RAMDEOBABA UNIVERSITY
[RBU]
NAGPUR – 440013

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

RBU
RAMDEOBABA UNIVERSITY, NAGPUR
Formerly Shri Ramdobaba College of Engineering & Management (RCOEM) Est. 1984

PROGRAMME SCHEME & SYLLABUS
2025-26

MASTER OF COMPUTER APPLICATIONS (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
MCA (AI & ML)

RAMDEOBABA UNIVERSITY (RBU), NAGPUR

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

MASTER OF COMPUTER APPLICATIONS
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
MCA(AI & ML)

Teaching & Evaluation Scheme

Semester-I

Sr. No.	Course Type	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester / Internal Eval	Total	Duration of End Semester
1	PCC	25CS60TP1175	Operating Systems	3	2	4	50+25	50+25	150	3 Hrs.
2	PCC	25CS60TP1176	Object Oriented Programming	3	2	4	50+25	50+25	150	3 Hrs.
3	PCC	25CS60TP1177	Data Structures	3	2	4	50+25	50+25	150	3 Hrs.
4	PCC	25CS60TP1178	Computer Networks	3	2	4	50+25	50+25	150	3 Hrs.
5	PCC	25CS60TP1179	Foundation of Data Science	3	2	4	50+25	50+25	150	3 Hrs.
6	PCC	25CS60PR1181	Fundamentals of Web Development Lab	0	2	1	25	25	50	-
			TOTAL	**15**	**12**	**21**	**400**	**400**	**800**	

Semester-II

Sr. No.	Course Type	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester / Internal Eval	Total	Duration of End Semester
1	PCC	25CS60TP1275	Database Management Systems	4	2	5	50+25	50+25	150	3 Hrs.
2	PCC	25CS60TP1276	Artificial Intelligence	3	2	4	50+25	50+25	150	3 Hrs.
3	PCC	25CS60PR1277	Computer Workshop Lab-I	0	2	1	25	25	50	-
4	PEC	25CS60TP1278	Elective-I	3	2	4	50+25	50+25	150	3 Hrs.
5	PCC	25CS60PR1279	Advanced Web Development Lab	0	4	2	25	25	50	-
6	HSMC/ SEC	25HS02PR1275	Communication Skills for Employability	0	2	1	25	25	50	-
7	OEC	25ID160TH1275	Open Elective	3	0	3	50	50	100	3 Hrs.
			TOTAL	**13**	**14**	**20**	**350**	**350**	**700**	

Course Code	Elective-I
25CS60TP1278-1	Image Processing
25CS60TP1278-2	Operations Research
25CS60TP1278-3	Pattern Recognition
25CS60TP1278-4	Cloud Computing

Open Elective (Offered by MCA(AI&ML) Department)	
25ID160TH1275-1	Introduction to Machine Learning
25ID160TH1275-2	Introduction to Natural Language Processing
25ID160TH1275-3	Text Mining Applications
25ID160TH1275-4	MOOC-Coursera
25ID160TH1275-5	CDPC

Semester-III

Sr. No.	Course Type	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester / Internal Eval	Total	Duration of End Semester
1	PCC	25CS60TP1375	Design and Analysis of Algorithms	3	2	4	50+25	50+25	150	3 Hrs.
2	PCC	25CS60TP1376	Machine Learning	3	2	4	50+25	50+25	150	3 Hrs.
3	PCC	25CS60TP1377	Business Analytics and Intelligence	3	2	4	50+25	50+25	150	3 Hrs.
4	PEC	25CS60TP1378	Elective-II	3	2	4	50+25	50+25	150	3 Hrs.
5	PEC	25CS60TP1379	Elective-III	3	2	4	50+25	50+25	150	3 Hrs.
6	MLC	25CS60TH1381	Research Methodology	2	0	2	50	50	100	2 Hrs.
			TOTAL	**17**	**10**	**22**	**425**	**425**	**850**	

Course Code	Elective-II
25CS60TP1378-1	Information Security
25CS60TP1378-2	Computer Vision
25CS60TP1378-3	Generative AI and its Applications

Course Code	Elective-III
25CS60TP1379-1	Software Engineering
25CS60TP1379-2	AI on Cloud
25CS60TP1379-3	Advanced Data Analytics
25CS60TP1379-4	Advanced Databases

Semester-IV

Sr. No.	Course Type	Course Code	Course Name	L	P	C	Continuous Assessment	End Semester / Internal Eval	Total	Duration of End Semester
1	PCC	25CS60TP1475	Deep Learning	3	2	4	50+25	50+25	150	3 Hrs.
2	PEC	25CS60TP1476	Elective -IV	3	2	4	50+25	50+25	150	3 Hrs.
3	AEC	25CS60PR1480	Computer Workshop Lab-II	0	2	1	25	25	50	-
4	VSEC/ Project	25CS60PR1481	Project Work	0	12	6	75	75	150	-
5	AEC	25CS60PR1482	Technical Seminar	0	2	1	25	25	50	-
6	HSMC/ SEC	25HS02PR1475	Personality Development and Softs Skills	0	2	1	25	25	50	-
			TOTAL	**6**	**22**	**17**	**300**	**300**	**600**	

Course Code	Elective-IV
25CS60TP1476-1	Internet of Things
25CS60TP1476-2	Prompt Engineering
25CS60TP1476-3	Data Privacy and Security

1 Year Internship (Semester-III and IV)

Sr. No.	Course Type	Course Code	Course Name	L	T	P	C	Continuous Assessment	End Semester / Internal Eval	Total	Duration of End Semester
1	PEC	25CS60PR1391	Project Work- Full Time (Phase-I)	0	0	44	22	450	400	850	-

Six months Internship (Semester- IV)

Sr. No.	Course Type	Course Code	Course Name	L	T	P	C	Continuous Assessment	End Semester / Internal Eval	Total	Duration of End Semester
1	PEC	25CS60PR1491	Project Work- Full Time (Phase-II)	0	0	34	17	300	300	600	-

Bridge Program

Sr. No.	Course Type	Course Code	Course Name	L	T	P	C	Continuous Assessment	End Semester / Internal Eval	Total	Duration of End Semester
1		25CS60TH1199	Discrete Structures and Digital Logic	2	1	0	0	-	-	-	-

Credits Distribution Semester-wise:

SEM-I	SEM-II	SEM-III	SEM-IV	Total Credits
21	20	22	17	80

Qualification Type and Credit Requirements under NEP Guidelines		
Levels	**Qualification title**	**Credit requirements**
Level 8	**Post-Graduate Diploma** for those who exit after the successful completion of the first year or two semesters of the two-year Master's degree programme). (Programme duration: One year or two semesters) **[Post-Graduate Diploma in Computer Applications]**	41
Level 9	**Master's Degree** (Programme duration: Two years or four semesters after obtaining a Master's degree). **[MASTER OF COMPUTER APPLICATIONS (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)]**	80

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1175 **Course: Operating Systems**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits : 4**

Course Objectives

To study various elements of operating systems and compare core functionalities of Windows and Linux operating systems. Students can learn concurrent processes problems, understand various memory management techniques, analyze deadlock handling methodologies and different protection and security concerns of operating system.

Course Outcomes

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

1. Identify various elements of operating system and compare core functionalities of Windows and Linux.
2. Identify and synchronize concurrent processes problems, analyze various memory management techniques and deadlock handling methodologies.
3. Understand different protection and security concerns of operating systems.

Syllabus

Unit - I :

Introduction - Types of OS, Operating system services, system calls.

File system introduction, Access methods, Allocation methods, Directory system, Disk and drum scheduling. Case study on Unix and Windows Operating System.

Unit - II :

Process: Introduction, Threads, CPU Scheduling algorithms, Inter-process communication, Critical section problem, Semaphores, Classical process coordination problem.

Unit - III :

Deadlock: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance, Banker's algorithm, Deadlock detection and Recovery.

Unit - IV :

Memory Management: Concept of Fragmentation, Swapping, Paging, Segmentation.

Virtual memory: Demand Paging, Page replacement algorithm, Thrashing.

Unit - V :

Protection: Goal, Domain of protection, Access matrix, Access control.

Security: The security problem, Program threats, System and network threats, User authentication.

Text Books:

1. Operating System Concepts: *Siliberschatz Galvin: John Wiley & Sons.*
2. Modern Operating Systems: *Andrew Tanenbaum, PHI.*

3. Operating System, internals and Design Principles: Williams Stallings.

Reference Books :

1. An Introduction to Operating System: *H.M.Dietel, Pearson Education.*
2. Operating System: *Charles Crowley, IRWIN Publications.*
3. Operating systems: Archer J. Harris, Schaum's Outline, McGraw Hill Publication

Lab Syllabus :

Minimum 8 practical's based on the theory topics.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1176 **Course: Object Oriented Programming**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits : 4**

Course Objectives

To develop the skills through which students will gain expertise in writing programs using object-oriented programming features. Students can learn to apply concepts of File handling, exception handling, Generics, Collections, multithreading along with the development of various programs using JDBC, JSP for skill development of basic web programming concepts and server-side scripting.

Course Outcomes

1. Understanding and analysis of different object-oriented programming features and ability to develop basic programming
2. Introduction to File handling, exception handling, Generics, Collections and multithreading to develop efficient programs with the concepts of error handling.
3. Understanding the concepts of JSP and JDBC to develop basic web programming concepts, database connectivity in addition to servlets to develop basic concepts

Syllabus

Unit - I :

Features of Object Oriented Programming languages like data encapsulation, inheritance, polymorphism and late binding.Introduction to class and Methods, Access control of members of a class, instantiating a class, Constructors, Garbage Collection, finalize() Method.

Unit - II :

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism. Abstract classes and methods, interface, implementation of interface, creating packages, importing packages, static and non-static members.

Unit - III :

Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw andthrows clause, user defined exceptions, Generics, generic class with two type parameter, bounded generics,Collection classes: Arrays, Vectors, Array list, Linked list, Hash set, Queues, Trees,

Unit - IV :

Introduction to streams, byte streams, character streams, file handling in Java, Serialization Multithreading:Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, Inter-thread communications.

Unit - V :

JSP-Why JSP?, JSP Directives, Writing simple JSP page, Scripting Elements, Default Objects in JSP, JSP Actions,Managing Sessions using JSP, JSP with beans. Java Database Connectivity, Servlets - Introduction Servlets vs CGI, Servlets API Overview, Servlets Life Cycle, Coding Writing &runningsimple Servlets, Generic Servlets, HTTPServlet, Servlets Config, Servlets Contest Writing Servlets to handle Get& Post methods.

Text Books:

1. JAVA The Complete Reference*: Herbert Schildt;*; Seventh Edition, Tata McGraw- Hill Publishing Company Limited 2007.
2. A programmer's Guide to Java SCJP Certification: A Comprehensive Primer: *Khalid A. Mughal and Rolf W.Rasmussen,* Third Edition.
3. Java Fundamentals: A Comprehensive Introduction:*HerbertSchildt and Dale Skrien*; Tata McGraw- Hill Education Private Ltd., 2013.

Reference Books:

1. Core JAVA Volume-II Advanced Features: *Cay S. Horstmann and Gary Cornell;* Eighth Edition; Prentice Hall, Sun Microsystems Press, 2008.
2. Java Programming: A Practical Approach: *C Xavier;* Tata McGraw- Hill Education Private Ltd., 2011

Lab Syllabus :

Minimum 8 practical's based on theory topics.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1177 **Course: Data Structures**

L: 3 Hrs, P: 2 Hr, Per Week **Total Credits : 4**

Course Objectives

Given knowledge about various data structures, students should develop skills to create error free and efficient logics; by applying data-structures algorithms for real world problems.

Course Outcomes

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

1. Solve real world problems based on the concepts of arrays, sorting, searching and various linked list algorithms.
2. Apply stacks mechanism, queues and select appropriate algorithm as per the properties of the given problem.
3. Identify tree data structure and hashing techniques to formulate the problem, devise an algorithm and transform into code.

Syllabus

Unit - I :

Introduction to Data Structures: Definition, Arrays implementation in memory, Types of arrays. Applications of Arrays: Polynomial Representation Using Arrays, Addition and multiplication of Two Polynomial.

Sorting & Searching: General Background, Different Sorting & Searching Techniques and their complexities.

Unit - II:

Linked List - Concept of Linked Lists, Types, Operations on Linked lists, concept of Doubly Linked List, Header Linked List. Other Operation & Applications: Reversing a Linked List, Concatenation of Two Lists.

Unit - III :

Stacks: Definition and example, primitive operations on Stacks, Arithmetic expressions (Infix, Postfix and Prefix), Evaluating postfix expression, converting an expression from infix to postfix. Applications of stacks: Tower of Hanoi Problem, Recursion, etc.

Unit - IV :

Queues: Definition and examples of queues, primitive operations, Types of Queues.

Trees: Definition and Basic Terminology of trees, Binary Tree, Binary Search Tree, Tree Traversal.

Unit - V :

Hashing: Introduction to Hashing, Different Hashing techniques, Collision handling mechanisms.

Text Books:

1. Data Structures and Program Design: Robert Kruse, PHI.
2. Classical Data Structure: Samanta, PHI.
3. Fundamentals of Data Structures: Elis Horowitz, Sartaj Sahani, Galgotia Publications.
4. Data Structures And Algorithms: Alfred V. Aho , John E. Hopcroft and Jeffrey D Ullman, Pearson.

Reference Books:

1. Schaum's Outlines Data structure: Seymour Lipschutz, Tata McGraw Hill 2nd Edition.
2. Data Structures and Algorithms: G A V Pai, Tata McGraw Hill.

Lab Syllabus :

Minimum 8 practicals based on theory topics.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1178 **Course: Computer Networks**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives

The objective of the course is to introduce the fundamental concepts and architecture of computer networks, including the network edge, core, and service models. It explores the functionality of key network layers such as application, transport, network, and link layers. It also develops practical skills through socket programming and understanding of network applications such as web services, email, and peer-to-peer systems

Course Outcomes

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

1. Analyze and implement application-layer protocols and understand web technologies, DNS, and multimedia communication over the internet.
2. Describe the structure of the internet and explain how different components interact within the network using layered protocols.
3. Distinguish between transport layer protocols and evaluate their mechanisms for error control, reliability, and congestion management.
4. Understand and evaluate link-layer technologies including error detection, LAN protocols, and data center network architectures.

Syllabus

Unit-I

Computer Networks and the Internet: The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and Their Service Models, Networks Under Attack.

Unit-II

Application Layer: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distribution Networks, Socket Programming: Creating Network Applications

Unit-III

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.

Unit-IV

The Network Layer: Data Plane: Overview of Network Layer, Inside a Router, The Internet Protocol (IP): IPv4, Addressing, IPv6, Generalized Forwarding and SDN.

The Network Layer: Control Plane: Routing Algorithms (LS and DV). Intra-AS Routing in the Internet (OSPF), Routing Among the ISPs (BGP), The SDN Control Plane, ICMP: The Internet Control Message Protocol.

Unit-V

The Link Layer and LANs: Introduction to the Link Layer, Error-Detection and -Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking.

Text Books

1. "Computer Networking- A Top-Down Approach", by James F. Kurose and Keith W Ross, Person Education, ISBN- 978-81-317-9054-0, 5th Edition.

2. "Data and Computer Communications" by William Stallings, Publisher: Pearson,

3. "Computer Networks", by Tanenbaum A. S., Pearson Education, 2008, ISBN-978-81-7758-165-2, 4th Edition

Reference Books

1. "Data Communications and Networking", by Forouzan B. A, Tata McGraw-Hill Publications,2006, ISBN-0-07-063414-9, 4th edition.
2. "Communication Networks- Fundamental Concepts and Key Architectures", by LeonGarcia-Wadjaja, Tata McGraw-Hill Publications, ISBN-978-0072463521.

Additional Reading

1. "Computer Networks and Internet", by Comer D., Pearson Education, ISBN-81-297- 0330-0, 2nd Edition.
2. "Computer Networks- A Systems Approach", by Larry L. Peterson and Bruce S. Davie, Morgan Kaufmann, ISBN-978-81-312-1045-1, 4th Edition.

Lab Syllabus :

Minimum 6 to 8 Practical's based on theory topics.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1179 **Course: Foundation of Data Science**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives

This course aims to introduce students to the foundational concepts and techniques of data science. This course also provide knowledge on data processing, analysis, and visualization techniques.

Course Outcomes

At the end of the course, the students will be able to:

1. Explore the needs and importance of Data Science concepts.
2. Work with data science platform for data preprocessing steps.
3. Use Descriptive and Exploratory tools to communicate data insights effectively
4. Apply the various statistical and probability measures on data set.
5. Demonstrate various data mining algorithms on large volume of data sets.

Syllabus

Unit-I :

Introduction to Data Science: What is Data Science? Evolution and scope of Data Science, Data Science vs. Data Analytics vs. Machine Learning vs Business intelligence, Data Science Lifecycle, Role of a Data Scientist, Data Science Platform – Challenges of Conventional Systems -Intelligent data analysis Tools and technologies used in Data Science, Real-world applications of data science.

Unit-II :

Data Collection and Preprocessing: Types and sources of data: Structured, Unstructured, Semi-structured, Data formats: CSV, JSON, XML, SQL, APIs, Handling missing data, duplicate values, and outliers Data transformation: encoding, normalization, scaling, Data wrangling and cleaning, Handling missing data and outliers, Feature engineering and normalization.

Unit-III :

Exploratory Data Analysis (EDA) and Visualization: Descriptive statistics: Mean, Median, Mode, Variance, Standard Deviation, Data distributions and correlations, Data visualization using histograms, boxplots, scatter plots, and heatmaps, Introduction to dashboards and storytelling with data, Concept of model building in data science.

Unit-IV :

Probability and Statistical Inference: Basics of probability theory, Bayes' Theorem, Probability distributions: Binomial, Normal, Poisson, Hypothesis testing and confidence intervals, p-value, t-tests, ANOVA, Central Limit Theorem

Unit-V :

Introduction to Data Mining : Supervised vs. Unsupervised Learning, Linear Regression, Multiple Regression and Logistic Regression, Evaluation of classification methods – Confusion matrix, Students T-tests and ROC curves- Decision Tree algorithms, Clustering algorithms, Association Mining Algorithms.

Text Books:

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly.
2. Doing Data Science – Cathy O'Neil and Rachel Schutt, O'Reilly Media.
3. Jiawei Han, Micheline Kamber and Jian Pei, " Data Mining: Concepts and Techniques", Third Edition.

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP.
3. Data Science for Business by F. Provost and T. Fawcett.

Lab Syllabus :

Minimum 10 practical's based on theory topics:

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1181 Course: Fundamentals of Web Development Lab

L: 0 Hrs, P: 2 Hrs, Per Week Total Credits: 1

Course Objectives

Students will be able to understand the basics of HTML, CSS, Javascript language syntax and to know the fundamentals of server side website programming using PHP.

Course Outcomes

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

1. To implement basic webpage programming using HTML, CSS and Javascript.
2. To implement a dynamic website using PHP.

Syllabus

Minimum 18 Practical's based on following topics but not limited to:

1. **HTML Basics :** Knowing HTML Basics, Elements, Attributes, Advanced Tags, HTML Forms, Form elements, Frames, XHTML.
2. **HTML5 :** Canvas, Audio and Video elements, Local Storage, Graphics, Geolocation.
3. **CSS Styling** : Advantages of CSS, Types of including styles, Selectors, Multicolumn Layouts, Colors and Opacity, Transformations, Viewport, Responsive websites using Media Queries, using popular libraries.
4. **Javascript :** History of Javascript, Variables, Literals, Operators, Functions, Objects, DOM Events, Validating User Input with Javascript, Using different libraries like JQuery, AngularJS etc.
5. **PHP** : Installing WAMP and creating basic dynamic web pages, accessing form variables, read-write from files, using sessions & cookies, database operations using MySQL with PHP.

Text Books:

1. Beginning HTML, XHTML, CSS, and JavaScript – *Jon Duckett (Wrox)*
2. PHP, MySQL, Javascript & HTML5 All-in-one for Dummies - *Steven Suehring, Janet Valade* (*Wiley*)

Reference Books:

1. HTML5, JavaScript, and jQuery 24-Hour Trainer - *Dane Cameron (Wrox)*
2. Programming PHP – *Kevin Tatroe, Peter MacIntyre (O'Reilly)*

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1275 **Course: Database Management Systems**

L: 4 Hrs, P: 2 Hrs, Per Week **Total Credits: 5**

Course Objectives

To design, manipulate and manage databases. Students can learn to develop preliminary understandings, skills for designing a database information system, the concepts of SQL and PL/SQL and to implement database systems in real world.

Course Outcomes

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

1. Recognize the context, phases and techniques for designing and building database information systems in business.
2. Design and implement a database schema, database objects for a given problem-domain, organize database entities, understand the principles of storage structures and apply various Normalization techniques.
3. Apply concurrency control and recovery techniques to build application for real world problem and understand query processing techniques involved in query optimization.

Syllabus

Unit - I :

Introduction to Database Management Systems:

Introduction, Conventional File Processing System, Components of DBMS, Advantages and Disadvantages, Three-level Architecture proposal for DBMS, Abstraction and Data Integration, Data Independence.

Data Models: Introduction, Types of Data Models, Entity-Relationship Model: E-R diagram, Reduction to relational schemas, Generalization, Specialization & Aggregation. The Relational Model: Keys, Relationship, Integrity rules, Relational Algebra.

Unit - II:

SQL: Overview of SQL, DDL, integrity constraints, DML, set operations, null values, aggregate functions, sub-queries.

Intermediate SQL: Joins, Views, Indexes, Abstract Data type.

Unit - III :

Advanced SQL: PL-SQL.

Relational Database Design: Functional Dependency, Normalization.

Unit - IV :

File Organization, Indexing and Hashing:

Introduction, Ordered indices, B-Tree and B+-Tree file organization, Static & Dynamic hashing.

Query Processing and Optimization:

Query Processing: Overview, Selection Operation, Join Operation.

Query Optimization: Overview, Transformation of Relational Expressions, Cost-Based Optimization, Heuristic Optimization.

Unit - V :

Concurrency Control and Database Recovery:

Concept of Transaction, Serializability, locking protocols.

Deadlock Detection and Recovery, Log based Recovery, Recovery with concurrent transactions.

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Text Books:

1. Database Systems Concepts: *Silberschatz, Korth, Sudarshan, McGraw-Hill*.
2. An Introduction to Database Systems: *Bipin C. Desai, Galgotia.*
3. SQL & PL/SQL using Oracle: *Ivan Bayross, BPB Publications.*

Reference Books:

1. Fundamental of Database Systems: *Elmasri, Navathe, Somayajulu, Gupta Pearson Publications*
2. Database Management System: *Raghu Ramkrishan, Johannes, McGraw Hill*
3. An Introduction to Database Systems: *C.J.Date, Narosa*

Lab Syllabus :

Minimum 8 practicals based on theory topics.

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1276 **Course: Artificial Intelligence**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives

To study various search, heuristic techniques for solving AI problems, learn various knowledge representation techniques, understand various reasoning and learning techniques and to discuss the learned concepts for designing and solving AI related problems.

Course Outcomes

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

1. Identify and specify a problem definition for a given real world problem domain.
2. Apply and analyse both deterministic and non-deterministic Artificial Intelligence search techniques to a well-defined problem domain.
3. Formulate a problem description for CSP, Understand and apply knowledge representation, reasoning, machine learning techniques and Uncertainty methods to solve real-world problems.

Syllabus

Unit - I :

Introduction to Artificial Intelligence: Definition and Concepts, History, Overview, Intelligent Agents, Performance Measure, Rationality, Structure of Agents, Problem-solving agents, Problem Formulation, Uninformed Search Strategies.

Unit - II :

Search and Exploration: A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing, Genetic Algorithms, Online search.

Constraint Satisfaction Problems: Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs.

Unit - III :

Adversarial Search: Games, The minimax algorithm, Alpha- Beta pruning.

Knowledge and Reasoning: Knowledge Based Agents, Logic, Propositional Logic, Inference, Equivalence, Validity and satisfiability, Resolution, Forward and Backward Chaining, Local search algorithms.

First Order Logic: Syntax and Semantics of FOL, Inference in FOL, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Unit - IV :

Learning and Uncertainty: Rote Learning, learning by taking advice, learning in problem solving, learning from examples: Induction, Explanation based learning, Discovery, Analogy. Basic Probability Notations, Axioms of Probability, Baye's Rule and its use.

Unit - V :

Applications of Artificial Intelligence: Introduction to Neural networks-supervised, unsupervised learning algorithms, Introduction to Deep Learning, Introduction to Robotics, Case studies.

Text Books:

1. Artificial Intelligence: A Modern Approach: Stuart Russel and Peter Norvig, Prentice Hall
2. Artificial Intelligence: E. Rich and Knight, Tata McGraw Hill.

Reference Books :

1. Artificial Intelligence: E. Charniack and D. Mcdermott, Addison Wesley.
2. Introduction to Knowledge Systems: Mark Stefik, Morgan Kaufmann.
3. https://www.coursera.org/learn/gcp-big-data-ml-fundamentals
4. https://www.coursera.org/learn/natural-language-processing

Lab Syllabus :

Minimum 8 practical's implemented using Tensor flow/Torch Tools/Python

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1277 **Course: Computer Workshop Lab-I**

L: 0 Hrs, P: 2 Hrs, Per Week **Total Credits: 1**

Goal: *Introduce software engineering tools not covered in labs.*

Tools & Technologies

- **Project Management Tools** – Jira, Trello, ClickUp
- **API Testing & Documentation** – Postman Advanced (beyond basic API concepts)
- **Software Testing Tools**
    - Selenium (basic)
    - JMeter (performance testing)
- **UI/UX Design Basics** – Figma
- **Networking & Cybersecurity Basics**
    - Wireshark
    - Nmap (conceptual)

Purpose: Understand industry workflows, software testing culture, and project planning.

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1278-1 **Course: Image Processing**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives:
To learn the fundamental concepts and applications of digital image processing, learn the concepts of and how to perform Intensity transformations, spatial filtering, image segmentation, restoration and reconstruction, color image processing, image compression and watermarking.

Course Outcomes:
On successful completion of the course, students will be able to:
1. Illustrate the fundamental concepts of a digital image processing system.
2. Apply different image Filtering Models, Image restoration and reconstruction
3. Apply the different segmentation algorithms and image compression standards for Computer vision & image analysis.
4. Apply the different techniques of Image representation and description.

Syllabus

Unit - I :

Introduction - Fundamental steps in Digital Image Processing, Components of an Image Processing System. A Simple Image Formation Model, Image Sampling and Quantization, Basic relationship between pixels, Neighbors of pixel, Adjacency, Connectivity, Regions, Boundaries: Labeling of connected components, Distance measure, Application of image processing.

Unit - II :

Intensity Transformations and Spatial Filtering -Some Basic Intensity Transformation Functions, Histogram equalization and histogram matching, Fundamentals of Spatial Filtering, Introduction to Smoothing and Sharpening Spatial Filters. Filtering in the Frequency Domain**,** Image Smoothing.

Unit - III :

Image Restoration and Reconstruction - Degradation model, Restoration in the Presence of Noise Only—Spatial domain, Periodic Noise Reduction by Frequency Domain, Geometric Mean Filter.

Image Compression - Coding Redundancy, Spatial and Temporal Redundancy, Fidelity Criteria, Image Compression Models, Huffman Coding, LZW Coding, Lossy Compression,

Unit - IV :

Image Segmentation - Image Segmentation–Detection of Discontinuities, Edge Linking and Boundary Detection,

Thresholding: Foundation, Basic Global Thresholding, Region Growing, Region Splitting and Merging

Unit - V :

Representation and Description - Representation Schemes like Chain Coding, Polygonal Approximation Approaches, Signatures, Boundary Segments, Skeletons, Boundary Descriptors, and Regional Descriptors.

Text Books:

1. Digital Image Processing: R.C.Gonzalez & R.E. Woods, Addison Wesley Pub.
2. Fundamentals of Digital Image Processing: A.K.Jain, PHI Pub.
3. Fundamentals of Electronic Image Processing: A.R.Weeks.

Reference Books:

1. Digital Image Processing: S.Sridhar, Oxford Uni. Press.

Lab Syllabus :

Minimum 8 practical's and assignments based on the Theory Topics.

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1278-2 **Course: Operations Research**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives

This course will help the students to get acquaint with the applications of Operations research to formulate and optimize business and industry related problems. Students can realize the need for mathematical tools to take decisions in a complex environment. This course will also improve the analytical thinking, algorithmic approach and modeling abilities related to programming, networking.

Course Outcomes

On the successful completion of the subject students will be able to:

1. Demonstrate the models of Operations research.
2. Implement the tools of decision making and network scheduling.
3. Solve the real-life problems of Inventory control.

Syllabus

Unit - I :

Introduction to Operations Research (OR): Origin and Development of OR, Nature of OR, Characteristics of OR, Classification of Problems in OR, Models in OR, Phases of OR, Uses and Limitations of OR, Methodologies in OR, Applications in OR. Linear Programming – Concept of Linear Programming Model, Mathematical Formulation of the Problem, Graphical solution Methods. Linear Programming Methods - Simplex Methods, Big M methods, Dual Simplex Method, Two Phase Methods, Duality Rules, Formulation of Dual Problem.

Unit - II :

Transportation Problem: Mathematical Model for Transportation Problem, Types of Transportation Problem. North-West Corner Rule, Least Cost Cell Method, Vogel Approximation Method, MODI Method. Assignment Problem – Zero-One programming model for Assignment Problem, Types of assignment Problem, Hungarian Method, Branch and Bound Technique for Assignment Problem, Travelling Salesman Problem.

Unit - III :

Decision Theory: Introduction, Decision under Certainty, Decision under Risk, Decision under Uncertainty, Decision Tree. Game Theory – Terminologies of Game Theory, Two person Zero-Sum Games, The Maximin-Minimax Principle, Saddle Point, Game of Mixed Strategies, Dominance Property, Graphical Solution of 2xn and mx2 Games.

Unit - IV :

Network Scheduling By CPM/PERT: Introduction, Basic Concept, Constraints in Network, Critical Path Methods (CPM), PERT Network, PERT calculations, PERTvs.CPM., Project Cost, Crashing Algorithm,

Unit - V :

Inventory Control: Introduction, Inventory Control, Selective Control Techniques, Types of Inventory, Economic Lot Size Problem, Problem of EOQ without and with shortage(Purchase and Manufacturing Models) , Inventory Control with Price Breaks.

Text Books:

1. Operations Research: Kanti Swarup, P.K.Gupta, Man Mohan, Sultan Chand.
2. Operations Research: R. Panneerselvam, PHI.
3. Operations Research: Hira and Gupta, S. Chand.

Reference Books :

1. Introduction to Operations Research: Billy Gillett, Tata McGrawHill
2. Operations Research Theory & Application: Sharma J. K, MacMillan.
3. Operations Research: Hemdy Taha, IEEE.

Lab Syllabus :

Minimum 8 practical's and assignments based on the Theory Topics.

1. Linear Programming Model by
    a) Simplex Method Program
    b) Big-M Method
2. Transportation Problem using
    a) North West Corner Rule
    b) Least cost Cell Method
    c) Vogel Approximation Method
3. Assignment Problem by
    a) Hungarian Method
    b) Branch and Bound Approach
4. Implementation of Travelling Salesman Problem
5. Implementation of Decision Making Under Uncertainty methods
6. Implementation of Game Theory Model
    a) Saddle point
    b) Dominance Rule
    c) Value of the Game
7. Critical Path Method
8. Program Evaluation and Review Technique
9. Economic Order Quantity without and with shortage
10. Implementation of (M/M/1:¥/FCFS) and(M/M/N:¥/FCFS) models

Note: Program implementation using C/C++/Java/Matlab

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1278-3 **Course: Pattern Recognition**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives

Students should be able to introduce the fundamental algorithms for pattern recognition, to instigate the various classification and clustering techniques

Course Outcomes

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

1. Apply a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques
2. Illustrate the major approaches in statistical pattern recognition.
3. Use the clustering algorithm and cluster validation.
4. Design and construct a pattern recognition system.

Syllabus

Unit - I :

Introduction - Basics of pattern recognition system, various applications, Machine Perception, classification of pattern recognition system Statistical Pattern Recognition: Review of probability theory, Gaussian distribution, Bayes decision theory and Classifiers, Optimal solutions for minimum error and minimum risk criteria, Normal density and discriminant functions, Decision surfaces.

Unit - II :

Bayes Decision Theory: Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

Unit - III :

Parameter Estimation Methods - Maximum-Likelihood estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation.

Unit - IV :

Dimensionality reduction: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorisation - a dictionary learning method.

Linear discriminant functions: Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.

Unit - V :

Artificial neural networks: Multilayer perceptron - feedforwark neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

Non-metric methods for pattern classification: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).

Text Books:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

Reference Books:

1. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.
2. Robert J. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
3. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4/e, Academic Press, 2009. 4
4. Tom Mitchell, Machine Learning, McGraw-Hill 5. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London 1974.

Lab Syllabus :

Minimum 8 practical's and assignments based on the Theory Topics.

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1278-4 **Course: Cloud Computing**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Outcomes:

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

1. Exhibit an understanding of virtualization technologies.
2. Analyse architecture, services, and challenges in Cloud computing
3. Exhibit the knowledge of Compute services of the AWS platform and their usage
4. Exhibit the knowledge of Network services of the AWS platform and their usage
5. Exhibit the knowledge of Storage services of the AWS platform and their usage

Syllabus:

Unit - I :
Introduction: Traditional server concept: pros and cons. Need of Virtualized Technology, Benefits of Virtualization. Hypervisors, Types of Hypervisors, Types of virtualizations: Various forms of virtualization: Desktop, Application, Server, Hardware, Storage, Memory and I/O virtualization. Virtualization Vs Containerization, Concept of Containers, Container Orchestration.

Virtualization Technologies. Accomplishing Virtualization. Migration: Migration consideration, Things to do before migration of servers- Discovery, Assessment and Migration.

Unit - II :
Cloud Computing Fundamentals: Cloud deployment models, Cloud service models. Benefits and challenges of cloud computing. Regions, Availability zones, Edge locations. Fundamentals of pricing: Total cost of ownership (TCO) and monthly calculator.

Unit - III :
Compute Services in AWS: Elastic Compute Cloud (EC2) in AWS, Virtual Machine creation in Windows and Linux platforms, Remote Desktop Protocol (RDP), Secure Shell (SSH) protocol, Security Groups, Elastic Beanstalk, AWS Lambda.

Unit - IV :
Concepts of Networking: CIDR Blocks, Subnet Mask, Designing a network. VPC, Subnets, Internet Gateway, Route Table, NAT Gateway, NAT instance. Load balancer, Autoscaling.

Unit - V :

Amazon Web services (AWS): AWS core services: Storage: Simple Storage Service (S3), Elastic Block Store (EBS), Elastic File Store (EFS), Content Delivery Network (CDN), Cloudfront, Snowball, Snowmobile, Route53.

Text Books:

1. Distributed and Cloud Computing : Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, 1st Edition Elsevier
2. Cloud Computing Basics: A Non-Technical Introduction, Anders Lisdorf, Apress Publication.
3. Cloud Computing Bible : Barrie sosinsky, Wiley- India Edition
4. Cloud Computing : A Practical approach for learning and Implementation, A. Srinivasan, J. Suresh, 1stEdition, Pearson Publication

Reference Books:

1. The Complete Cornerstone Guide to Virtualization Best Practices: Ivanka Menken, Paperback, 2nd Edition, Emereo Pty Ltd.
2. Cloud Computing Explained: Implementation Handbook for Enterprise, 2013 Edition, Recursive Press Publication.
3. Enterprise Cloud Computing: Technology, Architecture, Applications, Gautam Shroff, 1st Edition, Cambridge University Press
4. Cloud Computing: Dr. Kumar Saurabh, 2nd Edition, Wiley- India Edition

Lab Syllabus :

Minimum 8 practicals based on theory topics.

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1279 **Course: Advanced Web Development Lab**

L: 0 Hrs, P: 4 Hrs, Per Week **Total Credits: 2**

Course Objectives

To learn and implement the latest web development frameworks for creating the dynamic websites using different technologies existing in the industry as of today.

Course Outcomes

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

1. To implement basic webpage programming using JSP & ASP.NET.
2. To implement a dynamic website using Django & MEAN stack.

Syllabus

Minimum 20 Practical's based on following technologies, but not limited to:

1. **JSP :** JSP Directives, Writing simple JSP page, Scripting Elements, Default Objects in JSP, JSP Actions, Managing Sessions using JSP, JSP with beans JSP.
2. **ASP.Net :** Introduction to Asp.Net MVC, Creating controllers, invoking actions, Models, Razor views, HTML helper functions, MVC State management, Routing.
3. **Django** : Django framework, Creating an app, Django views, URL patterns, Models, Templates.
4. **MEAN Stack :** Introduction to MEAN, Getting started with Node.js, Node modules, Synchronous & Asynchronous programming, Callbacks, Using Express, Routing, EJS Template engine, Introduction to MongoDB, keyfeatures, databases, collections, MongoDB CRUD operations.

Text Books:

1. Getting MEAN with Mongo, Express, Angular, and Node - *Simon Holmes (Manning).*
2. Mean Web Development - *Amos Q. Haviv, PACKT Publishing.*
3. Asp.Net Web Developer's Guide – Mesbah Ahmed, Chris Garett (Syngress)
4. Beginning Django: Web Application Development and Deployment with Python – Daniel Rubio (Apress)

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

School of Humanities and Sciences
Department of Humanities
Syllabus for Semester II (MCA)

Course Code: 25HS02PR1275 **Course: Communication Skills for Employability**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 1**

Course Outcomes:

On successful completion of the course, the student will able to do the following:
CO1. Apply effective listening and speaking skills in professional and everyday conversations.
CO2. Apply various techniques and tools for effective correspondence.
CO3. Demonstrate the techniques of effective Presentation Skills.
CO4. Analyse and apply the effective strategies for Group Discussions.
CO5. Analyse and apply the effective strategies for Personal Interviews.

Syllabus:

List of Practical (2 hours each for each batch)

1. Speaking Skills
2. Listening Skills
3. Correspondence for Employment
4. Formal Presentations: Orientation
5. Formal Presentations: Practice Session
6. Group Discussion- Orientation
7. Group Discussion- Practice Session
8. Personal Interview: Orientation
9. Personal Interviews: Practice Session

Text Books:

1. Sanjay Kumar, Pushp Lata, “Communication Skills”, Second Edition, Oxford University Press, 2019
2. Barun K. Mitra, “Personality Development and Soft Skills”, Oxford Press, 2016
3. Dr. K. Alex, “Soft Skills: Know Yourself & Know the World”, S Chand. 2009

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Open Elective

Course Code: 25ID160TH1275-1 **Course: Introduction to Machine Learning**

L: 3 Hrs, P: 0 Hrs, Per Week **Total Credits: 3**

Course Objectives

1. To introduce the student to various fundamental concepts applicable to the domain of Machine Learning.
2. To study some basic machine learning algorithms, techniques and their applications.
3. To study the various evaluation metrics and validation techniques of machine learning models.

Course Outcomes

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

1. Understand the fundamental concepts and utility of Machine Learning.
2. Implement basic machine learning algorithms and techniques.
3. Analyze and interpret various evaluation metrics and validation techniques of machine learning models.

Syllabus

Unit -I :

Introduction - Types of machine learning: Supervised, Unsupervised and Reinforcement learning, Concept Learning, Version spaces, Inductive bias, Under-fitting and Over-fitting,

Evaluation and Validation Techniques

Unit -II :

Decision Tree Learning: Representation, Basic Decision Tree Learning Algorithm

Unit -III :

Artificial Neural Network basics - Introduction to artificial neural networks, Linear Perceptron and Multi-Layer Perceptron, Feed Forward Network, Backpropagation

Unit -IV :

Probabilistic Machine Learning: Basics of sampling theory, Bayesian Learning: Bayes theorem and concept learning, Maximum Likelihood Estimation, MAP, Naive Bayes Classifier, Bayesian belief networks. **Instance based learning:** k-nearest neighbor

Unit -V :

Linear Regression and predictive analysis, Support Vector Machines,**Clustering:** Distance measures, Different clustering methods (Distance, Density, Hierarchical) k-means clustering,

Text Books:

1. Machine Learning: Tom M. Mitchell, McGraw Hill
2. An Introduction to Statistical Learning: Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer Texts in Statistics

Reference Books :

1. Algorithms for Clustering Data: A. K. Jain and R. C. Dubes, Prentice Hall

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Open Elective

Course Code: 25ID160TH1275-2 **Course : Introduction to Natural Language Processing**

L: 3 Hrs, P: 0 Hr, Per Week **Total Credits : 3**

Course Objectives

1. To study basic text processing through word level analysis.
2. To study various syntactical analysis techniques.
3. To study lexical, vector semantics and word sense disambiguation.
4. To study various natural language processing applications.

Course Outcomes

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

1. Perform basic text processing at the word level.
2. Perform Part-of-Speech, Named Entity Tagging and apply production rules of context free grammar.
3. Apply lexical, vector semantics as well as perform word sense disambiguation.
4. Corelate the Natural Language Processing techniques learnt with specified NLP applications.

Syllabus

Unit -I :

Introduction to Natural Language Processing: History of NLP, Generic NLP system, challenges of NLP, The language model.

Unit-II :

Basic Text Processing (Word level analysis): Words, Corpora, Morphology analysis, Inflectional morphology & Derivational morphology, Word Normalization, Lemmatization and Stemming.

Unit-III :

Syntax Analysis: Word Classes, Part-of-Speech Tagging, Named Entities and Named Entity Tagging, Introduction to Context Free Grammar, N-gram language model

Unit-IV :

Semantic Analysis: Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Word2vec, Word Sense Disambiguation, Relations among lexemes & their senses.

Unit-V :

NLP Applications: Text Summarization, Text Classification, Sentiment Analysis and Opinion Mining, Machine Translation

Text Book:

1. Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009.

Reference Book:

1. Chris Manning and Hinrich Schütze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999.

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Open Elective

Course Code: 25ID160TH1275-3 **Course: Text Mining Applications**

L: 3 Hrs, P: 0 Hr, Per Week **Total Credits: 3**

Course Objectives

1. To understand the concepts of Text Mining.
2. To develop the ability for solving various Text Mining Problems.
3. To study the tools and techniques for handling Text Mining the Problems.

Course Outcomes

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

1. Identify the nature and characteristics of the Text data set.
2. Apply and evaluate the Text Mining Problems with proper tools and techniques.
3. Demonstrate and analyze the Text Mining the Problems.

Syllabus

Unit-I :

Introduction to Text mining and text pre-processing. Web Crawler to collect data, unique words and counts. Handling numbers, Punctuation, stop words, incorrect spelling, Lemmatization and Term-Documentation computation

Unit-II :

Unstructured vs semi-structured data, Fundamentals of Information retrieval

Properties of words, Vector Space models, Similarity measures

Unit-III :

Low-level processes (Sentence splitting, Tokenization, Part of speech Tagging, Stemming, Chunking)

Unit-IV :

Text Classification and feature selection, Application using Naïve Bayes classifier for text Classification

Unit-V :

Evaluation systems on the accuracy of text mining
Application of Sentimental Analysis and Natural Language Analysis

Recommended on line book materials;

1. http://hadoop.apache.org
2. http://spark.apache.org
3. http://graphlab.org/projects/index.html

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1375 **Course: Design and Analysis of Algorithms**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objective

This course aims to introduce the concept of the design of algorithms.

Course Outcomes

At the end of the course, the student will be able to:
1. Define the basic concepts and analyze worst-case running times of algorithms using asymptotic analysis.
2. Identify how divide and conquer works and analyze complexity of divide and conquer methods by solving recurrence.
3. Illustrate Greedy paradigm and Dynamic programming paradigm using representative algorithms.
4. Describe the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete.

SYLLABUS

Unit - I :

Elementary Algorithmic: What Is an Algorithm? Problems and Instances, The Efficiency of Algorithms, Average and Worst-Case Analysis, Elementary Operations, Need for Efficient Algorithms, Some Practical Examples on Sorting, Multiplication of Large Integers, Evaluating Determinants, Calculating the Greatest Common Divisor, Calculating the Fibonacci Sequence.

Exploring Graphs: Depth-First Search, Breadth-First Search.

Unit - II :

Analysis of Algorithms: Asymptotic Notations, Analysis of algorithms, Amortized Analysis, Solving Recurrences Using the Characteristic Equation.

Divide and Conquer: Introduction, Binary Searching, Sorting by Merging, Quicksort, Selection and the Median, Arithmetic with Large Integers, Matrix Multiplication.

Unit - III :

Greedy Algorithms: Introduction, Greedy Algorithms and Graphs, Minimal Spanning Trees, Shortest Paths Greedy Algorithms for Scheduling: Minimizing Time in the System, Scheduling with Deadlines, Greedy Heuristics: Colouring a Graph, The Travelling Salesperson Problem, Knapsack Problem.

Unit - IV :

Dynamic Programming:

Introduction, The Principle of optimality, knapsack problem, Chained Matrix Multiplication, Shortest Paths, Optimal Search Trees, The Travelling Salesperson Problem, Memory Functions.

Network Flow: Maximum flow problem and Ford – Fulkerson algorithm, maximum flows and minimum cuts in a network.

Unit - V :

Back Tracking & Branch Bound: N-Queens problem, Branch and Bound.

Introduction to NP and Intractability: Introduction to NP-Completeness, The Classes P and NP, NP-Complete Problems, Cook's Theorem, Some Reductions, Non-determinism.

Text Books:

1. ALGORITHMICS: Theory and Practice: *Gilles Brassard and Paul Brately, Prentice Hall India Ltd.*
2. Introduction to Algorithms: *Thomas H. Cormen et.al, Prentice Hall of India.*
3. Algorithm Design: *Jon Klienberg& Eva Tardos, Pearson India Education services Pvt. Ltd.*

Reference Book:

1. Computer Algorithms–Introduction to Design and Analysis: *Sara Baase and Alien Van Gelder – Addison –Wesley Publishing Company.*
2. An Introduction to Analysis of Algorithms: *Robert Segdewick, Philippe Flajolet.*
3. Fundamentals of Computer Algorithms: Ellis Horowitz and Sartaj Sahani.

Lab Syllabus :

Minimum 8 practical’s based on theory topics.

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1376 **Course: Machine Learning**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives

The Objective of the course is to introduce the basic concepts and techniques of machine learning, understand major machine learning algorithms and identify machine learning techniques suitable for a given problem.

Course Outcomes

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

1. Solve the problems related to the fundamental concepts in machine learning.
2. Analyse the strengths and weaknesses of various machine learning approaches.
3. Apply machine learning algorithms to solve classification, regression and clustering problems.
4. Implement various machine learning models to efficiently solve real-world problems.

Syllabus

Unit – I :

The concept learning task, General-to-specific ordering of hypotheses, Version spaces, Inductive bias, Decision Tree Learning, Over-fitting, Cross Validation, Experimental Evaluation of Learning Algorithms.

UNIT - II :

Instance-Based Learning: K-Nearest neighbour algorithm, Radial basis functions, Case- based learning. Computational Learning Theory: probably approximately correct (PAC) learning, Sample complexity, Computational complexity of training, Vapnik Chervonenkis dimension.

UNIT – III :

Artificial Neural Networks: Linear threshold units, Perceptron, Multilayer networks and backpropagation, recurrent networks.

UNIT - IV :

Probabilistic Machine Learning: Maximum Likelihood Estimation, MAP, Bayes Classifiers, Naive Bayes, Bayes optimal classifiers, Bayesian Networks, Inference in Bayesian Networks, Minimum description length principle.

UNIT – V :

Clustering and Unsupervised Learning: Unlabelled data: EM, Gaussian Mixture Models, K-means and Hierarchical Clustering., Hidden Markov Models, Support Vector Machines, Ensemble learning: boosting, bagging.

Text Books:

1. Tom Mitchell; Machine Learning- an Artificial Intelligence Approach, Volume-II; Morgan Kaufmann, 1986. 2. Christopher Bishop, Pattern Recognition and machine learning; Springer Verlag, 2006.

Reference Books :

1. Soumen Chakrabarti; Mining the Web: Discovering Knowledge from Hypertext Data, MorganKaufmann, 2003.
2. A. K. Jain and R. C. Dubes; Algorithms for Clustering Data; Prentice Hall PTR, 1988.
3. Ethem Alpaydin, Introduction to Machine Learning, PHI.

Lab Syllabus :

Minimum 8 practical's implemented using Python/NumPy/Tensor flow/PyTorch Tools

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1377 **Course : Business Analytics and Intelligence**

L: 3 Hrs, P:2 Hr, Per Week **Total Credits : 4**

Course Objectives

This course aims to provide a strong foundation in business analytics and decision-making processes. This course, also introduce students to core concepts of Business Intelligence (BI), including reporting and performance management. Lastly to enable students to understand how data supports business processes and strategy.

Course Outcomes

At the end of the course, the students will be able to:

1. Identify key concepts and components of Business Analytics and Intelligence systems.
2. Analyze different types of data relevant to business decisions.
3. Apply business metrics, KPIs, dashboards, and reporting techniques to real-world situations.
4. Use BI tools to generate actionable insights and support decision-making.
5. Explore data governance, data quality, and ethics in analytics.

Syllabus

Unit – I :

Introduction to Business Analytics and Intelligence: What is Business Analytics? What is Business Intelligence? The Growing Role of Business Analytics, Types of analytics: Descriptive, Diagnostic, Predictive (excluding ML), Prescriptive Components and architecture of BI systems, Business decision-making models, Role of analytics in business functions (HR, Finance, Marketing, Operations)

Unit – II :

Business Data and Data Management: Types of business data: structured, semi-structured, unstructured, Sources: ERP, CRM, Web, Social-Media (overview only), Data Warehousing concepts: ETL, OLAP vs. OLTP, Data Quality, Data Governance, and Master Data Management (MDM), Data privacy, compliance, and ethical considerations,

Unit – III :

Business Reporting and Performance Measurement: Metrics, KPIs, and business dashboards, Types of reports: Static, Ad-hoc, Real-time, Operational, Strategic, Balanced Scorecard and performance monitoring, Scorecards and heat maps, Executive Information Systems (EIS).

Unit – IV :

Tools and Technologies for Business Intelligence: Overview of BI tools: Microsoft Power BI, Tableau, QlikView, SAP BI, Connecting BI tools to data sources, Interactive reports and dashboards, Data visualization principles and best practices, Collaborative analytics and mobile BI.

Unit – V :

Applications and Strategy in Business Analytics: Use Cases-Financial analysis, Sales forecasting, Customer analysis, Risk analytics, Analytics in supply chain and logistics, Competitive intelligence and market analysis, Strategy and value creation through analytics, Organizational challenges and analytics maturity models

Text Books:

1. Business Intelligence: A Managerial Perspective on Analytics, by Ramesh Sharda, Dursun Delen, Efraim Turban – Pearson Education
2. Business Analytics: The Science of Data-Driven Decision Making, by U. Dinesh Kumar – Wiley India
3. Successful Business Intelligence: Secrets to Making BI a Killer App , by Cindi Howson-McGraw Hill Professional

Reference Books:

1. How to Measure Anything: Finding the Value of Intangibles in Business, by Douglas W. Hubbard, Wiley 3rd Edition.
2. Analytics at Work: Smarter Decisions, Better Results, by Thomas H. Davenport, Jeanne G. Harris, Robert Morison, Harvard Business Press.
3. Data Science for Business by F. Provost and T. Fawcett.

Lab Syllabus :

Minimum 8 practical's based on theory topics.

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1378-1 **Course: Information Security**

L: 3 Hrs, P:2 Hrs, Per Week **Total Credits: 4**

Course Objectives

To understand the basic concepts of cryptography and their mathematical foundation required for various cryptographic algorithms. To study signature schemes using well-known signature generation and verification algorithms. Describe and analyze the existing authentication protocols for two-party communications and analyze key agreement algorithms.

Course Outcomes

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

1. Describe and apply appropriate encryption techniques to solve problems.
2. Apply techniques of number theory in cryptography
3. Apply various public key cryptography techniques and understand the usability of key management and distribution.
4. Analyze various message authentication codes and hash functions.
5. Identify measures of detection and prevention of various attacks.

Syllabus

Unit - I :

Classical Encryption Techniques: Substitution Cipher, Transposition Ciphers, Stream and block Ciphers; Modern Symmetric Key Ciphers: Modern Block cipher, Modern Stream Ciphers. **Data Encryption Standers (DES):** Structure of DES, Analysis of DES, Strength of DES, Differential and Linear Cryptanalysis., 3-DES.

Unit - II :

Number Theory and Finite Fields: Integer Arithmetic, Modular Arithmetic, Polynomial Arithmetic, Euclidean Algorithm. **Mathematics of Asymmetric Key Cryptography:** Prime Numbers, Fermat's and Euler's Theorems, Testing of Primality, Chinese Reminder Theorem.

Unit - III :

Public Key Cryptography: Principles of Public Key Cryptosystem, RSA algorithm. Diffie-Hellman Key Exchange, ElGamal Cryptographic System.

Key Management and Distribution: Key Distribution using Symmetric Encryption and Asymmetric Encryption, Distribution of public key, Public key Infrastructures.

Unit - IV :

Cryptographic Hash Function: Application of Hash Function, Description of MD and SHA family, cryptanalysis.

Message Authentication Codes (MAC): Requirements, Functions, Security of MAC, HMAC and CMAC. **Digital Signature:** Process, Services, Attacks on digital Signature, RSA Digital Signature Scheme, Digital Signature Standard (DSS).

Unit - V :

Transport Layer Security: SSL Architecture, Four Protocols, Message Formats. IP Security: Security Overview, Policy, Encapsulating Security Payload (ESP). **E-Mail Security:** Pretty Good Privacy, S/MIME. **System Security:** Intruders, Malicious Software, Firewalls.

Text Book:

1. Cryptography and Network Security Principles and Practice, William Stallings.
2. Cryptography and Network Security, Behrouz A. Forouzan and Debdeep Mukhopadhyay.
3. Information Security: The Complete Reference, Second Edition by Mark Rhodes-Ousley ISBN-13:978-0071784351, ISBN-10:0071784357.

Reference Book:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill.
2. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
3. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
4. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
5. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning MOOCS Courses

Lab Syllabus :

Minimum 8 practicals based on Theory topics

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1378-2 **Course: Computer Vision**

L: 3 Hrs, P:2 Hrs, Per Week **Total Credits: 4**

Course Objectives

To learn concepts of image processing, computer vision and utilize them for solving real-world problems

Course Outcomes

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

1. Work with digital images and perform image processing using pixel connectivity and image histograms.
2. Perform 2D and 3D transformations, estimation and work on image formation using camera geometry.
3. Perform feature detection using points, edges, lines and texture,
4. Apply segmentation and object detection techniques for performing object recognition.

Syllabus

Unit - I:

Fundamentals of Image processing

Image Digitization: Sampling and Quantization, Neighbourhood and connectivity of pixels, Histogram based image processing, Introduction to computer vision.

Unit - II:

Image Formation

2D and 3D transformations, Optics, The digital camera: Sampling and aliasing, Colour, Compression, Projective Geometry, Transformations and Estimation: Projective transformations, Direct Linear Transformation (DLT) algorithm, Cost functions

Unit - III:

Camera Geometry

Camera: Pinhole cameras, Camera models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Camera matrix, Epipolar geometry, Fundamental matrix,

Unit - IV:

Feature Detection and Matching

Linear Filters: Linear Filters and Convolution, Points and patches, Edges and contours, Hough Transforms for detecting lines, Texture representation and synthesis.

Unit - V:

Image Segmentation and Recognition

Edge based segmentation, Region based segmentation, Segmentation using Clustering Methods, Recognition – object detection, face recognition, instance recognition, category recognition. Deep learning-based methods for image segmentation and recognition.

Text Books:

1. Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.
2. Computer Vision: Algorithms & Applications, R. Szeleski, Springer.

Reference Books :

1. Computer vision: A modern approach: Forsyth and Ponce, Pearson.
2. Ballard And Brown, “Computer Vision”, Prentice Hall Publication.

Lab Syllabus :

Minimum 8 practicals based on Theory topics

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1378-3 **Course: Generative AI and its Applications**

L: 3 Hrs, P: 2 Hr, Per Week **Total Credits: 4**

Course Objectives

This course will help students understand the basic concepts and techniques of Generative AI in Natural Language Processing, along with the working principles of encoder and decoder architectures. Learners can explore the attention mechanism and its role in improving sequence modeling tasks. They will also gain knowledge of transformer models, which form the foundation of modern generative AI applications in NLP.

Course Outcomes

On successful completion of the course, students will be able to:
1. Define and illustrate the fundamental concepts and techniques in Natural Language Processing.
2. Describe and analyse the Neural language models and encoder-decoder architecture.
3. Analyse and solve the problems related to Attention Mechanism for sequence-to-sequence models.
4. Analyse and solve the problems related to Self-Attention Mechanism for sequence-to-sequence models.
5. Demonstrate the requirement of Positional encoding and Normalization in Transformer models to efficiently solve the NLP problems.

Syllabus

Unit-I:

Course Introduction, Introduction to NLP (NLP Pipeline, Applications of NLP), Word Embeddings, Word2Vec, Types of Word2Vec, Continuous Bag of Words [CBOW], Skip-gram, Evaluation Metrics.

Unit-II:

Neural Language Models, CNN, RNN, LSTM, GRU, Encoder Decoder Architecture, Problems in encoder decoder Architecture.

Unit-III:

Attention Mechanism in Encoder Decoder Architecture, Variants of Attention Mechanism, Introduction to Transformers.

Unit-IV:

Self-Attention, The Problem of average meaning, Query, Key and Value Vectors in self-attention, Scaled dot product Attention. Multi-Head Attention.

Unit-V:

Positional Embedding, Types of Positional Embeddings, Internal covariate shift, Batch Normalization, Layer Normalization, Transformer Encoder block, Transformer Decoder, Block

Text Books:

1. Tanmoy Chakraborty, Introduction to Large Language Models, Wiley India, 1st Edition

Reference Books :

1. Dan Jurafsky and James H. Martin, Speech and Language Processing, 2nd edition, Pearson Press, 2008.
2. Jacob Eisenstein, Natural Language Processing, First edition,The MIT Press, 2019.

Lab Syllabus :

Minimum 8 practicals implemented using Python/NumPy/Tensor flow/PyTorch Tools

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1379-1 **Course: Software Engineering**

L: 3 Hrs, P:2 Hrs, Per Week **Total Credits: 4**

Course Objectives

This course's objective is to provide students with an in-depth understanding of software development processes, methodologies, and best practices, including software testing techniques. It equips students with the knowledge required to design, develop, test, and maintain high-quality software systems in a systematic and professional manner.

Course Outcomes

By the end of the course, students will be able to:

1. Understand the fundamental concepts, principles, and methodologies of software engineering.
2. Analyze and model software requirements effectively.
3. Apply design principles and choose appropriate software development life cycle (SDLC) models.
4. Utilize various testing techniques to ensure software quality.
5. Implement software testing strategies and tools in real-world scenarios.

Syllabus

Unit - I :

Introduction to Software Engineering

Overview of Software Engineering, Software Development Life Cycle (SDLC) Models: Waterfall, Incremental, Prototyping, Spiral, Agile, and DevOps, Importance of Software Engineering in the IT industry, Principles of Software Engineering, Software Process and Process Models

Unit - II :

Software Requirements and Analysis

Requirements Engineering: Elicitation, Analysis, and Specification, Functional and Non-functional Requirements, Use Case Diagrams and User Stories, Software Requirement Specification (SRS), Feasibility Study and Requirement Validation

Unit - III :

Software Design and Development

Design Principles: Cohesion, Coupling, and Modularity, Architectural Design: MVC, Client-Server, and Microservices Architecture, User Interface Design and Prototyping, Coding Standards and Guidelines, Software Configuration Management

Unit - IV :

Software Testing Fundamentals

Introduction to Software Testing: Objectives, Principles, and Importance, Types of Testing: Manual and Automated Testing, Levels of Testing: Unit Testing, Integration Testing, System Testing, and Acceptance Testing, Black Box and White Box Testing Techniques, Testing Tools Overview: Selenium, JUnit, TestNG

Unit - V :

Advanced Testing and Quality Assurance

Test Planning, Test Case Design, and Test Data Management, Regression Testing and Performance Testing, Debugging Techniques and Tools, Software Quality Assurance (SQA) and Standards (CMMI, ISO), Testing in Agile Environments, Emerging Trends: AI in Testing, Continuous Testing in DevOps

Textbooks:

1. Ian Sommerville, "Software Engineering," 10th Edition, Pearson Education, 2015.
2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing: Principles and Practices," Pearson Education, 2006.

Reference Books:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach," 8th Edition, McGraw Hill, 2014.
2. Naresh Chauhan, "Software Testing: Principles and Practices," Oxford University Press, 2010.
3. Capers Jones, "Software Quality: Analysis and Guidelines for Success," International Thomson Computer Press, 1997.

Lab Syllabus :

Minimum 8 practicals based on Theory topics

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1379-2 **Course: AI on Cloud**

L: 3 Hrs, P: 2 Hr, Per Week **Total Credits: 4**

Course Objectives

This course aims to provide students with an understanding of Artificial Intelligence applications deployed on cloud platforms. The course focuses on cloud computing fundamentals, AI service models, cloud-based machine learning workflows, deployment of AI models on cloud infrastructure, and real-world use cases. Students will gain practical exposure to designing, implementing, and managing AI solutions using cloud technologies.

Course Outcomes

At the end of the course, students will be able to:

1. Understand cloud computing concepts and their role in AI applications.
2. Analyze cloud service models and AI-enabled cloud platforms.
3. Design and deploy machine learning models on cloud infrastructure.
4. Apply cloud-based AI services for data analytics and intelligent applications.
5. Evaluate security, privacy, and cost considerations in AI on cloud systems.

Syllabus

Unit-I:
Introduction to Cloud Computing and AI
Overview of cloud computing, Evolution of cloud technologies, Cloud service models (IaaS, PaaS, SaaS), Cloud deployment models (public, private, hybrid, multi-cloud), Introduction to Artificial Intelligence and Machine Learning, Role of cloud in scalable AI solutions.

Unit-II: Cloud Platforms and AI Services
Introduction to major cloud platforms (AWS, Microsoft Azure, Google Cloud), AI and ML services offered by cloud providers, Compute, storage, and networking for AI workloads, Cloud-based data storage solutions, Introduction to cloud-native AI tools and APIs.

Unit-III: Machine Learning on Cloud
Cloud-based machine learning workflow, Data preparation and management on cloud, Training and evaluation of ML models on cloud platforms, AutoML concepts, Model versioning and experiment tracking, Use of containers and virtual machines for ML.

Unit-IV: Deployment, Scalability, and MLOps
Deploying AI models on cloud, Model serving and inference, Scalability and load balancing, Introduction to MLOps, Continuous integration and deployment (CI/CD) for ML, Monitoring and performance optimization of AI models, Cost optimization strategies.

Unit-V: Security, Ethics, and Applications of AI on Cloud
Security challenges in cloud-based AI systems, Data privacy and compliance in cloud AI, Ethical considerations in AI deployment, Responsible AI practices, Case studies and applications: AI on cloud in healthcare, finance, smart cities, retail, and education.

Text Books

1. *Cloud Computing: Concepts, Technology & Architecture* By: Thomas Erl, Publisher: Pearson.
2. *Hands-On Machine Learning on Google Cloud Platform* By: Valliappa Lakshmanan et al., Publisher: O'Reilly Media.

Reference Books

1. *Architecting the Cloud: Design Decisions for Cloud Computing Service Models* By: Michael J. Kavis, Publisher: Wiley.
2. *Practical MLOps* By: Noah Gift and Alfredo Deza, Publisher: O'Reilly Media.

Lab Practicals :

Minimum 8 practical's based on theory topics.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1379-3 **Course: Advanced Data Analytics**

L: 3 Hrs, P: 2 Hr, Per Week **Total Credits: 4**

Course Objectives

This course introduces techniques and tools for handling, processing, and analyzing semi-structured and unstructured data. Students learn to work with formats such as JSON, XML, text, images, and multimedia using Python and NoSQL technologies, culminating in real-world analytics applications and a mini-project.

Course Outcomes

At the end of this course, students will be able to:

CO1: Differentiate structured, semi-structured, and unstructured data formats and identify their applications.
CO2: Process and analyze semi-structured data from APIs, logs, and NoSQL sources.
CO3: Apply text preprocessing and basic NLP techniques for unstructured text analysis.
CO4: Perform introductory image and multimedia data preprocessing and feature extraction.
CO5: Build an end-to-end mini analytics project involving semi-structured or unstructured data.

Unit 1: Introduction to Non-Traditional Data Formats

- Difference between structured, semi-structured, and unstructured data
- Importance of non-traditional data in modern analytics
- Data sources: web data, logs, social media, IoT, documents, images, text
- Data storage formats: JSON, XML, YAML, HTML, logs, documents

Unit 2: Semi-Structured Data Processing & Analysis

- Characteristics of semi-structured data
- Working with JSON, XML, and YAML files
- Data extraction from REST APIs
- Transforming semi-structured data into tabular formats
- Tools: Python (json, xml.etree, pandas), MongoDB basics

- Hands-on: API data, server logs, metadata files

Unit 3: Unstructured Text Data Analysis (NLP Basics)

- Text acquisition: scraping, documents, social media, chat logs
- Text preprocessing: tokenization, stop words, stemming, lemmatization
- Bag-of-Words, TF-IDF, word embeddings (intro)
- Sentiment analysis basics
- Hands-on: Text classification, sentiment scoring

Unit 4: Unstructured Image & Multimedia Data

- Introduction to image data characteristics
- Image preprocessing (resize, grayscale, noise removal)
- Feature extraction basics (edges, color histograms)
- Intro to deep learning for images (CNN basics, no math)
- Multimedia data: audio/video structure overview
- Hands-on: Simple image analysis tasks

Unit 5: Tools, Applications, and Real-World Analytics Project

- Hadoop & Spark for semi/unstructured data (conceptual)
- NoSQL ecosystems (MongoDB, ElasticSearch, HBase)
- Use cases: recommender systems, social media analysis, IoT analytics
- Mini Capstone Project:
    - Acquire semi-structured/unstructured data
    - Clean + parse
    - Analyze + model
    - Visualize + report findings

Text Books:

1. Unstructured Data Analytics Using Machine Learning – M. Sangeetha et al. Focuses on dealing with unstructured data using machine learning techniques, useful for practical approaches to text, image, and other formats. Bookswagon
2. Tapping into Unstructured Data: Integrating Unstructured Data and Textual Analytics into Business Intelligence – Anthony Nesavich & William H. Inmon
   Great for understanding how unstructured text analytics integrates into BI systems, with real case studies. O'Reilly Media
3. Text Mining and Analysis: Practical Methods, Examples, and Case Studies – [Various Authors / SAS Press]
   Excellent text mining reference that covers large-scale text processing and analytics. O'Reilly Media

Reference Books :

1. Text Mining with R – Julia Silge & David Robinson
   A practical guide to text analytics and natural language processing using R. O'Reilly Media
2. Practical SQL: A Beginner's Guide to Storytelling with Data – Anthony DeBarros
   Useful for pre-processing semi-structured data and integrating it with SQL workflows. (Popular community recommendation) Reddit
3. MongoDB: The Definitive Guide – Kristina Chodorow (O'Reilly)
   While not fully specific to analytics, great for learning NoSQL document database design and querying JSON-based data. (Commonly recommended in data engineering circles) Reddit

Lab Syllabus :

Minimum 8 practicals based on theory topics.

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1379-4 **Course: Advanced Databases**
L: 3 Hrs, P:2 Hrs, Per Week **Total Credits: 4**

Course Objectives

To help students understand various database architectures, concepts of data storage structures, and different types of advanced databases with their issues.

Course Outcomes

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

1. Analyze different database system architectures, including centralized, client-server, parallel, and cloud-based databases.
2. Implement and evaluate various data storage techniques for modern high-performance business applications.
3. Apply concepts of object-based and temporal databases for advanced data modeling and query processing.
4. Develop and manage mobility and personal databases, addressing challenges like routing, disconnection, and consistency.
5. Explore and utilize NoSQL and geographic databases for scalable, distributed, and location-based applications.

Syllabus

Unit - I:

Database System Architectures

Centralized and Client-Server Architectures. Server System Architectures: Transaction Servers, Data Servers, Cloud-Based Servers. Parallel Databases: Introduction, Speedup and Scale up, I/O Parallelism, Interquery & Intraquery parallelism, Interoperational & Intraoperational parallelism. Cloud-Based Databases: Data storage systems on cloud, Data Representation, Partitioning and Retrieving, Transactions and Replication, Challenges.

Unit - II:

Data Storage for Modern High-Performance Business Applications

Implementing a Relational Database, Implementing a Key/Value Store, Implementing a Document Database, Implementing a Column-Family Database, Implementing a Graph Database.

Unit - III:

Object-Based and Temporal Databases

Object-Based Databases: Overview, Complex Data Types, Structures Types and Inheritance in SQL Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R features, Object-Relational Mapping, Object-Oriented versus Object Relational Databases. Temporal Databases: Time in Databases: Time Specification in SQL, Temporal Query Languages.

Unit - IV:

Mobility and Personal Databases

A Model of Mobile Computing, Routing and Query Processing, Broadcast Data, Disconnection and Consistency. Case studies on Temporal & Mobile Databases.

Unit - V:

NoSQL and Geographic Databases

NoSQL Databases: Introduction, Differences from Relational Databases, Basic Schema and Data Types, Types of NoSQL Databases, Concepts of Replication, Distribution, Sharding, and Resilience, Use of NoSQL in Industry.

Spatial and Geographic Data: Representation of Geometric Information, Design Databases, Applications of Geographic Data, Representation of Geographic Data, Spatial Queries, Indexing of Spatial Data Multimedia Databases, Mobility and Personal Databases.

Text Books:

1. Fundamentals of Database Systems - R. Elmasri, S.B. Navathe, Pearson Education (4th Edition)
2. Database Systems Concepts - Silberschatz, Korth, Sudarshan, McGraw-Hill (6th Edition)
3. Data Access for Highly-Scalable Solutions: Using SQL, NoSQL, and Polyglot Persistence - Microsoft MSDN.
4. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence – Pramod J. Sadalage, Martin Fowler

Reference Books:

1. Modern Database Management - McFadden, Prescott, and Hoffer (10th Edition)
2. Readings in Database Systems – Peter Bailis, Joseph M. Hellerstein, Michael Stonebraker, MIT Press, 5th Edition (2015)

Lab Syllabus :

Minimum 8 practicals based on theory topics.

SYLLABUS OF SEMESTER - III, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TH1381 **Course: Research Methodology**

L: 2 Hrs, P: 0 Hr, Per Week **Total Credits: 2**

Course Objectives

1. To introduce students to the fundamental concepts and processes involved in research methodology and to equip students with knowledge of various sampling techniques, data collection methods, and statistical analysis methods used in research.

Course Outcomes

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

1. Demonstrate an understanding of the research process, including the identification of research problems and the formulation of research hypotheses.
2. Develop proficiency in sampling techniques and data collection methods, and they will be able to apply statistical methods to analyze research data effectively.
3. Exhibit ethical behavior in their research practices, including avoiding plagiarism and maintaining integrity in data collection and reporting.

Syllabus

Unit - I :

Introduction to Research: The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, application of Research, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature.

Unit - II :

Types of Research: Types of research, pure (basic, fundamental) and applied research, qualitative and, quantitative. Research Design: Meaning, need, types of research design – Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design, Experiments, surveys and case study Research design.

Unit - III :

Sampling, Data Collection and analysis: Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample,, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling, classification and tabulation of data, graphical representation of data, graphs and, charts – Histograms, frequency polygon and frequency curves, bell shaped curve and its properties., Statistical Methods for Data Analysis : Applications of Statistics in Research,, measures of central, tendency and dispersion

Unit - IV :

Research Report: Research report and its structure, journal articles –, Components of journal article., Explanation of various components. Structure of an abstract and keywords. Thesis and dissertations, components of thesis and dissertations. Referencing styles and bibliography.

Unit - V :

Ethics in Research: Plagiarism - Definition, ICT Tools for Research: Role of computers in research, maintenance of data using software such as Mendeley, Endnote, Tabulation and graphical presentation of research data and software tools, Web search: Introduction to Internet, use of Internet and WWW, using search engines and Advanced Tools like Generative AI.

Text Books:

1. Donald Cooper and PS Schindler (2009) Business Research Methods, 9th edition, Tata McGraw Hill

2. Kothari C. R Research Methodology

3. Uma Sekaran (2010) Research Methods for Business, 4th edition, Wiley.

Reference Book:

1. Ranjit Kumar (2009) Research Methodology, 2nd edition, Pearson Education

2. Naresh Malhotra and S Dash (2009) Marketing Research, 5th edition, Pearson Prentice Hall.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1475 **Course: Deep Learning**

L: 3 Hrs, P: 2 Hrs, Per Week **Total Credits: 4**

Course Objectives

This course will help to introduce basic deep learning algorithms, understand real world problem which will be solved by deep learning methods and identify deep learning techniques suitable for a real-world problem.

Course Outcomes

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

1. Train fully connected deep neural networks to real world problem.
2. Evaluate the performance of different deep learning models with respect to the optimization, bias variance trade-off, overfitting and underfitting etc.
3. Apply the convolution networks in context with real world problem solving.
4. Apply recurrent neural networks in context with real world problem solving.

Syllabus

Unit - I :

Basic of Deep Learning

History of Deep Learning, Thresholding Logic Perceptrons, Perceptron Learning Algorithm and Convergence, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed forward Neural Networks.

Unit - II :

Training of feedforward Neural Network

Representation Power of Feed forward Neural Networks, Training of feed forward neural network, Gradient Descent, Activation Function and Initialization Methods: Sigmoid, Tanh, Relu, Xavier and He initialization.

Unit - III :

Optimization and Regularization

Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Regularization: Bias and variance, Overfitting, Hyperparameters tuning, L1 and L2 regularizations, Data Augmentation and early stopping, Parameter sharing and tying.

Unit-IV:

Convolution Neural Network (CNN)

Convolutional Neural Networks, 1D convolution network, 2D convolution network Visualizing Convolutional Neural Networks, Guided Backpropagation

Unit-V:

Recurrent Neural Network (RNN)

Recurrent Neural Networks, Backpropagation through Time (BPTT), Vanishing and Exploding Gradients, Long Short Term Memory (LSTM) Cells, Gated Recurrent Units (GRUs)

Text Books:

1. Sandro Skansi, Introduction to Deep Learning ,Springer.
2. Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2019.
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville. Deep Learning. An MIT Press book. 2016.
4. Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka, Deep Learning using Python, Willey Publication.

Reference Books :

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. A. Ravindran, K. M. Ragsdell , and G. V. Reklaitis, Engineering Optimization: Methods and applications , John Wiley & Sons, Inc. , 2016.

Lab Syllabus :

Minimum 8 practicals based on Theory topics

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1476-1 **Course: Internet of Things**

L: 3 Hrs, P: 2 Hr, Per Week **Total Credits: 4**

Course Objectives:

This course will help to understand the vision and purpose of IoT, to learn Data and Knowledge Management using Devices in IoT Technology. Students can understand State of the Art – IoT Architecture, real world IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes

At the end of the course students will be able to:

1. Understand the fundamental concepts of the Internet of Things (IoT)
2. Analyze and apply communication protocols used in IoT
3. Evaluate IoT system architectures using standard reference model.
4. Apply real-world design considerations to IoT systems.

Syllabus

Unit-I:

Introduction to Internet of Things

IoT basics, Connected devices evolution, Introduction to communication mechanisms in IoT, Challenges with IoT, Applications of IoT.

Hardware in IoT: Introduction to RFID, Types of RFID, Simple and programmable Beacons, Various sensors prominently used in mobile devices.

Unit-II:

Communication in IoT

Physical layer protocols used in IoT communication. IP Protocols used in communication such as HTTP based protocols - CoAP and MQTT, Specific aspects of protocols covering IoT communication.

Unit-III:

Sensor networks and M2M Architecture

High level M2M requirements, ETSI M2M services architecture, ZigBee network and its architecture. 6LoWPAN related standards.

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit-IV:

Real-World Design Constraints

Introduction, Technical Design constraints-hardware is popular again, Data representation and

visualization, Interaction and remote control.

Unit-V:

Applications of IoT

Case Studies of IoT Applications: IoT in Cities/Transportation, IoT in the Home, IoT in Retail, IoT in Healthcare and IoT in Sports.

Text Books:

1. Learning Internet of Things By: Peter Waher Publisher: Packt Publishing.
2. Internet of Things: A Hands-On Approach By: Arshdeep Bahga and Vijay Madisetti Publisher: Universities Press / VPT.

Reference Books:

1. The Internet of Things: Key Applications and Protocol By: Olivier Hersent; David Boswarthick; Omar Elloumi, Publisher: John Wiley & Sons.
2. M2M Communications: A Systems Approach By: David Boswarthick; Omar Elloumi; Olivier Hersent, John Wiley & Sons

Lab Syllabus :

Minimum 8 practical's based on theory topics.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1476-2 **Course: Prompt Engineering**

L: 3 Hrs, P: 2 Hr, Per Week **Total Credits: 4**

Course Objectives:

1. Understand the principles and techniques of prompt engineering, including the designs of effective prompts
2. Explore the capabilities of large language models for text and image generations and to leverage the creation of engaging content
3. Gain practical experience in crafting prompts and generating text and images using AI tools and platforms

Course Outcomes

On successful completion of the course, students will be able to:
1. Design clear, concise, and relevant prompts following the standard principles of prompt engineering.
2. Utilize LLMs to generate text and image for designing more effective content and design.
3. Analyze existing prompts and make strategic combinations for enhanced prompts.

Syllabus

Unit I :
Introduction to LLM and Prompting
Introduction to Large Language Models
What are Text Generation Models, Large Language Models are Magic, A Brief History of Language Models, LLMs in the Market
Understanding Prompting and Prompt Techniques
Five Principles of Prompting, Introducing LLM Prompts, How LLM Prompts Work, Types of Prompts, Components of an Prompt, Defining Personality in Prompts, Mix and Match Strategic Combination for Enhanced Prompts, Challenges and Limitations of Using Prompts
Case Studies and Examples for Successful Prompt Designs.

Unit II :
The Art of Text Data Generation with GenAI
Standard Practices for Text Generation
Generating Lists, Explain It Like I'm Five, Universal Translation Through LLMs, Ask For Context, Text Style Unbundling, Identifying the Desired Textual Features, Generating New Content with the Extracted Features, Role Prompting, Analyzing Existing Prompts for Strengths and Weaknesses

Unit III :

Generating Text with AI for Content Creation

Using AI for Copywriting, Creating Social Media Posts. Writing Video Scripts, Using AI for Personalized Messaging, Creating Engaging and Tailored Content with AI, Techniques for Crafting Effective Prompts for Surveys, Assessments, and Data Collection, Using Prompts in Research Methodology

Unit IV :

Introduction to Diffusion Models for Image Generation

Introduction to Image Generation with AI, Principles of Designing Prompts for Image Generation, Available Models - OpenAI DALL-E, Midjourney, Stable Diffusion, Google Gemini, Text to Video, Model Comparison, Reverse Engineering Prompts, Negative Prompts, Prompt Re-Writing, Prompt Analysis

Unit V :

Building AI Powered Applications

AI Blog Writing, Topic Research, Expert Interview, Generate Outline, Text Generation, Writing Style, Title Optimization, AI Blog Images, User Interface, Ethical Considerations of Using AI for Text and Image Generation

Text Books:

1. James Phoenix, Mike Taylor, "Prompt Engineering for Generative AI", O'Reilly, To Release in May 2024 https://www.oreilly.com/library/view/prompt-engineering-for/9781098153427/.

2.Gilbert Mizrahi, "Unlocking the Secrets of Prompt Engineering: Master the Art of Creative Language Generation to Accelerate Your Journey from Novice to Pro", January 2024 https://www.packtpub.com/en-in/product/unlocking-the-secrets-of-prompt-engineering-9781835083833

Reference Books:

1.Michael Ferguson, "Prompt Engineering: The Future of Language Generation", January 2023 https://books.apple.com/us/book/prompt-engineering-the-future-of-language-generation/id6445529200

2. "Prompt Engineering Guide", https://www.promptingguide.ai/

Lab Syllabus :

Minimum 8 practical's based on theory topics.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TP1476-3 **Course: Data Privacy and Security**

L: 3 Hrs, P: 2 Hr, Per Week **Total Credits: 4**

Course Objectives:

This course aims to provide students with the ability to identify privacy related aspects of data uses, attacks on data privacy, evaluate proposed technical mechanisms for privacy protection and understand ethical issues related to data privacy

Course Outcomes

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

1. Understand the basic principles of data privacy and the implications of data breaches.
2. Identify and evaluate different methods of protecting sensitive data.
3. Explain the role of privacy regulations in safeguarding personal information.Implement basic cryptographic techniques to secure data.
4. Apply data anonymization techniques to protect personal information.Analyze the ethical considerations in data privacy.

Syllabus

Unit-I:

Introduction to Data Privacy

Definition and scope of data privacy, Historical evolution of data privacy, Importance of data privacy in the digital era, Types of data: personal, sensitive, and non-personal data, Personally Identifiable Information (PII), Privacy risks in modern information systems.

Unit-II:

Privacy Laws, Regulations, and Compliance

Overview of data protection laws, General Data Protection Regulation (GDPR), Indian data protection framework (IT Act, DPDP Act), International regulations (HIPAA, CCPA), Data subject rights, Organizational responsibilities, Compliance challenges and penalties.

Unit-III:

Data Privacy Attacks and Data Protection Techniques

Types of data privacy attacks and data breaches, Insider threats, phishing and malware attacks, Impact of data breaches on individuals and organizations, Introduction to cryptography, Symmetric and asymmetric encryption, Hashing techniques, Digital signatures, Role of cryptography in data protection.

Unit-IV:

Data Collection, Anonymization, Use and Reuse

Data collection practices and privacy concerns, Harms associated with data collection, use and reuse, Introduction to data anonymization, Anonymization techniques: data masking, generalization, suppression, k-anonymity, l-diversity, Challenges and limitations in anonymizing data, Re-identification risks.

Unit-V:

Ethical Considerations in Data Privacy

Ethical principles in data privacy, Privacy and surveillance, Ethics of data collection and use, Consent and transparency, Bias and discrimination in data analysis, Ethical challenges in AI and big data systems.

Text Books

1. Data Privacy: Principles and Practice By: Natraj Venkataramanan, Publisher: CRC Press.
2. Privacy, Big Data, and the Public Good By: Julia Lane et al., Publisher: Cambridge University Press.

Reference Books

1. The Algorithmic Foundations of Differential Privacy By: Cynthia Dwork and Aaron Roth, Publisher: Now Publishers.
2. Security and Privacy in Big Data By: Chao Shen and Hui Xu, Publisher: Springer.

Lab Syllabus :

Minimum 8 practical's based on theory topics.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1480 **Course: Computer Workshop-II**

L: 0 Hrs, P: 2 Hrs, Per Week **Total Credits: 1**

Course Outcomes:

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

1. Learn about the features and installation of Flutter
2. Learn about the basic programming constructs of Dart
3. To implement the Materials and Widgets for design in Flutter.
4. To connect with APIs and handling user input

Syllabus:

Minimum 8 practical's based on Flutter App development

1. Environment setup & Dart essentials
2. Stateless vs Stateful widgets
3. Layout widgets
4. Material & Cupertino components
5. State Management : setState & lifting state up
6. Navigation
7. Networking, storage & forms

Text Books :

1. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps First Edition by Rap Payne, Apress.
2. Flutter in Action, First Edition by Eric Windmill – Manning.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1481 **Course: Project Work**

L: 0 Hrs, P: 12 Hrs, Per Week **Total Credits: 6**

Course Objectives

The students can explore a wide range of project ideas mapping within the domain of computer science and its applications. The students should able to learn detailed design, development, and testing during their project.

Course Outcomes

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

1. Implement comprehensive project planning, designing, development and testing phases.
2. Demonstrate conception of modern software engineering principles.

Syllabus:

Project work to be carried out under the supervision of one internal guide.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)

(Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1482 **Course: Technical Seminar**

L:0 Hrs, P: 2 Hrs, Per Week **Total Credits: 1**

Course Objectives

To assess the overall knowledge of the student in the Computer Science and Application domain. To assess the preparedness of the student for placements and entrance examinations for higher studies. To facilitate the students in selecting an appropriate career track for themselves.

Course Outcomes

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

1. Identify recent trends in Generative AI domain.
2. Exhibit oral presentation skills and interpersonal skills
3. Enhance and apply interview skills across academic and industry environments.

Syllabus

The technical Seminar will be based on the following topics but not limited to:

- Prompt Engineering
- Agentic AI
- ML Ops
- AI Ops
- LLMs

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Department of Humanities
Shri Ramdeobaba College of Engineering and Management
Syllabus for Semester IV (MCA)

Course Code: 25HS02PR1475 Course: Personality Development and Soft Skills

L: 0 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 1

Course Outcomes:

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

CO1: Understand and evaluate one's personality type to interact effectively in society and at work.
CO2: Apply strategies for effective goal setting.
CO3: Evaluate and apply soft skills enhancement techniques in individual as well as team tasks.
CO4: Understand and apply the techniques for effective time- management.
CO5: Understand and apply techniques of stress management in personal as well as professional life.
CO6: Understand the importance and techniques of image building for a successful life

Syllabus

List of Practical (2 hours each for each batch)

1. Self-Analysis: Personality assessment through Big 5 Model, SWOC analysis and RBS Technique
2. Goal Setting
3. Group Dynamics and Leadership Skills
4. Conflict Resolution
5. Critical Thinking and Problem Solving
6. Time Management
7. Stress Management
8. Image Building

Reference Books and Material

1. Barun K. Mitra, "Personality Development and Soft Skills", 2016, Oxford
2. Dr. K. Alex, "Soft Skills: Know Yourself & Know the World", 2009, S. Chand
3. E.N McGrath, "Basic Managerial Skills for all", 2009, PHI Learning
4. Shalini Verma, "Enhancing Employability @ Soft Skills, Pearson Publications, 2012
5. Stephen Robbins, Timothy Judge, and Neharika Vorah, "Organizational Behaviour", Pearson Publications, 2016
6. Harvard Business Review - https://hbr.org/2005/01/how-to-play-to-your-strengths
7. Steven Covey "The 7 habits of highly Effective people", 2016, Simon & Schuster

1 Year Internship (Semester-III and IV)

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS) (Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1391 **Course:** Project Work- Full Time (Phase-I)

L: 0 Hrs, T:0 Hr P: 44 Hrs, Per Week **Total Credits: 22**

Course Objectives

This course will help to get familiar with the basics of project planning, designing and development. Also, students can learn to understand technology and processes associated in software industries. The internship project work is an opportunity for students to earn and learn simultaneously.

Course Outcomes

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

1. Implement comprehensive project planning, designing and development process.
2. Acquire and understand Software industry needs.

Syllabus:

A full-time project work to be carried out under the supervision of one external guide from industry and one internal guide.

SYLLABUS OF SEMESTER - IV, MCA (MASTER OF COMPUTER APPLICATIONS) (Artificial Intelligence and Machine Learning)

Course Code: 25CS60PR1491 **Course:** Project Work- Full Time (Phase-II)

L: 0 Hrs, T:0 Hr P: 34 Hrs, Per Week **Total Credits: 17**

Course Objectives

This course will help to get familiar with the basics of project planning, designing and development. Also, students can learn to understand technology and processes associated in software industries. The internship project work is an opportunity for students to enhance the interaction with industry and placement prospects.

Course Outcomes

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

1. Implement comprehensive project planning, designing and development process.
2. Acquire and understand Software industry needs.

Syllabus:

A full-time project work to be carried out under the supervision of one external guide from industry and one internal guide.

Bridge Courses

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)

Course Code: 25CS60TH1199 **Course:** Discrete Structures and Digital Logic

L: 2 Hrs, T:1hr P: 0 Hrs, Per Week **Total Credits: 0**

Course Objectives

Students can study the basics of set theory, relations and functions, Algebraic Structure and Combinatorics. Studens can explore several mathematical topics in order to understand the relation between exploration, Logic concept and discovery and proof. Students can learn to introduce number systems, codes, basic postulates of Boolean algebra, methods for simplifying Boolean expressions. Also it will help to outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.

Course Outcomes

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

1. Solve the problems based on set theory, relations and functions, Algebraic Structure and Combinatorics.
2. Translate statements and reasoning from natural language to propositional and predicate logical language
3. Perform arithmetic operations with different number systems, use various optimization techniques to minimize and design digital circuits.
4. Analyze and design various combinational logic circuits and sequential circuits.

Syllabus

Unit-I

Set Theory: Introduction, Combination of sets, Multisets, Ordered pairs, Set Identities.
Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.
Functions: Definition, Classification of functions, Operations on functions.

Unit-II

Algebraic Structures: Definition, Groups, Subgroups and order, Semigroups, Monoids, Cyclic Groups, Cosets.
Combinatorics: Sum and product rule, Principle of Inclusion Exclusion, Permutations and Combination, Pigeon Hole Principle, Linear Recurrence relations.

Unit-III

Methods of Proof: Proof by Contrapositive, Proofs by Cases, Proofs by Contradiction, The Principle of Mathematical Induction.
Propositional Logic: Proposition, well-formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Normal forms, Theory of Inference, Natural Deduction.

Predicate Logic: First order predicate, well-formed formula of predicate, quantifiers, Inference theory of predicate logic.

Unit-IV

Binary Systems: Digital Computers and Digital Systems, Number Systems, Representation of Signed Numbers and Binary Arithmetic in Computers,Binary Codes.

Logic gates: Truth table, properties and symbolic representation of NOT, AND, OR,

NOR, NAND, EX-OR, EX-NOR gates. NOR and NAND gates as a universal gate.

Boolean algebra: Axioms and Laws of Boolean Algebra, Duality, Canonical and Standard Forms, Minimization of switching functions: 2, 3, 4 variable Karnaugh map.

Unit-V

Combinational Logic - Adders, Subtractors (Half and Full), Decoders, Encoders, Multiplexers, Demultiplexers, code converter.

Sequential Logic - Flip-Flop, Concept of clock, Counters- Ring Counter, Johnson Counter.

Text Books:

1. Bernard Kolman, Robert Busby, Sharon C. Ross, Discrete Mathematical Structures, Pearson
2. Jean Paul Trembley, R Manohar, Discrete Mathematical Structures with Application to Computer Science, McGraw-Hill
3. Digital Design: M. M. Mano, Prentice Hall.
4. Fundamentals of Digital Circuits: A. Anand Kumar, PHI.

Reference Books:

1. Liu and Mohapatra, “Elements of Discrete Mathematics”, McGraw Hill
2. Discrete Mathematics and its Applications - Kenneth H. Rosen 7th Edition -Tata McGraw Hill Publishers
3. Modern Digital Electronics: R.P.Jain.