

Course code		PRACTICAL I: JAVA PROGRAMMING LAB	L	T	P	C
Core/Elective/ Supportive		Core			5	3
Pre-requisite		Basic Programming Knowledge and Understanding of Object-Oriented Concepts	Syllabus Version		2025 - 26	

Course Objectives:

The main objectives of this course are to:

1. Understand and apply object-oriented programming concepts such as inheritance, polymorphism, and encapsulation using Java.
2. Develop GUI-based applications using AWT, Swing, and JavaFX.
3. Implement file handling techniques for storing and retrieving data from text and binary files.
4. Handle events such as mouse and keyboard interactions in graphical applications.
5. Create interactive and graphics-based applications using 2D graphics and transformation concepts.

Expected Course Outcomes:

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

1	Recall and understand core Java syntax, semantics, and basic programming structures.	K1, K2
2	Apply object-oriented programming principles to build modular and reusable Java programs.	K3
3	Analyze and differentiate Java GUI frameworks and handle event-driven programming using AWT/Swing/JavaFX.	K4
4	Evaluate the efficiency of Java applications and create innovative solutions using file handling and 2D graphics with transformations.	K5, K6

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

LIST OF PROGRAMS	**75 hours**

1. Create an employee package to maintain the information about the employee. Use constructors to initialize the employee number and use overloading method to set the basic pay of the employee. By using this package create a java program.
2. Program to implement polymorphism, inheritance and inner classes.
3. Create a frame with user specific size and position it at user specific position (use command line argument). Then different shapes with different colours (use menus).
4. Java program to handle different mouse events.
5. Java program to maintain the student information in text file.
6. Java program by using to implement the tree viewer.
7. Java program that prohibit to reading of text files that containing bad words.
8. Write a GUI program called TemperatureConverter to convert temperature values between Celsius and Fahrenheit. User can enter either the Celsius or the Fahrenheit value, in floating-point number.
9. Write a GUI Program to collect the students' details using Java FX components such as Label, Text and Button

10. Write a Java Program to load to image file and view the file after selecting the file from the local drive. 11. Write a Java program to draw 2D Shapes and set the various attributes. 12. Write a Java program to performing transformations such as translation, scaling and rotation of line / rectangle.

Total Practical hours	**75 hours**

Text Books	
1	Deitel and Deitel, "Java How to Program", 9 th Edition, Pearson, New Delhi, 2012.
2	Schildt Herbert, "Java – The Complete Reference", 9th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014
Reference Books	
1	C.Xavier, "Programming with Java 2", SciTech Publications (India) P. Ltd.
2	Deitel and Deitel, "Java How to Program: An Objects-Natural Approach", 12th Edition, Pearson, New Delhi, 2019.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/java-programs
2	https://www.tutorialspoint.com/java/index.htm
3	https://nptel.ac.in/courses/106/105/106105191/

Course Designed By:

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

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

Course code		PRACTICAL II: DBMS LAB (MY SQL & MANGO DB)	L	T	P	C
Core/Elective/ Supportive		Core			5	3
Pre-requisite		Basic programming using databases to store and retrieve data	Syllabus Version		2025 - 26	

Course Objectives:

The main objectives of this course are to:

1. To study the features of commercial RDBMS packages such as MySQL and MongoDB
2. To give Foundation knowledge in database concepts, technology and practice to groom students into well informed database application developers.
3. To give strong practice in MySQL programming through a variety of database problems.
4. To give the strong knowledge in NoSQL programming through the real time and high performance applications.
5. Develop database applications using front-end tools and back-end DBMS

Expected Course Outcomes:

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

1	Understand Entity Relationship model and develop E-R diagrams for some applications	K1, K2
2	Write MySQL queries to user specifications	K3, K4
3	Apply the analyze the SQL and NoSQL statements using appropriate problem.	K4, K5
4	Develop an application to handle the structured data set with MySQL.	K5, K6
5	Create an application to handle the unstructured data set with MongoDB	K5, K6

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

LIST OF PROGRAMS	75 hours

Study the features of MySQL and MongoDB.
Laboratory exercise should include defining scheme of applications, creation of a database, writing MySQL queries to retrieve information from database.

SQL LAB

1. Banking system various schemes
2. Online reservation system.
3. Personal information.
4. Student mark processing system (Internal and External marks).

NoSQL LAB

1. Design an E-Commerce product catalog system using MongoDB as a storage engine and insert values.
2. Perform basic CURD operations (Create, Update, Read and Delete) functions for the product catalog.
3. Apply built-in functions to solve the real-time problems.
4. Perform Sorting, indexing and filter for a dataset (use some real time data set)

5. Create a Collection and Document and perform the following:
   a) Find a document by id
   b) b) Find a user by email
   c) Find a list of all users with the same first name
   d) Find all users who are more than 12 years old

6. Use real time data set of Stock exchange. Import the file from the command line using the mongo import shell command.
   a) Find all the stocks where the profit is over 0.5
   b) Find all the stocks with negative growth

Total Practical hours	**75 hours**

Text Books

1	Hugh E. Williams, Seyed M. M. Tahaghoghi, "Learning MySQL", O'Reilly, 2006
2	Kristina Chodorow ,"MongoDB: The Definitive Guide", O'Reilly, Third Edition.

Reference Books

1	Mithun Satheesh, "Web development with MongoDB and Node JS" Packt Publishing Limited, Second Revised Edition 2015.
2	Paul DuBois , MySQL Cookbook: Solutions for Database Developers and Administrators, O'Reilly Media, 3rd Edition, 2014.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.javatpoint.com/what-is-rdbms
2	https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
3	https://nptel.ac.in/courses/106/105/106105175/
4	www.MongoDB.com
5	www.openmymind.net/2011/3/28/The-Little-MongoDB-Book/

Mapping with Programming Outcomes

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

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

Second Semester

Course code		DATA MINING AND DATA ANALYTICS	L	T	P	C
Core/Elective/ Supportive		Core	4	-	-	4
Pre-requisite		Basic knowledge of databases, statistics, and programming fundamentals	Syllabus Version		2025 - 26	

Course Objectives:

The main objectives of this course are:

1. Understand fundamental concepts and scope of data mining and its applications.
2. Explore various data preprocessing techniques to prepare data for mining tasks.
3. Learn and apply classification algorithms for predictive modeling.
4. Understand clustering techniques for unsupervised data grouping.
5. Discover association rules and frequent patterns for knowledge discovery.

Expected Course Outcomes:

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

1	Recall and describe the fundamental concepts, types of data, patterns, technologies, and issues in data mining.	K1
2	Explain and interpret various data preprocessing techniques including cleaning, integration, reduction, and transformation.	K2
3	Apply appropriate classification and clustering techniques to solve real-world problems.	K3
4	Analyze model performance and evaluate different data mining techniques for accuracy and efficiency.	K4, K5
5	Design and create data mining solutions using frequent pattern mining and association rule generation.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit: 1	INTRODUCTION	11 Hours

Introduction: Why Data Mining – Definition of Data Mining – Types of Data – Types of Patterns – Technologies used in Data Mining – Applications of Data Mining – Issues in Data Mining

Unit:2	DATA PREPROCESSING	12 hours

Data Preprocessing: An Overview – Data Cleaning – Data integration – Data reduction – Data Transformation and Data Discretization

Unit:3	CLASSIFICATION	12 hours

Classification: Basic Concepts – Decision Tree Induction – Bayes Classification Methods - Rule-Based Classification - Model Evaluation and Selection - Techniques to Improve Classification Accuracy

Unit:4	**CLUSTER ANALYSIS**	**12 hours**
Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density based Methods – Grid based Methods – Evaluation of Clusters		
Unit:5	**ASSOCIATION RULE MINING**	**11 hours**
Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods: Market Basket Analysis - Frequent Item sets - Closed Item sets, and Association Rules - Frequent Itemset Mining Methods - Pattern Evaluation Methods.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books

1	Jinweihan, Micheline Kambler, Jian Pie, Data Mining: Concepts and Techniques", Morgan Kaufman Publishers, New Delhi, Third Edition, 2012.
2	Margaret H.Dunbam, Data Mining Introductory and Advanced Topics, Pearson Education – 2003

Reference Books

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

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/big_data_analytics/index.htm
2	https://nptel.ac.in/courses/110/106/110106072/
3	https://nptel.ac.in/courses/106/105/106105174/

Course Designed By:

Mapping with Programming Outcomes

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

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

Course code		PYTHON PROGRAMMING	L	T	P	C
Core/ Elective/ Supportive		Core	4			4
Pre-requisite		Fundamental knowledge of algorithmic thinking and object-oriented principles.	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are:

1. Understand the fundamental concepts, syntax, and features of Python programming.
2. Apply core programming constructs including functions, data structures, and exception handling to solve basic problems.
3. Develop object-oriented Python programs and perform file operations for real-world data management tasks.
4. Utilize Python packages such as NumPy, Pandas, and Matplotlib for data processing and visualization.
5. Build interactive applications using GUI frameworks and web development using Django

Expected Course Outcomes:

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

1	Demonstrate proficiency in Python syntax, control structures, and script execution.	**K1**
2	Design and implement Python programs using functions, lists, dictionaries, and built-in modules.	**K2**
3	Apply object-oriented principles to develop structured and reusable code.	**K3**
4	Analyze and visualize data using NumPy, Pandas, and Matplotlib libraries.	**K4**
5	Create basic GUI applications and simple web applications using Django framework.	**K5-K6**

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create

Unit:1	Introduction to Python	12 hours

Introduction to Python: History - Features of Python - Installing Python: IDLE and other IDEs - Executing Python scripts. Python Basics: Variables, - Keywords – Indentation - Comments and Documentation Strings. Data Types – Typecasting – Operators - Control Flow Statements: if, if-else, if-elif-else - while and for loops - Loop Control Statements: break, continue, pass statements.

Unit:2	Functions, Strings, Lists & Dictionaries	12 hours

Functions :Defining and calling functions-Function arguments-Return statement-Recursion-Lambda, map(), filter(), reduce().Modules and Packages: Importing modules -Creating user-defined modules-Standard Python modules .Exception Handling: try, except, else, finally-Built-in exceptions-Raising exceptions. Strings-Lists and Tuples: Dictionaries -Sets: Set operations and methods-Frozenset.

Unit:3	Object-Oriented Programming and File Handling	12 hours

Object-Oriented Programming : Classes and Objects-__init__ method- Instance and class variables-Methods -Inheritance – Polymorphism-Encapsulation. File Handling: Opening/closing files-Reading and writing files -File modes - File methods -Using with statement.

Unit:4	**Python Packages and Data Visualization**	**12 hours**
Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The Data Frame – The Index Objects – Data Visualizations with Matplotlib – The Matplotlib Architecture – pyplot –The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts.		
Unit:5	**Graphical User Interfaces**	**10 hours**
Graphical User Interfaces - The Behavior of terminal-Based programs-and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events-Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema.		
Unit:6	**Contemporary Issues**	**2hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Book(s)

1. Mark Lutz, "Learning Python", O'Reilly Media, 2009. (Units 1–3)
2. Fabio Nelli, Python Data Analytics: With Pandas, NumPy, and Matplotlib, Second Edition, Kindle Edition, 2018 (Unit - 4)
3. Antonio Mele, "Django 3 By Example", Third Edition, 2020 (Unit – 5)

Reference Books

1 Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press

2 Kenneth A. Lambert, "Fundamentals of Python: First Programs", 3rd Edition, Cengage Learning, 2024.

3 Alan D. Moore, "Python GUI Programming with Tkinter", 2nd Ed., Packt, 2022.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.tutorialspoint.com/python/python_pdf_version.htm
2. https://nptel.ac.in/courses/106106212
3. https://swayam.gov.in/nd1_noc20_cs46/preview

Course Designed By:

Mapping with Programming Outcomes

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

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

Course code		OPERATIONS RESEARCH	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basic applications of Mathematics and Business Mathematics.	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Learn formulation of LPP, mathematical formulation, feasible solution to transport problem, EOQ model.
2. Learn individual replacement, group replacement and the characteristics of queuing theory.
3. Apply PERT / CPM for Network Construction.

Expected Course Outcomes:

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

1	Firm basis for understanding the linear programming problems.	K1, K2
2	Construct networks, apply queuing theory and replacement modelconcepts.	K2, K3
3	Apply the optimality in transportation problem.	K1, K2, K3
4	Analyze on inventory control.	K3, K4
5	Solve a wide range of problems related to network construction through PERT / CPM	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	LINEAR PROGRAMMING	12 Hours

LINEAR PROGRAMMING: Formulation of LPP – Graphical solutions to LPP –Simplex Method - Big M method – Two – Phase Simplex Method - Duality in Linear Programming: Primal & Dual Problems – Dual Simplex Method.

Unit:2	PROBLEMS	12 Hours

THE TRANSPORTATION PROBLEM: Introduction – Mathematical Formulation- Finding Initial Basic Feasible Solutions – Moving towards Optimality – Unbalanced Transportation Problems – Degeneracy.

THE ASSIGNMENT PROBLEM: Introduction – Mathematical formulation - Hungarian Assignment Method – Maximization in Assignment Problem – Unbalanced Assignment Problem – Impossible Assignment.

Unit:3	INVENTORY CONTROL	12 Hours

INVENTORY CONTROL: Introduction – Costs involved in inventory - Deterministic models : EOQ models without and with shortage - Buffer stock and Reorder Level – Price Break models – ABC Analysis.

Unit:4	REPLACEMENT MODEL	12 hours

REPLACEMENT MODEL: Introduction – Replacement of items that deteriorates gradually :

value of money does not change with time – value of money changes with time – Replacement of items that fails suddenly: Individual Replacement –Group Replacement. PERT/CPM: Introduction – Construction of Network - CPM calculations –PERT Calculations.		
Unit:5	**QUEUING THEORY**	**10 hours**
QUEUING THEORY: Introduction - Characteristics of queuing system - Problems of single server with finite / infinite population model – Problems of multi server with finite /infinite population model.(No derivation).		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Kanti Swarup, P.K. Gupta, Man Mohan, “Operations Research”, Sultan Chand & Sons.
2	P.K. Gupta, D.S Hira, “Problems in Operations Research”, S.Chand& Company Ltd.
3	Hamdy A. Taha, “Operations Research – An Introduction”, Seventh Edition, PHI/Pearson Education.
Reference Books	
1	Frederick S. Hillier, Gerald J. Lieberman, “Introduction to Operations Research”, Tata McGraw Hill Pub Company Ltd., Seventh Edition.
2	J.K.Sharma, “Operations Research Theory and Applications”, Macmillan India Ltd., Second Edition.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/linear_programming/index.asp
2	https://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf
3	https://www.classcentral.com/course/swayam-operations-research-14219
Course Designed By:	

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

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

Course code		SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basics of Software Development	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to enable the students:

1. To understand basics and importance of Software Engineering.
2. To get a deep insight to software project management concepts.
3. To understand the software project, Analyze project Characteristics, estimate efforts, project evaluation, and selection of process model, software effort estimation, risk management and managing contracts.

Expected Course Outcomes:

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

1	Understand the basic concepts of Software Project Management	K1,K2
2	Identify the different project contexts and suggest an appropriate management strategy	K1,K2, K3
3	Demonstrate through application, knowledge of the key project management skills, such as product and work break-down structure, schedule, governance including progress reporting, risk and quality management	K3,K4
4	Analyze a comparison on Product Versus Process Quality Management	K3,K4
5	Perform case studies on cost estimation models like COCOMO	K3,K4, K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 hours

Introduction: Software Engineering, Software Myths, Layered Technology, Process Models, Software Project Management - Software Project Versus Other Project – Requirement Specification – Information and Control in Organization – Introduction to step wise Project Planning – Select – Identify Scope and Objectives - Identify Project Infrastructure – Analyze Project Characteristics – Products and Activities – Estimate Effort for each Activity – Identify Activity Risks – Allocate Resources - Review / Publicize Plan – Execute Plan and Lower Levels of Planning.

Unit:2	PROJECT EVALUATION	12 hours

Project Evaluation : Introduction – Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation – Selection of an Appropriate Project App roach – Choosing Technologies – Choice of Process Models – Structured Methods – Rap id Application Development – Waterfall Model – VProcess Model – Spiral Model – Software Prototyping – Ways of Categorizing Prototypes – Tools – Incremental Delivery – Selection Process Model.

Unit:3	SOFTWARE EFFORT ESTIMATION	12 hours
Software Effort Estimation : Introduction – Problem s with Over and Under Estimates – Basis for Software Estimating – Software Effort Estimation Technique – Albrecht Function Point Analysis – Function Points – Object Points – Procedural Code Oriented Approach – COCOMO – Activity Planning – Project Schedules - Projects and activities – Sequencing and Scheduling Activities – Network Planning Models – Formulating a Network Planning – Adding Time Dimension – Forward Pass – Backward Pas s – Identifying the Critical Path – Activity Float - Shortening Project Duration – Identifying Critical Activities – Precedence Networks.		
Unit:4	**RISK MANAGEMENT**	**11 hours**
Risk Management: Introduction – Nature of Risk Man aging Identification – Analysis – Reducing – Evaluating – Z values – Resource Allocation – Nature of Resources – Requirements – Scheduling – Critical Paths – Counting the Cost – Resource Schedule – Cost Schedule – Scheduling Sequence – Monitoring and Control – Creating the Frame Work - Collecting the Data – Visualizing the Progress – Cost Monitoring – Prioritizing Monitoring – Change Control.		
Unit:5	**SOFTWARE QUALITY**	**11 hours**
Managing Contracts : Introduction – Types of Contract – Stages in Contract Placement – Terms of Contract – Contract Management – Acceptance – Managing People and Organizing Teams – Organizational Behavior Background – Selecting the Right Person for the Job – Instruction in the Best Methods – Motivation – Decision Making – Leadership – Organizational Structures – Software Quality – Importance – Practical Measures – Product Versus Process Quality Management – External Standards – Techniques to Help Enhance Software Quality.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Roger .Pressman: Software Engineering, Tata McGrawHill , V Edition.
2	Bob Hughes and Mike Cottrell, “Software Project Management”, McGraw Hill, Second Edition.
Reference Books	
3	Walker Royce, “Software Project Management”, Addition Wesley.
4	Derrel Ince, H. Sharp and M. Woodman, “Introduction to Software Project Management and Quality Assurance”, Tata McGraw Hill, 1995.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/software_engineering/software_project_management.htm
2	https://www.javatpoint.com/software-project-management
3	https://onlinecourses.nptel.ac.in/noc19_cs70/preview

Course Designed By:

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

*S-Strong; M-Medium

Course code		PRACTICAL III: DATA MINING LAB	L	T	P	C
Core/Elective/ Supportive		Core			5	3
Pre-requisite		Basics of Datamining algorithms and various tools available.	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are:

1. To provide practical knowledge of data preprocessing, exploration, and visualization techniques using R.
2. To implement supervised and unsupervised learning algorithms on real-world datasets.
3. To develop skills in applying classification, clustering, and association rule mining techniques.
4. To enable students to evaluate model performance using appropriate statistical and graphical methods.
5. To introduce dimensionality reduction and frequent pattern mining for handling high-dimensional data.

Expected Course Outcomes:

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

1	Perform exploratory data analysis using summary statistics and visualizations in R.	K1, K2
2	Handle missing values, detect outliers, and normalize data for data mining tasks.	K3, K4
3	Apply classification algorithms such as Decision Trees and Naïve Bayes, and evaluate their performance.	K3, K5
4	Implement clustering techniques including K-Means and Hierarchical Clustering with proper visual interpretation.	K3, K6
5	Discover hidden patterns using Association Rule Mining techniques like Apriori and FP-Growth.	K4, K5

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

LIST OF PROGRAMS — **60 hours**

Develop R programs for the following:

1. To perform Exploratory Data Analysis using summary statistics and visualizations.
2. To identify and handle missing values and detect outliers in a dataset.
3. To perform Min-Max Normalization on a given numeric dataset
4. To reduce the dimensionality of a dataset using Principal Component Analysis.
5. To perform classification using Naïve Bayes algorithm and measure model performance.
6. To build a classification model using the Decision Tree algorithm and evaluate its performance using a confusion matrix.
7. To apply K-Means clustering and visualize cluster assignments on a dataset.
8. To perform hierarchical clustering and represent the cluster structure with a dendrogram.

9. To discover frequent itemsets and generate association rules using the Apriori algorithm on a transactional dataset.
10. To mine frequent itemsets using the FP-Growth algorithm and visualize the results

Total Practical hours	**60 hours**

Text Books

1	Jinweihan, Micheline Kambler, "Data Mining: Concepts and Techniques", Morgan Kaufman Publishers, New Delhi.
2	Jeeva Jose, Beginner's Guide for Data Analysis using R Programming, Khanna Publishing House, 2018

Reference Books

1	G. Sudhamathy, C. Jothi Venkateswaran**,** "R Programming. An Approach to Data Analytics", MJP Publishers, 2019.
2	Yanchang Zhao**,** R and Data Mining: Examples and Case Studies, Academic Press, 2013

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.geeksforgeeks.org/data-mining-in-r
2	https://www.rdatamining.com/
3	https://www.tutorialspoint.com/exploring-data-mining-with-r

Course Designed By:

Mapping with Programming Outcomes

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

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

Course code		PRACTICAL IV: PYTHON PROGRAMMING LAB	L	T	P	C
Core/Elective/ Supportive		Core			5	3
Pre-requisite		Basic knowledge of programming and problem-solving concepts..	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Develop foundational programming skills using Python syntax, control structures, functions, and modules.
2. Apply object-oriented programming concepts to design and implement real-world applications.
3. Enable students to work with file handling, exception handling, and data analysis using built-in libraries like Pandas and Matplotlib.
4. Introduce students to GUI and web development frameworks such as Tkinter and Django for building interactive applications.

Expected Course Outcomes:

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

1	Recall basic Python syntax and demonstrate understanding of control structures, functions, and data types.	K1, K2
2	Apply programming constructs to develop solutions for real-world problems involving decision-making, looping, and modularity.	K2,K3
3	Analyze data using Python libraries like Pandas and Matplotlib, and evaluate insights through visualization and descriptive statistics.	K4
4	Create interactive applications using object-oriented programming, graphical user interfaces with Tkinter, and basic web interfaces with Django.	K5,K6

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

LIST OF PROGRAMS — **60 hours**

1. Write a Python program to check whether a given number is positive, negative, or zero using conditional statements.
2. Create a triangle number pattern and demonstrate the use of break, continue, and pass within nested loops.
3. Develop a program to compute the factorial of a number using both recursive functions and lambda with reduce()
4. Design a mini banking system with user-defined functions to perform deposit, withdrawal, and balance inquiry. Handle insufficient balance with exceptions. Place the functions in a user-defined module and import them in the main program
5. Design an Employee class with attributes and methods to calculate performance-based bonuses using conditional logic
6. Develop a Python program that includes Book and Library classes. Allow options to add, search, borrow, and return books. Store book details using dictionaries or lists.

7. Write a program to store student details (roll number, name, marks) in a file. Include functionality to search by roll number and update marks.
8. Create a pandas DataFrame to store student records including marks. Generate summary statistics such as mean, max, min, and use .describe() and .value_counts() methods for analysis.
9. Read monthly expense data from a CSV file and visualize it using a line chart and a bar chart. Use appropriate labels, titles, and legends for clear representation.
10. Write a Python program to read a text file, count its lines and words, then save all words longer than 5 characters to a new file
11. Design a graphical calculator application using Tkinter that allows users to perform basic arithmetic operations: addition, subtraction, multiplication, and division with proper layout and error handling
12. Create a basic Django web application that includes a user login form. Validate the entered username and password on submission and display a success or error message accordingly.

Text Books

1	Mark Lutz, "Learning Python", O'Reilly Media, 2009. (Units 1–3)
2	Fabio Nelli, Python Data Analytics: With Pandas, NumPy, and Matplotlib, Second Edition, Kindle Edition, 2018 (Unit - 4)
3	Antonio Mele, "Django 3 By Example", Third Edition, 2020 (Unit – 5)

Reference Books

1	Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press
2	Kenneth A. Lambert, "Fundamentals of Python: First Programs", 3rd Edition, Cengage Learning, 2024.
3	Alan D. Moore, "Python GUI Programming with Tkinter", 2nd Ed., Packt, 2022.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/python/python_pdf_version.htm
2	https://nptel.ac.in/courses/106106212
3	https://swayam.gov.in/nd1_noc20_cs46/preview

Course Designed By:

Mapping with Programming Outcomes

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

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

Course code		PRACTICAL V: WEB APPLICATION DEVELOPMENT AND HOSTING	L	T	P	C
Core/Elective/ Supportive		Core	0	0	2	2
Pre-requisite		Basic Programming using HTML Tags	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are:

1. To enable students to design and develop static multi-page websites using HTML and CSS.
2. To familiarize students with form design, validation, and user interaction using HTML and JavaScript
3. To develop practical skills in designing structured web content for real-world applications.
4. To introduce students to modern web deployment practices

Expected Course Outcomes:

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

1	Apply HTML, CSS, and JavaScript to construct well-structured and visually appealing web pages	K1, K2
2	Apply client-side scripting techniques to enhance user interaction and form handling.	K2, K3
3	Design and develop user-friendly, multi-page websites suitable for real-world applications.	K4, K5
4	Deploy static web applications using modern web hosting platforms and understand the basics of web deployment workflows.	K5, K6

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

LIST OF PROGRAMS — **30 hours**

1. Develop a Multi-page Website with a Navigation Bar using HTML and CSS.
2. Build a College Timetable Web Page using HTML Tables and CSS Styling
3. Create a Personal Portfolio Web Page using HTML and Internal CSS.
4. Design a Product Catalogue Page with Card Layout using HTML and CSS
5. Create a Responsive College Admission Form with Styled Inputs using internal CSS
6. Develop a User Registration form using HTML and JavaScript. Validate input fields such as name, email, and age using DOM and event handling.
7. Create a Login Page with Basic Authentication Logic using HTML and JavaScript
8. Deploy a Static Website using GitHub Pages, Netlify, or Other Free Hosting Platforms

Total Practical hours	**30 hours**

Text Books

1	Dean, J., Web Programming with HTML5, CSS, and JavaScript. Jones & Bartlett Learning, 2018

Reference Books

1	Rebah, H.B., Boukthir, H. and Chedebois, A., Website Design and Development with HTML5 and CSS3. John Wiley & Sons, 2022.

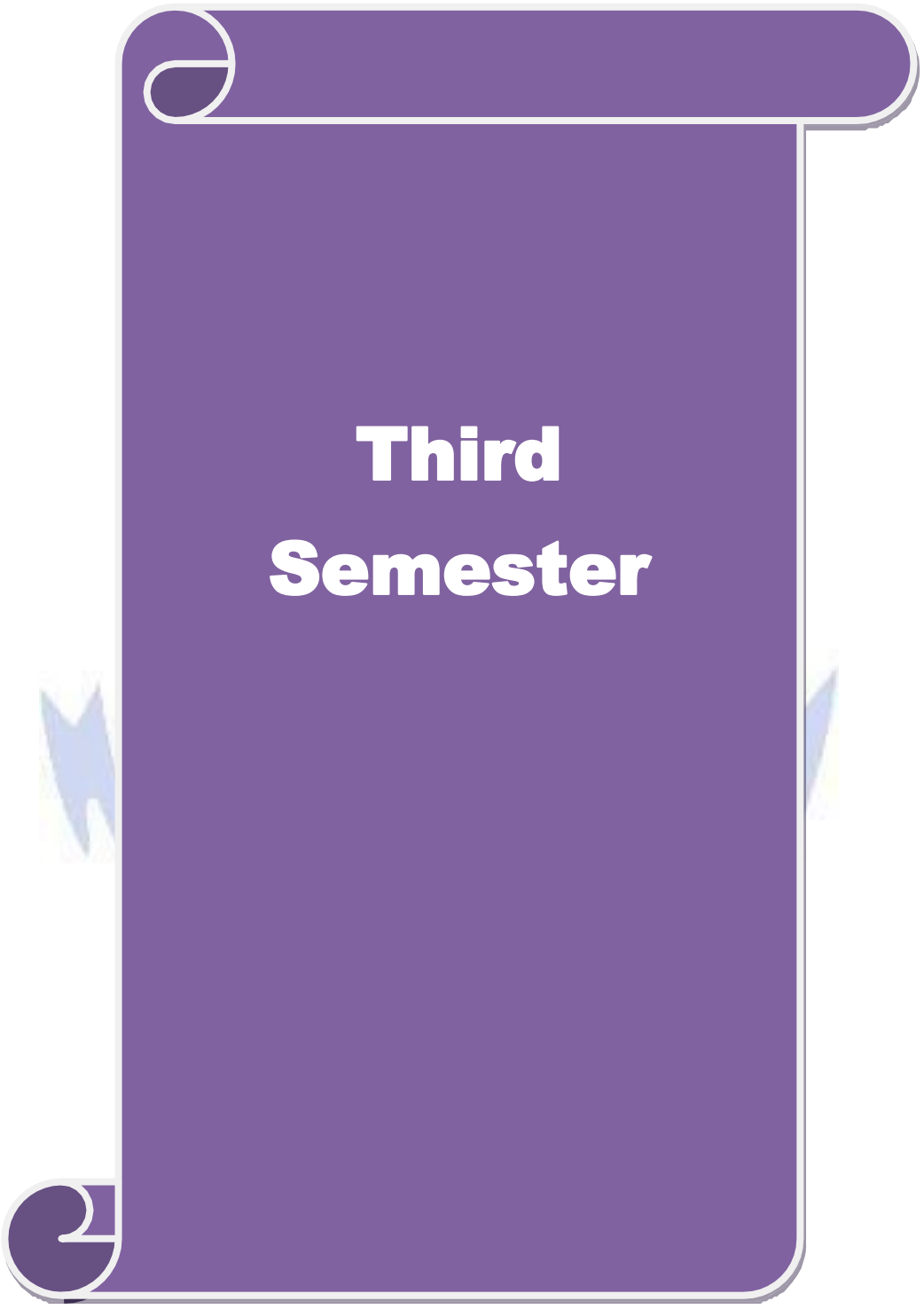
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.w3schools.com/html/default.asp
2	https://www.geeksforgeeks.org/web-design/
3	https://www.tutorialspoint.com/internet_technologies/website_designing.htm

Mapping with Programming Outcomes

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

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


Third
Semester

Course code		OPEN-SOURCE COMPUTING	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basic programming and understanding of software development	Syllabus		2025 - 26	

Course Objectives:

The main objectives of this course are:

1. To introduce the philosophy and principles of Open-Source Software (OSS).
2. To explore open source operating systems, programming languages, databases, and tools.
3. To provide an understanding of licensing, ethics, and community-driven development.
4. To familiarize students with modern open-source development platforms and practices

Expected Course Outcomes:

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

1	Understand the foundations and legal aspects of open-source software	**K1, K2**
2	Analyze and compare open-source programming languages and their applications	**K3**
3	Explore open-source operating systems and containerization tools	**K2, K4**
4	Understand open-source database systems and data models	**K5**
5	Utilize version control, CI tools, and platforms used in OSS development	**K3, K4**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION TO OPEN-SOURCE SOFTWARE	12 hours

Overview of OSS – Characteristics and objectives. Open-Source vs Free Software. History and evolution – FSF and GNU. Open Source licensing – GPL, MIT, Apache. Ethical and social impacts, challenges, and the role of OSS in education, industry, and research

Unit:2	OPEN-SOURCE PROGRAMMING LANGUAGES	12 hours

Introduction to PHP and JavaScript – Syntax, usage, and community support. Server-side scripting with PHP. JavaScript DOM manipulation and event handling. Introduction to Node.js and its use in full-stack development

Unit:3	OPEN-SOURCE OPERATING SYSTEMS	12Hours

Linux and Android – Features and architecture. Kernel mode vs user mode. Linux for servers and desktops. Virtual Machines using VirtualBox. Introduction to Docker containers. Use of Linux and Docker in cloud and DevOps environments.

Unit:4	OPEN SOURCE DATABASES	12Hours

DBMS concepts – Architecture, data models. Overview of MySQL and MongoDB. CRUD operations and schema management. SQL vs NoSQL – Concepts and use cases. Open-source DBMS adoption in real-world systems.

Unit:5	OPEN-SOURCE DEVELOPMENT TOOLS AND PLATFORMS	12Hours

Version control: Git, GitHub, GitLab – Repositories and collaboration. IDEs: Eclipse, VS Code, NetBeans. Package managers: pip, npm. CI tools: Jenkins, Travis CI. Open-source project

workflows and community practices		
Unit:6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online webinars, open-source community engagement, and current developments in the OSS landscape		
	Total Lecture hours	**60Hours**

Text Books	
1	RAO M.N, Fundamentals of open source software, PHI Learning , 1st Edition, 2014
2	Kailash Vadera, Bhavyesh Gandhi, Open Source Technology, Laxmi Publications, 1st Edition, 2012
3	Shannon Bradshaw et al., MongoDB: The Definitive Guide , O'Reilly, 2020
4	Jon Loeliger & Matthew McCullough, Version Control with Git (O'Reilly, 2012)
Reference Books	
1	Karl Fogel, Producing Open Source Software, O'Reilly Media,
2	2005Fadi P. Deek, James A. M. McHugh, Open Source: Technology and Policy, Cambridge University Press, 2007.
3	Chris DiBona et al., Open Sources: Voices from the Open Source Revolution, O'Reilly Media.
4	Christopher Negus, Linux Bible, Wiley, 2020

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://opensource.org
2	https://github.com
3	https://docs.docker.com
4	https://www.coursera.org/learn/open-source-software-development-methods
5	https://www.codecademy.com/catalog/subject/open-source

Mapping with Programming Outcomes

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

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

Course code		ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T	P	C
Core/ElectIve/ Supportive		Core	5			4
Pre-requisite		Basic knowledge of programming and mathematics	Syllabus	2025 - 26		

Course Objectives:

The main objectives of this course are:

1. To introduce the foundational concepts of Artificial Intelligence, including problem-solving methods and search strategies.
2. To familiarize students with heuristic search techniques and knowledge representation issues in AI systems.
3. To provide a comprehensive understanding of machine learning fundamentals
4. To explore advanced learning paradigms such as deep learning, unsupervised learning, reinforcement learning, and generative models.

Expected Course Outcomes:

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

1	Explain the core concepts, techniques, and problem-solving strategies in Artificial Intelligence	**K1, K2**
2	Apply heuristic search methods and knowledge representation techniques to solve AI problems.	**K3, K4**
3	Analyze various machine learning algorithms and evaluate their performance on classification, regression, and clustering tasks.	**K4, K5**
4	Design and implement machine learning models using supervised, unsupervised, deep learning, and reinforcement learning techniques.	**K5, K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	12 Hours

Introduction: AI Problems - Al techniques - Criteria for success. **Problems, Problem Spaces, Search**: State space search - Production Systems - Problem Characteristics - Issues in design of Search.

Unit:2	HEURISTIC SEARCH AND KNOWLEDGE REPRESENTATION	10 Hours

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. **Knowledge representation issues:** Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.

Unit:3	FUNDAMENTALS OF MACHINE LEARNING AND SUPERVISED ALGORITHMS	12 Hours

Basics of Machine Learning: Types of Machine Learning-Regression Analysis- Classification Algorithm- Clustering Techniques-Association Rule Learning-Model Evaluation and Performance Metrics- **Supervised Algorithms**: Steps involved in Supervised Learning- Linear Regression - Logistics Regression - Random Forest Algorithms - Support Vector Machines - K-Nearest Neighbors - Gradient Boosting Machines - Ensemble Method.

Unit:4	DEEP LEARNING AND NEURAL NETWORKS	12 Hours
Deep Learning and Neural Networks: Basic Structure-Types of Neural Network models - Feed Forward Neural Network - Multilayer Perceptron - Double Nature – Convolutional Neural Network-Radial Base Functional Neural Networks-Intermittent Neural Networks.		
Unit:5	**UNSUPERVISED AND REINFORCEMENT LEARNING TECHNIQUES**	**12 Hours**
Unsupervised Learning Algorithm: One Class SVM- Algorithms for Learning Association Rules-Hierarchical Clustering-Cluster Conformation-PCA Stands for Star Element Analysis-The AIS Algorithm – Machine Learning- Different Generative Model Types**. Reinforcement Learning**: Real-Life Exemplifications of Underpinning Learning - Markov Decision Processes - Key Components of Markov Decision Processes - Deep Q-Networks		
Unit:6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60Hours**

	Text Books
1	Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence." Tata McGraw Hill, 3rd Edition
2	Dr.M.Punithavalli, Anju Pavithran, " A Journey Through AI & ML- Your Essential Handbook"
3	Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015
	Reference Books
1	Stuart Russell and Peter Norvig (1995), "Artificial Intelligence: A Modern Approach," Third edition, Pearson, 2003.
2	Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.geeksforgeeks.org/machine-learning/
2	https://builtin.com/artificial-intelligence/ai-vs-machine-learning
3	https://www.coursera.org/learn/fundamentals-of-machine-learning-and-artificial-intelligence

Mapping with Programming Outcomes

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

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

Course code		NETWORK SECURITY AND CRYPTOGRAPHY	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basics of Networks and their Security	Syllabus Version	2025-26		

Course Objectives:

The main objectives of this course are to:

1. Deal with principles of encryption algorithms, and conventional and public key cryptography.
2. Enable to know the levels of network security and security tools.

Expected Course Outcomes:

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

1	Remember the basic knowledge of security models	K1,K2
2	Understand the concept of AES and DES cipher	K1,K2
3	Apply on encryption function	K2,K3,K4
4	Analyze about public key cryptography and RSA	K2,K3,K4, K5
5	Analyze on authentication functions in security	K2,K3,K4, K4,K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 hours

Service mechanism and attacks – The OSI security architecture – A model for network security – symmetric Cipher model – Substitution techniques – transposition techniques – simplified des – block chipper principles – the strength of des – blockcipher design principles and modes of operation.

Unit:2	ENCRYPTION	12 hours

Triple des-blow fish – RCS Advanced Symmetric Block Ciphers –RC4 stream Cipher confidentially using symmetric encryption – introduction to number theory – public – key cryptography and RSA.

Unit:3	KEY MANAGEMENT	12 hours

Key management – Diffie Hellman key exchange – message authentication and hash function – hash algorithm – digital signature and authentication protocols – digital signature standard.

Unit:4	SECURITY	12 hours

Authentication application – pretty good privacy – S/MIME – IP security – web security considerations –secure socket layer transport layer security –secure electronic transaction.

Unit:5	INTRUDERS AND VIRUS	10 hours

Intruders –intrusion detection – password management –viruses and related threats – virus

countermeasures – fire wall design principles – trusted systems		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total hours	**60 hours**

Text Books	
1	William Stallings, "Cryptography and Network Security Principles and Practices". Fourth Edition, PHI.
2	Atul Kahate, "Cryptography and Network Security",Second Edition, TMH.
Reference Books	
1	Behrouz A.Forouzan, "Cryptography and Network Security", TMH.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105031/
2	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3	https://www.tutorialspoint.com/cryptography/index.htm
Course Designed By:	

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

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

Course code		CLOUD COMPUTING	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basics of cloud and its applications	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Understand the cloud computing architectures, applications and challenges.
2. Know how the data is stored in the cloud and the various services offered by the cloud.
3. Develop the skills in Web Application Development using cloud technologies.

Expected Course Outcomes:

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

1	Understand the basic knowledge on virtualization	K1,K2
2	Understand the concept of cloud computing services and its business value	K1,K2
3	Analyze various web based applications for collaborating everyone in cloud computing	K1,K2, K3,K4
4	Assess various industrial platforms for the developments	K2,K3, K4
5	Analyze on cloud mobility and governance	K2,K3, K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 hours

Introduction – Essentials – Benefits – Why cloud – Business and IT perspective – cloud and virtualization – cloud service requirements – dynamic cloud infrastructure – cloud computing characteristics – cloud adoption – cloud rudiments. Cloud deployment models: introduction – cloud characteristics – measured service accounting – cloud deployment models – security in a public cloud – public versus private clouds – cloud infrastructure self-service.

Unit:2	SERVICES	12 hours

Cloud as a service: introduction – gamut of cloud solutions – principal technologies- cloud strategy – cloud design and implementation using SOA – conceptual cloud model – cloud service defined. Cloud solutions: introduction – cloud ecosystem – cloud business process management – cloud service management – on premise cloud orchestration and provisioning engine – computing on demand.

Unit:3	VIRTUALIZATION	12 hours

Cloud offerings: Introduction – introduction storage, retrieval archive and protection-cloud analytics – testing under cloud – information security – virtual desktop infrastructure-storage cloud. Cloud Management: Introduction – resiliency – provisioning – asset management-cloud governance – high availability and disaster recovery – charging models – usage reporting, and metering. Cloud Virtualization Technology: Introduction – virtualization demand – virtualization benefits – server virtualization – virtualization for x86 architecture – hypervisor management

software – virtual infrastructure requirements.		
Unit:4	**CLOUD INFRASTRUCTURE**	**12 hours**
Cloud Infrastructure: Introduction – storage virtualization – storage area networks-network-attached storage – cloud server virtualization – networking essential to the cloud. Cloud and SOA: Introduction – SOA Journey to Infrastructure – SOA and the cloud – SOA Defined – SOA and infrastructure as a service – SOA based cloud infrastructure steps – SOA Business and IT services.		
Unit:5	**CLOUD MOBILITY**	**10 hours**
Cloud Mobility: Introduction – the business problem – mobile enterprise application platforms – mobile application architecture overview. Cloud Governance: Introduction – service level agreement and compliance – data privacy and protection risks – enterprise governance – risk management – third party management – information management.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books

1	Dr. Kumar Saurabh "Cloud Computing-Unleashing Next Gen Infrastructure to Application", 3rd Edition, Wiley India Pvt Ltd, 2014.
2	RajkumarBuyya, James Broberg, AndrzejGoscinski , "Cloud computing principles and paradigms", Wiley India, 2014.

Reference Books

1	Michael Miller, "Cloud computing web based application that change the way you work & collaborate online", Pearson Education, 2013.
2	Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business"

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial

Course Designed By:

Mapping with Programming Outcomes

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

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

Course code		PRACTICAL VI: OPEN-SOURCE COMPUTING LAB	L	T	P	C
Core/Elective/ Supportive		Core			5	3
Pre-requisite		Basic knowledge of web technologies and programming fundamentals.	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are:

1. Iintroduce students to the fundamentals of open-source software tools, platforms, and development environments.
2. Enable students to develop web-based applications using open-source programming languages such as PHP, JavaScript, and Node.js.
3. Train students in integrating open-source databases such as MySQL and MongoDB with server-side applications.
4. Provide hands-on experience in version control, collaborative development, and deployment using Git and GitHub.

Expected Course Outcomes:

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

1	Recall and identify basic concepts, tools, and terminologies related to open-source development and version control.	K1
2	Explain the working principles of client-server communication and database connectivity in web applications.	K2
3	Apply scripting and programming skills to build interactive web applications using PHP, JavaScript, and Node.js.	K3
4	Analyze functional requirements and evaluate appropriate tools and technologies for building full-stack applications.	K4, K5
5	Design and develop complete open-source-based applications with front-end, back-end, and database integration, following version control best practices	K6

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

LIST OF PROGRAMS	75 hours

1. Design an image slideshow application using JavaScript DOM methods and setInterval() to cycle through images automatically
2. Develop a PHP program that calculates the electricity bill based on units consumed, using conditional logic and slab-based rates
3. Build a web-based feedback system using PHP and MySQL. Allow users to submit feedback and display stored responses from the database
4. Create a user login system using PHP and MySQL. Use sessions to maintain user authentication and display a dashboard upon successful login
5. Write a Node.js program that uses the fs module to create a text file, write data into it, read it back, and display the contents in the console.
6. Develop a student registration form using HTML and handle form submission with Node.js

and Express.js, displaying the submitted data on a new page.

7. Create an Employee Information Portal using Node.js, Express, and MongoDB. Include features to add, view, and delete employee records using Mongoose.
8. Initialize a local Git repository and demonstrate basic version control operations including git init, git add, and git commit

Total Practical hours	75 hours

Text Books

1	RAO M.N, Fundamentals of open source software, PHI Learning , 1st Edition, 2014
2	Kailash Vadera, Bhavyesh Gandhi, Open Source Technology, Laxmi Publications, 1st Edition, 2012
3	Shannon Bradshaw et al., MongoDB: The Definitive Guide , O'Reilly, 2020
4	Jon Loeliger & Matthew McCullough, Version Control with Git (O'Reilly, 2012)

Reference Books

1	Karl Fogel, Producing Open Source Software, O'Reilly Media,
2	2005Fadi P. Deek, James A. M. McHugh, Open Source: Technology and Policy, Cambridge University Press, 2007.
3	Chris DiBona et al., Open Sources: Voices from the Open Source Revolution, O'Reilly Media.
4	Christopher Negus, Linux Bible, Wiley, 2020

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://opensource.org
2	https://github.com
3	https://docs.docker.com
4	https://www.coursera.org/learn/open-source-software-development-methods
5	https://www.codecademy.com/catalog/subject/open-source

Course Designed By:

Mapping with Programming Outcomes

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

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

Course code		PRACTICAL VII: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB	L	T	P	C
Core/Elective/ Supportive		Core			5	3
Pre-requisite		Basic knowledge of Python programming and data handling	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are:

1. To introduce the fundamental concepts of Artificial Intelligence and its problem-solving approaches.
2. To explore heuristic search strategies and knowledge representation techniques in AI.
3. To impart the core concepts of Machine Learning, focusing on supervised, unsupervised, and deep learning methods.
4. To enable learners to apply ML models to real-world datasets and evaluate performance using appropriate metrics.

Expected Course Outcomes:

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

1	Define basic concepts, applications, and problem-solving approaches in Artificial Intelligence and Machine Learning.	K1, K2
2	Apply appropriate search algorithms and knowledge representation schemes to AI problems	K3, K4
3	Implement and compare supervised learning algorithms for regression and classification tasks using Python.	K3, K5
4	Develop and test deep learning models such as neural networks and CNNs using relevant tools and libraries.	K4, K6
5	Evaluate and interpret the results of ML models using statistical and performance metrics.	K5

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

LIST OF PROGRAMS	60 hours

1. Implement state-space search algorithms using Breadth-First Search (BFS) and Depth-First Search (DFS) for a basic problem.
2. Solve the classic 8-puzzle problem using state-space representation.
3. Design and implement the A* search algorithm with a suitable heuristic function for optimal pathfinding.
4. Implement the Hill Climbing algorithm for solving an optimization problem.
5. Develop a Linear Regression model using Python and visualize the results with matplotlib.
6. Build a Logistic Regression classifier for a binary classification task such as spam detection.
7. Apply Support Vector Machine (SVM) on the Iris dataset and evaluate the classification performance.
8. Implement the K-Nearest Neighbors (KNN) algorithm and test it on a real-world dataset.
9. Construct a Feedforward Neural Network using TensorFlow for a simple classification problem.
10. Design and implement a Convolutional Neural Network (CNN) for image classification tasks.

Total Practical hours	60 hours

Text Books	
1	Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence." Tata McGraw Hill, 3rd Edition
2	Dr.M.Punithavalli, Anju Pavithran, "A Journey Through AI & ML- Your Essential Handbook"
Reference Books	
1	Stuart Russell and Peter Norvig (1995), "Artificial Intelligence: A Modern Approach," Third edition, Pearson, 2003.
2	Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.geeksforgeeks.org/machine-learning/
2	https://builtin.com/artificial-intelligence/ai-vs-machine-learning
3	https://www.coursera.org/learn/fundamentals-of-machine-learning-and-artificial-intelligence
Course Designed By:	

Mapping with Programming Outcomes

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

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

PRACTICAL VII- MINI PROJECT (Guidelines for Mini Project)

- The aim of the Mini Project is to lay a foundation for the Main Project.
- Each student should carry out individually one Mini Project Work and it may be a case study using the software packages that they have learnt or may be an implementation of a concept in a paper prescribed on a journal.
- It should be compulsory done in the college only under the supervision of the staff concerned.
- The University Exam will be conducted as like a practical exam with one Internal and one External Examiner, which carries 40 marks for project evaluation and 10 marks for viva examination. Remuneration for the examiners is equivalent as that of practical examination.

Elective Courses

Course code		.NET PROGRAMMING	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basics of internet programming	Syllabus		2025 - 26	

Course Objectives:

The main objectives of this course are:

1. To enable the students to understand and apply the practical aspects of application. development using .Net framework.
2. To enable the students to understand the Common Language Runtime (CLR), .Net framework classes.
3. To enable the students to understand and apply the .NET concepts using C#.
4. To enable the students to understand and apply .NET concepts using ADO.Net Programming

Expected Course Outcomes:

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

1	Understand the concepts of .NET Framework Technology	K1, K2
2	Apply error handling techniques in .NET	K2, K3
3	Demonstrates the C# console applications	K3, K4
4	Design and develop the Web applications using C#	K4, K5
5	Design and develop distributed data driven applications using .NET framework	K4, K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	EVOLUTION OF WEB DEVELOPMENT	12 hours

Evolution of Web Development: HTML Forms-Server Side and Client Side Programming. Developing ASP.Net Applications – Visual Studio: Creating Websites- Designing a Webpage- The anatomy of a Web form – Writing Code. Web Form Fundamentals: The anatomy of an ASP.Net application – Introducing Server Controls – Improving the Currency Converter – A Deeper Look at HTML Control Classes – The Page Class. Web Controls: Steeping up to Web Controls – Web Control Classes – List Controls – Table Controls – Web Control Events and AutoPostBack

Unit:2	STATE MANAGEMENT	12 hours

State Management: The problem of State – View State – Transferring Information between Pages – Cookies – Session State – Session State Configuration. Error Handling, Logging, and Tracing: Common Errors – Exception Handling – Handling Exceptions – Throwing Your Own Exceptions – Logging Exceptions – Error Pages – Page Tracing. Deploying ASP.Net Applications: ASP.Net Applications and the Web Server – Internet Information Services(IIS) – Managing Websites with IIS Manager – Deploying a Simple Site – Deploying with Visual Studio.

Unit:3	C#	10 hours

C# Language: C# Languages Basics – Variables and Data Types – Variable operations – Object based manipulation – Conditional Logic – Loops – Methods. Types, Objects and Namespaces:

Classes – Value types and reference types – Understanding namespaces and assemblies.		
Unit:4	**ENUMERATORS, INTERFACES AND EVENTS**	**12 hours**
C#: Enumerators and Iterators – Exceptions - Serializing objects - Deep serialization-XML based serialization - Multithreading – Interfaces and Structures - Delegates and Events – Indexers and Properties.		
Unit:5	**ADO.NET FUNDAMENTALS**	**12 hours**
ADO.NET Fundamentals: Understanding Data Management – Configure database – SQL Basics - ADO.Net basics – Direct Data Access – Disconnect Data Access. Data Binding: Single- Value data binding		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Matthew MacDonald (2008), Beginning ASP.NET 3.5 in C#, 2/e; A press Berkeley.
2	Jesse Liberty (2003), Programming Visual Basic .NET, 2/e; O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
3	Bill Evjen, Jason Beres (2009), Visual Basic .Net Bible, Hungry Minds Inc.
Reference Books	
1	Herbert Schildt (2010), Complete Reference C#, Tata McGraw-Hill.
2	Joe Duffy(2010), Professional .Net Framework 2.0l, Wiley India.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/asp.net/index.htm
2	https://www.javatpoint.com/net-framework
3	https://www.btechguru.com/training--dot-net--c-sharp-dot-net--framework--microsoft-net-framework-part-1-video-lecture--11280--27--139.html
Course Designed By:	

Mapping with Programming Outcomes

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

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

Course code		MOBILE COMPUTING	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basics of mobile communication	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Present the overview of Mobile computing, Applications and Architectures.
2. Describe the futuristic computing challenges.
3. Enable the students to learn the concept of mobile computing.

Expected Course Outcomes:

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

1	Understand the need and requirements of mobile communication	K1, K2
2	Focus on mobile computing applications and techniques	K2, K3
3	Demonstrate satellite communication in mobile computing	K3, K4
4	Analyze about wireless local loop architecture	K3, K4
5	Analyze various mobile communication technologies	K3, K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 hours

Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.

Unit:2	MOBILE COMMUNICATION	12 hours

Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.

Unit:3	MOBILE COMPUTING	12 hours

Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.

Unit:4	INTERNET	12 hours

Important Parameters of Mobile Communication System – Mobile Internet: Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.

Unit:5	COMMUNICATION SYSTEM	10 hours
WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books

1	T.G. Palanivelu, R. Nakkeeran, "Wireless and Mobile Communication", PHI Limited, 2009.
2	Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2007.

Reference Books

1	Asoke K Talukder, Hasan Ahmed, Roopa Yavagal, "Mobile Computing", TMH, 2010.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/mobile_computing/index.htm
2	https://www.javatpoint.com/mobile-computing
3	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

Course Designed By:

Mapping with Programming Outcomes

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

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

Course code		DEEP LEARNING	L	T	P	C
Core/Elective/ Supportive		Elective	4			4
Pre-requisite		Foundation in linear algebra, calculus, probability, and basic machine learning concepts	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Introduce major deep neural network frameworks and issues in basic neural networks.
2. Solve real world applications using Deep learning

Expected Course Outcomes:

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

1	Understand the methods and terminologies involved in deep neural network, differentiate the learning methods used in Deep nets.	K1, K2
2	Identify and apply suitable deep learning approaches for given application.	K1, K2
3	Design and develop custom Deep-nets for human intuitive applications.	K3, K4
4	Design of test procedures to assess the efficiency of the developed model.	K2,K3, K4
5	Understand the need for Reinforcement learning in real – time problems.	K2,K3, K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	10 hours

Neural Networks Basics - Functions in Neural networks – Activation function, Loss function - Function approximation - Classification and Clustering problems - Deep networks basics - Shallow neural networks – Activation Functions – Gradient Descent – Back Propagation – Deep Neural Networks – Forward and Back Propagation – Parameters – Hyperparameters.

Unit:2	IMPROVING DEEP NEURAL NETWORKS	12 hours

Mini-batch Gradient Descent – Exponential Weighted Averages – Gradient Descent with Momentum – RMSProp and Adam Optimization – Hyperparameter tuning – Batch Normalization – Softmax Regression – Softmax classifier – Deep Learning Frameworks – Data Augmentation - Under-fitting Vs Over-fitting.

Unit:3	CONVOLUTION NEURAL NETWORKS	12 hours

Foundations of Convolutional Neural Networks – CNN operations – Architecture – Simple Convolution Network – Deep Convolutional Models – ResNet, AlexNet, InceptionNet and others.

Unit:4	RECURRENT NETWORKS AND RECURSIVE NEURAL NETWORKS	12 hours

Recurrent Neural Networks - Bidirectional RNNs, Encoder, Decoder, Sequence-to-Sequence Architectures, Deep Recurrent Networks, Auto encoders - Bidirectional Encoder Representations from Transformers (BERT). Long-Term Dependencies - Echo State Networks - Long Short-Term Memory and Other Gated RNNs

Unit:5	DEEP REINFORCEMENT LEARNING	12 hours
Deep Reinforcement Learning – Q-Learning – Deep Q-Learning – Policy Gradients - Advantage Actor Critic (A2C) and Asynchronous Advantage Actor Critic (A3C) – Model based Reinforcement Learning – Challenges		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Ian Goodfellow Yoshua Bengio Aaron Courville, Deep Learning, MIT Press, 2017.
2	Michael Nielsen, Neural Networks and Deep Learning, Determination Press, first
Reference Books	
1	N D Lewis, Deep Learning Step by Step with Python, 2016.
2	2. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly
3	Umberto Michelucci, Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks, Apress, 2018.
4	Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy, Deep Learning with TensorFlow: Explore neural networks with Python, Packt Publisher, 2017.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.geeksforgeeks.org/deep-learning-tutorial/
2	https://www.youtube.com/watch?v=ErnWZxJovaM
3	https://www.kaggle.com/code/kanncaa1/deep-learning-tutorial-for-beginners
Course Designed By:	

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

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

Course code		EMBEDDED SYSTEMS	L	T	P	C
Core/Elective/ Supportive		Elective	4			4
Pre-requisite		Basics of micro controllers	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Present the introduction to embedded systems, Devices and Buses for Device Networks, Program modeling concepts, Inter – process communication & Synchronization of processes, Tasks and threads
2. Enable the students learn the embedded systems concepts and fundamentals.

Expected Course Outcomes:

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

1	Understand embedded systems concepts	K1,K2
2	Understand RTOS concepts	K1,K2
3	Identify the devices and buses used in embedded networking	K2,K3, K4
4	Analyze on software development process life cycle and its models	K2,K3, K4
5	Analyze and design various real time embedded systems using RTOS	K2,K3, K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 hours

Introduction to Embedded Systems: Embedded System – Processor in the system – Other hardware units – software embedded into a system – Exemplary Embedded systems – On chip and in VLSI Circuit. Processor and Memory selection for Embedded systems.

Unit:2	NETWORKS	12 hours

Devices and Buses for Device Networks: I/O devices – Timer and counting Devices. Device Drivers and Interrupts Servicing Mechanism: Device drivers – Parallel Port device drivers in system – Serial Port device in a system – Device drivers for internal programmable timing devices – Interrupt servicing mechanism – context and the periods for context-switching, deadline and interrupt latency.

Unit:3	PROGRAMMING MODELS	12 hours

Program modeling concepts in single & Multiprocessor systems software- Development Process: Modeling Processes for Software analysis before software Implementation – Programming models for event controlled or response time constrained real time programs – Modeling for microprocessor systems. Software Engineering Practices in the Embedded Software Development Process: Software algorithm complexity – Software Development process life cycle and its models – Software analysis – Software design – Software implementation – Software Testing, Validating and Debugging – Real time programming issues during the software

development process – Software project management – Software maintenance – UML.		
Unit:4	REAL TIME OPERATING SYSTEMS	**11 hours**
Inter – process communication & Synchronization of processes, Tasks and threads: Multiple processes in an application – Problem of sharing data by multiple tasks and routines – Inter Process communication. REAL TIME OPERATING SYSTEM:- Real time and Embedded systems operating systems – Interrupt routines in RTOS environment – RTOS Task scheduling models, Interrupt latency and Response times of the Tasks as performance Metrices – performance Metric in scheduling models for periodic, sporadic and Aperiodic Tasks – IEEE standard POSIX 1003.1b functions for Standardization of RTOS and Inter-task communication functions – List of Basic actions in a preemptive scheduler and Expected times taken at a processor – Filters – point strategy for synchronization between the processes, ISRs, OS functions and tasks and for Resource management – Embedded Linux Internals.		
Unit:5	**EMBEDDED SYSTEM**	**11 hours**
Hardware – Software co-design in an embedded System: Embedded System Project Management – Embedded system design and co-design issues in system development processes – Design cycle in the development phase for an Embedded system – Uses of Target system, or its Emulator and In-circuit Emulator – Use of software tools for development of an embedded system – Use of scopes and logic analysis for system hardware tests – Issues in Embedded system design Case Study: An Embedded System for an Adaptive cruise control system in a car, embedded system for a smart card.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**
Text Books		
1	Raj Kamal, “Embedded Systems – Architecture, programming and design”, Tata McGraw – Hill, 2003.	
2	David E. Simon, “An Embedded Software primer” Pearson Education Asia, 2003.	
Reference Books		
1	Kenneth J Ayala, “The 8051 Microcontroller and Architecture programming and application”, Second Edition, PenramInternational.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_cs14/preview	
2	https://www.javatpoint.com/embedded-system-tutorial	
3	https://www.tutorialspoint.com/embedded_systems/index.htm	
Course Designed By:		

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

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

Course code		WEB SERVICES	L	T	P	C
Core/Elective/ Supportive		Elective	4			4
Pre-requisite		Basics of distributed computing	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Present the Web Services, Building real world Enterprise applications using Web Services with Technologies XML, SOAP, WSDL, UDDI
2. Get overview of Distributed Computing, XML, and its technologies
3. Update with QoS and its features
4. Develop Standards and future of Web Services

Expected Course Outcomes:

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

1	Understand web services and its related technologies	K1,K2
2	Understand XML concepts	K1,K2
3	Analyze on SOAP and UDDI model	K1,K2,K4
4	Demonstrate the road map for the standards and future of web services	K2,K3,K4
5	Analyze QoS enabled applications in web services	K1,K2,K3, K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION	12 hours

Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.

Unit:2	XML FUNDAMENTALS	12 hours

XML Fundamentals – XML documents - XML Namespaces- XML Schema –Processing XML.

Unit:3	SOAP MODEL	12 hours

SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI

Unit:4	TECHNOLOGIES AND STANDARDS	12 hours

Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management-workflows and workflow management systems Security: Basics-data handling and forwarding-data storage-errors-Web services security issues.

Unit:5	QUALITY OF SERVICE	10 hours
Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoS enabled web services-QoS enabled applications. Web services management-web services standards and future trends.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

	Text Books
1	Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services: An Architects Guide", Prentice Hall, Nov 2003.
2	Keith Ballinger, "NET Web services: Architecture and Implementation with .Net", Pearson Education, First Education Feb 2003.
3	Ramesh Nagappan, Developing Java Web Services: Architecting and developing secure Web Services Using Java", John Wiley and Sons, first Edition Feb 2003.
	Reference Books
1	Eric A Marks and Mark J Werrell, "Executive Guide to Web services", John Wiley and sons, March 2003.
2	Anne Thomas Manes, "Web Services: A managers Guide" Addison Wesley, June 2003.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.tutorialspoint.com/webservices/index.htm
2	https://www.javatpoint.com/web-services-tutorial
3	https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html
	Course Designed By:

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

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

Course code		Natural Language Processing	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Basics of Programming Language, Mathematics and Machine Learning	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:
1. Understanding Human Language
2. Analyze of Language Generation and Human-Computer Interaction
3. Able make Text Classification & Categorization

Expected Course Outcomes:

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

1	Understand Core NLP Concepts	K1, K2
2	Apply Text Preprocessing Techniques	K2, K3
3	Build and Evaluate NLP Models	K4, K5
4	Solve Real-World Problems Using NLP	K3, K5
5	Understand Ethical and Practical Challenges	K1, K2

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

Unit:1	INTRODUCTION	12 hours

An Introduction to Natural Language Processing: History of Natural Language Processing – Components – Applications - Text Analysis vs Text Analytics - Levels of Natural Language Processing - Natural Language Processing Roadmap.

Text Understanding and Normalization: Natural Language Processing Libraries - Text Understanding and Text Normalization - Unveiling of Text - Word Vector Representation - Sentence Embedding.

Unit:2	CLASSIFICATION AND CLUSTERING	10 hours

Text Similarity: Distance Measures and Distance Metrics - Family of Similarity Measures and Distances - Types of Similarity Measures - Types of Similarities - Semantic Similarity Approaches.

Challenges in Classification and Prediction - Comparison of Classification and Prediction - Classification and Regression Algorithms – Clustering.

Unit:3	SENTIMENT ANALYSIS	12 hours

Sentiment Analysis: Steps of Sentiment Analysis - Strategies for Sentiment Analysis - Tools for Sentiment Analysis - Case Study - Datasets for Sentiment Analysis.

Topic Modeling and Text Summarization: Stages of Topic Modeling – Applications - Algorithms and Models - Text Summarization - Text Summarization Applications - Tools for Text Summarization - Case Study: Text Summarization.

Unit:4	MACHINE READING COMPREHENSION	10 hours

Question Answering and Machine Reading Comprehension: Architecture of Machine Reading Comprehension - Machine Reading Comprehension Tasks - Attribute-Based Classification - Recent Trends and Challenges in Reading Comprehension - Benchmarked Datasets - Baseline Models of Machine Reading Comprehension - Performance Evaluation Metrics - Datasets for Machine Reading Comprehension - Tools for MRC - Case Study of MRC.

Unit:5	CHATBOTS & DIALOGUE SYSTEMS	14 hours

Properties of Human Conversation – Fame based Dialogue Systems – Dialogue Acts and Dialogue State – Chatbots – Dialogue System Design.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 Hours**

Text Books	
1	Dr. Nisha Varghese, Dr. M Punithavalli, "Unveiling Language: A Comprehensive Guide to Natural Language Processing", IIP Iterative International Publishers, First Edition, 2024
2	Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Pearson International Edition, 2025
Reference Books	
1	Nitin Indurkhya, Fred J.Damerau, "Handbook of Natural Language Processing", Second Edition, CRC Press.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.nltk.org/
2	https://scikit-learn.org/stable/index.html
3	https://www.udemy.com/courses/search/?src=ukw&q=NLP
4	https://www.tutorialspoint.com/natural_language_processing/index.htm

Mapping with Programming Outcomes

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

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

Course code		VIRTUAL AND AUGMENTED REALITY	L	T	P	C
Core/Elective/ Supportive		Elective	4			4
Pre-requisite		Basic knowledge of programming, computer graphics, and linear algebra.	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamental concepts, history, and key components of Virtual Reality (VR) and Augmented Reality (AR).
2. Explore the hardware and software systems used in VR and AR environments, including input/output devices and rendering techniques.
3. Analyze user interaction models, tracking technologies, and display systems in immersive environments.
4. Apply VR and AR development concepts to real-world applications, including interaction design, vision processing, and collaborative systems.

Expected Course Outcomes:

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

1	Recall the key terminologies, history, and elements involved in Virtual and Augmented Reality.	K1
2	Explain the architecture of VR/AR systems including user interfaces, tracking mechanisms, and display technologies.	K2
3	Implement basic VR and AR interactions using visual, aural, and haptic technologies.	K3
4	Analyze the performance of VR/AR systems with respect to user interaction, rendering quality, and tracking accuracy.	K4
5	Design and evaluate immersive VR/AR solutions for real-time applications demonstrating innovation and problem-solving skills.	K5, K6

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

Unit:1	INTRODUCTION TO VIRTUAL REALITY	12 hours

Introduction to Virtual Reality: Definition – Key Elements of Virtual Reality Experience – History of VR. VR –The Medium: Communicating through a Medium – A Medium's Content – Common Issues of Human Communication Media – Narrative – Form and Genre – Experience Versus Information.

Unit:2	VIRTUAL REALITY SYSTEMS	12 hours

Interface to the Virtual World – Input: User Monitoring – World Monitoring. Interface to the Virtual World – Output: Visual Displays – Aural Displays – Haptic Displays.

Unit:3	RENDERING AND FUTURE OF THE VIRTUAL WORLD	12 hours

Rendering of the Virtual World: Representation of the Virtual World – Visual – Aural – Haptic Representation. Rendering Systems – Visual – Aural – Haptic Rendering Systems. Future of VR: State of VR – Field of VR Research – Trends – Technology Futures – Software – Application Futures.

Unit:4	INTRODUCTION TO AUGMENTED REALITY	12 hours

Augmented Reality: Definition and Scope – History - Examples. Displays: Multimodal Displays – Visual Perception – Requirements and Characteristics – Spatial Display Model – Visual Displays. Tracking: Tracking, Calibration, and Registration – Coordinate Systems – Characteristics of Tracking Technology – Stationary Tracking Systems – Mobile Sensors – Optical Tracking – Sensor Fusion.

Unit:5	**VISION, INTERACTION, ANNOTATION AND COLLABORATION**	**10 hours**
Computer Vision: Marker Tracking – Natural Feature tracking by Detection – Incremental Tracking and Outdoor Tracking. Interaction: Tangible interfaces – Virtual User Interfaces on Real Surfaces – Multi-view Interfaces – Haptic Interaction – Annotation – Collaboration: Properties – Co-located Collaboration – Remote Collaboration.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Sherman William R, Craig Alan B., “Understanding Virtual Reality: Interface, Application and Design”, 1st Edition, Morgan Kaufmann Publishers, 2020. (Units I, II and III)
2	Dieter Schmalstieg, Tobias Hollerer, Augmented Reality. Principles and Practice, 1st Edition, Addison-Wesley Publishers, 2016. (Unit IV and V)
Reference Books	
1	Jason Jerald, The VR Book: Human Centric Design for Virtual Reality, 1st Edition, Association for Computing Machinery and Morgan & Claypool Publishers, 2016.
2	Erin Pangilinan, Steve Lukas and Vasanth Mohan, “Creating Augmented and Virtual Realities Theory & Practice for Next-Generation Spatial Computing”, O’REILLY, 2019
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://youtu.be/WzfDo2Wpxks
2	https://www.coursera.org/learn/ar
3	https://www.geeksforgeeks.org/basics-augmented-reality/
Course Designed By:	

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

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

Course code		INTERNET OF THINGS	L	T	P	C
Core/Elective/ Supportive		Elective	4			4
Pre-requisite		Basics of Sensors and its applications	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
2. Enable students to learn the Architecture of IoT and IoT Technologies
3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.

Expected Course Outcomes:

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

1	Understand about IoT, its Architecture and its Applications	K1, K2
2	Understand basic electronics used in IoT & its role	K1, K2
3	Develop applications with C using Arduino IDE	K3, K4
4	Analyze about sensors and actuators	K2, K4
5	Design IoT in real time applications using today's internet & wireless technologies	K3,K4

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

Unit:1	INTRODUCTION	10 hours

Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT

Unit:2	BASIC ELECTRONICS FOR IoT	12 hours

Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.

Unit:3	ARDUINO	12 hours

Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

Unit:4	SENSORS AND ACTUATORS	12 hours

Sensors and Actuators: Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.

Unit:5	SENSOR IN INTERNET	12 hours
Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak).		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 2014. ISBN: 978-0996025515
2	Boris Adryan, DominikObermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.
Reference Books	
1	Michael Margolis, "Arduino Cookbook", O"Reilly, 2011
2	Marco Schwartz, "Internet of Things with ESP8266", Packt Publishing, 2016.
3	DhivyaBala, "ESP8266: Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit", 2018.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2	https://www.javatpoint.com/iot-internet-of-things
3	https://www.tutorialspoint.com/internet_of_things/index.htm
Course Designed By:	

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

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

Course code		PHP PROGRAMMING	L	T	P	C
Core/Elective/ Supportive		Core	4			4
Pre-requisite		Basic programming knowledge and Internet Programming.	Syllabus Version		2025- 26	

Course Objectives:

The main objectives of this course are to:

1. Present the Introduction to PHP, PHP functions, database handling and in addition AJAX is taught.
2. Enable the students to learn the fundamentals of Open Source software and get experience in PHP and AJAX.
3. Acquire skills to write PHP programs.

Expected Course Outcomes:

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

1	Understand the concepts of open source softwares	K1,K2
2	Understand the functions and browser handling power of PHP	K1,K2
3	Apply object oriented concepts and file handling concepts of PHP	K3, K6
4	Evaluate database and set sessions, cookies and FTP	K4,K5
5	Develop web pages using PHP	K3,K4, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	OPEN-SOURCE SOFTWARE	12 hours

Open-Source Software: Overview of Free/ Open Source Software: The Open-Source Definition - Examples of OSD Compliant Licenses - Examples of Open-Source Software Product – The Open-Source Software Development Process – A History of Open=Source software: The Berkeley Software Distribution – The Free Software Foundation – Linux – Apache – Mozilla – Open Source Software.

PHP: Introduction – Essential PHP – Operators and Flow control: Working with math, assignment, increment and decrement, string, bitwise, execution, comparison and logical operators, Working with loops – Strings and Arrays.

Unit:2	FUNCTIONS AND WEB PAGES	12 hours

PHP Functions and Browser handling power: Creating Functions, passing functions, passing arrays, pass by reference, default arguments, returning data, arrays, lists, references, accessing global data, working with static variables, PHP conditional functions, variable functions, nesting functions – Reading data in web pages: Handling text fields, areas, check boxes, radio buttons, list boxes, password controls, hidden controls, image maps, file uploads, buttons – PHP Browser handling power.

Unit:3	OOPS AND FILES	12 hours
Working with Object oriented programming and File handling: Object oriented programming: creating classes, objects, setting access to properties and methods, using constructors and destructors, inheritance, overriding and overloading methods, auto loading classes – File Handling: open, read, close, parsing files, copy, delete, write and append files.		
Unit:4	**DATABASE, SESSION AND COOKIES**	**12 hours**
Working with databases and setting sessions, cookies and FTP: Databases: creating, accessing, updating, inserting, deleting and sorting databases – Setting sessions, cookies and FTP: setting, reading, and deleting cookies, working, downloading, uploading, deleting, creating and removing directories with FTP.		
Unit:5	**AJAX**	**10 hours**
AJAX and Drawing Images on the server: Ajax: Handling AJAX requests, downloading images using AJAX, downloading javascript with AJAX– Drawing images on the server: creating and displaying images, drawing lines, rectangles, ellipse, arcs, polygons, figures, individual pixels, text, virtual text, working with image files, tiling images, copying images.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

	Text Books
1	Joseph Feller, Brain Fitzgerald, Eric S. Raymond, "Understanding Open Source Software Development", Addison-Wesley Professional, 1st Edition, 2001.
2	"The Complete Reference PHP Covers PHP 5.2, "Steven Holzner, Tata McGraw-Hill Edition 2008.
	Reference Books
1	PHP6 and MySQL6 Bible – Steve Svehring.
2	PHP Programming Solutions – VickramViswani.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.tutorialspoint.com/php/index.htm
2	https://www.javatpoint.com/php-tutorial
3	http://www.nptelvideos.com/video.php?id=2138&c=27

Mapping with Programming Outcomes

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

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

Course code		DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/ Supportive		Elective	4			4
Pre-requisite		Basics of Image Processing and applications	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Learn basic image processing techniques for solving real problems.
2. Gain knowledge in image transformation and Image enhancement techniques.
3. Learn Image compression and Segmentation procedures.

Expected Course Outcomes:

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

1	Understand the fundamentals of Digital Image Processing	K1,K2
2	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement	K1,K2
3	Apply, Design and Implement and get solutions for digital image processing problems	K3,K4
4	Apply the concepts of filtering and segmentation for digital image retrieval	K3,K4
5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner	K3,K4

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

Unit:1	INTRODUCTION	12 hours

Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.

Unit:2	IMAGE ENHANCEMENT	12 hours

Image Enhancement in the spatial domain:- Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

Unit:3	IMAGE RESTORATION	12 hours

Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.

Unit:4	IMAGE COMPRESSION	10 hours
Image Compression: Fundamentals – Image compression models – Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.		
Unit:5	**IMAGE SEGMENTATION**	**12 hours**
Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**hours**

Text Books	
1	Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Second Edition, PHI/Pearson Education.
2	B. Chanda, D. Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2003.
Reference Books	
1	Nick Efford, “Digital Image Processing a practical introducing using Java”, Pearson Education, 2004.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/105/117105135/
2	https://www.tutorialspoint.com/dip/index.htm
3	https://www.javatpoint.com/digital-image-processing-tutorial
Course Designed By:	

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

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

Course code		CYBER SECURITY	L	T	P	C
Core/Elective/ Supportive		Elective	5			4
Pre-requisite		Basic knowledge of Internet and data crimes.	Syllabus		2025 - 26	

Course Objectives:

Students should be able to understand

1. The transformation between threat, risk, attack and vulnerability.
2. How threats materialize into attacks.
3. To find information about threats, vulnerabilities and attacks.

Expected Course Outcomes:

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

1	Understand the broad set of technical, social & Cyber Security	**K2**
2	Understand the security design of operating system	**K3**
3	Recognize & analyze the importance of Data mining & Big data concepts	**K1-K4**
4	To improve the Problem-solving skills, Research, Innovation/creativity	**K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	INTRODUCTION TO CYBER SECURITY	10 hours

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authentic Access Control and Cryptography - Web—User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks

Unit:2	SECURITY IN OPERATING SYSTEM & NETWORKS	12 hours

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

Unit:3	DEFENCES: SECURITY COUNTER MEASURES	12Hours

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

Unit:4	PRIVACY IN CYBERSPACE	12Hours

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - DataMining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies- Where the Field Is Headed.

Unit:5	MANAGEMENT AND INCIDENTS	12Hours

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws – Cyber-crime - Cyber Warfare and Home Land Security.

Unit:6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60Hours**

Text Books	
1	Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
2	George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
Reference Books	
1	Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015.
2	Nelson Phillips and Enfinger Steuart, —Computer Forensics and Investigations, Cengage Learning, New Delhi, 2009.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.w3schools.com/cybersecurity/index.php
2	https://www.geeksforgeeks.org/cyber-security-tutorial/
3	https://www.coursera.org/courses?query=cybersecurity&msockid=0fea3cd0dcef65ed1bf4294add8d648a
Course Designed By:	

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

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

Course code		ADVANCEMENTS IN INDUSTRY 4.0	L	T	P	C
Core/Elective/ Supportive		Elective	4			4
Pre-requisite		Basics of AI, Image Processing and Security	Syllabus Version		2025 -26	

Course Objectives:

The main objectives of this course are to:

1. Present the concepts and application of Machine learning, RPA, Cyber Security, Virtual Reality and Augmented Reality in various domains.
2. Learn current trends in IT industry.

Expected Course Outcomes:

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

1	Understand the drivers and enablers of Industry 4.0	K1,K2
2	Learn about Cyber Security and Cyber-Systems from the industrial systems perspective	K1,K2
3	Analyze on purpose of Robotic Process Automation	K2,K3, K4
4	Analyze on Virtual Reality-Based Enhance Manufacturing Sustainability in Industry 4.0	K2,K3, K4
5	Analyze on Augmented Reality-Based Enhance Manufacturing Sustainability in Industry 4.0	K2,K3, K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	MACHINE LEARNING	12Hours

Machine Learning - Introduction – Definition – Types of Machine Learning –Supervised, Unsupervised, Reinforcement Learning – Algorithms for Machine Learning – Problems solved by Machine Learning - Tools for Machine Learning - Applications areas of Machine Learning

Unit:2	ROBOTIC PROCESS	12Hours

Robotic Process Automation (RPA): Introduction to RPA – Need for automation – Programming constructs in RPA – Robots and Softbots – RPA architecture and process methodologies - Industries best suited for RPA - Risks & Challenges with RPA

Unit:3	CYBER SECURITY	12Hours

Cyber Security: Cyber Crime and Information Security – Classification of Cyber Crimes - Types of Cyber Attacks - Cyber crime and Indian IT Act 2000 – Security Methods.

Unit:4	VRTUAL REALITY	11Hours

Virtual Reality: Definition – Types of Head Mounted Displays – Tools for Virtual Reality – Applications of VR in Education, Industries - Difference between VR and AR.

Unit:5	AUGMENTED REALITY	11Hours

Augmented Reality: Definition - Tools for Augmented Reality –Hololens - Advantages and Challenges of AR - Applications of AR in Education, Industries - Mixed Reality.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	P. Kaliraj, T. Devi, Higher Education for Industry 4.0 and Transformation to Education 5.0, 2020.
Reference Books	
1	Anand Nayyar, A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development (Advances in Science, Technology & Innovation), Springer; 1st ed. 2020
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm
2	https://www.javatpoint.com/rpa
3	https://onlinecourses.nptel.ac.in/noc19_me74/preview
Course Designed By:	

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

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

Annexure

Master of Computer Applications

Syllabus

(With effect from 2025 -2026)

Program Code : 38M

DEPARTMENT OF COMPUTER SCIENCE

Bharathiar University
(A State University, Accredited with "A" Grade by NAAC and
13th Rank among Indian Universities by MHRD-NIRF)
Coimbatore 641 046, INDIA

BHARATHIAR UNIVERSITY, COIMBATORE 641046
DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS
MISSION

To impart Knowledge and Skill that develop Technical, Social, Economical, and Cultural values by providing a good Platform to Perform, acquiring Basic Practical Knowledge of various Fundamental Theoretical concepts and apply them successfully to meet the industrial needs globally with an attitude of Self upliftment and Society.

Bridge Course

Bharathiar University, Coimbatore – 46
Bridge Course for MCA

(For students admitted from 2025-2026 onwards)

Total Hours: 60 hours

Goal:

The objective of bridge course is to provide the fundamental concepts and Practical knowledge about Computer Science and its Applications for students admitted from Non – Computer streams [with Mathematics at UG level or +2.]

Subject Code	Subject Name	Theory Hours	Practical Hours
01	Programming Fundamentals • Basics of C/C++ Programming • Data Types, Control Structures and Functions • Arrays and Pointers • Introduction to Object-Oriented Programming	12	10
02	Database and Data Structures • Introduction to DBMS & SQL • Basics of Data Structures (Stacks, Queues, Linked Lists)	10	10
03	Computer Fundamentals • Basics of Operating Systems • Computer Networks Overview • Fundamentals of Software Engineering	10	2
04	Logical and Analytical Reasoning • Problem-Solving Techniques • Logical and Analytical Reasoning	6	-
	Total	**38**	**22**

* Use PPT to enhance and Speed up the Teaching Learning Process and PPT can be used for Future References