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
2024-25

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	24CS60TH1175	Operating Systems	3	0	3	50	50	100	3 Hrs.
2	PCC	24CS60PR1175	Operating Systems Lab	0	2	1	25	25	50	-
3	PCC	24CS60TH1176	Object Oriented Programming	3	0	3	50	50	100	3 Hrs.
4	PCC	24CS60PR1176	Object Oriented Programming Lab	0	2	1	25	25	50	-
5	PCC	24CS60TH1177	Data Structures	3	0	3	50	50	100	3 Hrs.
6	PCC	24CS60PR1177	Data Structures Lab	0	2	1	25	25	50	-
7	PCC	24CS60TH1178	Analysis of Algorithms	3	0	3	50	50	100	3 Hrs.
8	PCC	24CS60PR1178	Analysis of Algorithms Lab	0	2	1	25	25	50	-
9	PCC	24CS60TH1179	Foundation of Data Science	3	0	3	50	50	100	3 Hrs.
10	PCC	24CS60PR1179	Foundation of Data Science Lab	0	2	1	25	25	50	-
11	PCC	24CS60PR1180	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	24CS60TH1275	Database Management Systems	4	0	4	50	50	100	3 Hrs.
2	PCC	24CS60PR1275	Database Management Systems Lab	0	2	1	25	25	50	
3	PCC	24CS60TH1276	Artificial Intelligence	3	0	3	50	50	100	3 Hrs.
4	PCC	24CS60PR1276	Artificial Intelligence Lab	0	2	1	25	25	50	
5	PCC	24CS60PR1277	Advanced Web Development Lab	0	4	2	25	25	50	-
6	PEC	24CS60TH1278	Elective-I	3	0	3	50	50	100	3 Hrs.
7	PEC	24CS60PR1278	Elective Lab-I	0	2	1	25	25	50	
8	HSMC/ SEC	24HS02PR1275	Communication Skills for Employability	0	2	1	25	25	50	-
9	CCA	24HS04PR1275	Sports-Yoga-Recreation	1	2	1	25	25	50	-
10	OEC	24ID160TH1275	Open Elective (Offered by MCA(AI&ML))	3	0	3	50	50	100	3 Hrs.
			TOTAL	**14**	**14**	**20**	**375**	**375**	**750**	

Course Code	Elective-I
24CS60TH1278-1	Image Processing
24CS60TH1278-2	Operations Research
24CS60TH1278-3	Pattern Recognition

Course Code	Elective Lab-I
24CS60PR1278-1	Image Processing Lab
24CS60PR1278-2	Operations Research Lab
24CS60PR1278-3	Pattern Recognition Lab

Open Elective (Offered by MCA(AI&ML) Department)	
24ID160TH1275-1	Introduction to Machine Learning
24ID160TH1275-2	Introduction to Natural Language Processing
24ID160TH1275-3	Text Mining Applications
24ID160TH1275-4	MOOC-Coursera

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	24CS60TH1375	Machine Learning	3	0	3	50	50	100	3 Hrs.
2	PCC	24CS60PR1375	Machine Learning Lab	0	2	1	25	25	50	
3	PCC	24CS60TH1376	Computer Networks	3	0	3	50	50	100	3 Hrs.
4	PCC	24CS60PR1376	Computer Networks Lab	0	2	1	25	25	50	
5	PCC	24CS60TH1377	Business Analytics and Intelligence	3	0	3	50	50	100	3 Hrs.
6	PCC	24CS60PR1377	Business Analytics and Intelligence Lab	0	2	1	25	25	50	
7	PEC	24CS60TH1378	Elective-II	3	0	3	50	50	100	3 Hrs.
8	PEC	24CS60PR1378	Elective Lab-II	0	2	1	25	25	50	
9	PEC	24CS60TH1379	Elective-III	3	0	3	50	50	100	3 Hrs.
10	PEC	24CS60PR1379	Elective Lab-III	0	2	1	25	25	50	
11	MLC	24CS60TH1380	Research Methodology	2	0	2	50	50	100	3 Hrs.
			TOTAL	**17**	**10**	**22**	**425**	**425**	**850**	

Course Code	Elective-II
24CS60TH1378-1	Information Security
24CS60TH1378-2	Computer Vision
24CS60TH1378-3	Distributed Systems

Course Code	Elective Lab-II
24CS60PR1378-1	Information Security Lab
24CS60PR1378-2	Computer Vision Lab
24CS60PR1378-3	Distributed Systems Lab

Course Code	Elective-III
24CS60TH1379-1	Software Engineering and Testing
24CS60TH1379-2	Information Retrieval
24CS60TH1379-3	Advanced Databases

Course Code	Elective Lab-III
24CS60PR1379-1	Software Engineering and Testing Lab
24CS60PR1379-2	Information Retrieval Lab
24CS60PR1379-3	Advanced Databases Lab

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	24CS60TH1475	Deep Learning	3	0	3	50	50	100	3 Hrs.
2	PCC	24CS60PR1475	Deep Learning Lab	0	2	1	25	25	50	
3	PEC	24CS60TH1476	Elective -IV	3	0	3	50	50	100	3 Hrs.
4	PEC	24CS60PR1476	Elective Lab-IV	0	2	1	25	25	50	
5	PEC	24CS60PR1477	Elective Lab-V	0	2	1	25	25	50	-
6	VSEC/Project	24CS60PR1478	Project Work	0	12	6	75	75	150	-
7	**HSMC/ SEC**	24HS02PR1475	Personality Development and Softs Skills	0	2	1	25	25	-	-
8	AEC	24CS60PR1479	Technical Seminar	0	2	1	25	25	50	-
			TOTAL	**6**	**22**	**17**	**300**	**300**	**600**	

Course Code	Elective-IV
24CS60TH1476-1	Internet of Things
24CS60TH1476-2	Generative AI and its Applications
24CS60TH1476-3	Blockchain Technology

Course Code	Elective Lab-IV
24CS60PR1476-1	Internet of Things Lab
24CS60PR1476-2	Generative AI and its Applications Lab
24CS60PR1476-3	Blockchain Technology Lab

Course Code	Elective Lab-V
24CS60PR1477-1	Mobile Application Development Lab
24CS60PR1477-2	System Administration Lab
24CS60PR1477-3	Game Development Lab

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	24CS60PR1390	Project Work- Full Time (Phase-I)	0	0	44	22	350	300	650	-

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	24CS60PR1490	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		24CS60TH1198	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: 24CS60TH1175

Course :Operating Systems

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

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

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60PR1175

Course :Operating Systems Lab

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

Course Objective

The objective of the course is to know the basics of operating systems, Introduction of the Linux operating system and to learn OS concepts in Linux.

Course Outcomes

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

1. Install and work with various operating systems.
2. Use and run the commands of Linux.
3. Implement OS concepts in LINUX.

Syllabus

Minimum 4 practicals and assignments based on but not limited to the following topics:

- Introduction to virtualization. Preparing Multiboot systems.
- Creating Linux Virtual machines (or any variant eg Fedora / ubuntu / Kalilinux).
- Introduction to Linux/Unix/ Windows Operating Systems.
  .
- Studying file system of Linux.
- Compiling and executing C programs in Linux environment.
- Implementing OS concepts in Linux.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60TH1176 **Course : Object Oriented Programming**
L: 3 Hrs, P: 0 Hr, Per Week **Total Credits : 3**

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

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60PR1176 **Course : Object Oriented Programming Lab**
L: 0 Hrs, P: 2 Hr, Per Week **Total Credits : 1**

Course Objectives

The objective of the course is to prepare the students for applying the object-based programming techniques using objects and classes. Students can learn concepts like File handling, Multithreading, Exception handling, Streams, Generic, Collection classes, Java Server side concepts like JSP and Servlets through programming.

Course Outcomes

1. Develop programs using object-based programming techniques using objects and classes.
2. Develop programs using Specialized Java programming concepts like File handling, Multithreading, Exception handling, Streams, Generic and Collection classes
3. Develop programs using Java Server side concepts like JSP and Servlets.

Syllabus

Minimum 8 practicals based on but not limited to the following topics:
Classes and Objects, Inheritance, Overloading, Polymorphism, Collections, Generics, File Handling, Database connectivity, JSP and Servlets.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60TH1177 **Course : Data Structures**
L: 3 Hrs, P: 0 Hr, Per Week **Total Credits : 3**

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.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60PR1177 **Course : Data Structures Lab**
L: 0 Hrs, P: 2 Hr, Per Week **Total Credits : 1**

Course Objectives

Students should develop skills to implement the various data structures, create error free and efficient program code by applying data-structures algorithms for real world problems.

Course Outcomes

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

1. Implement real world problems based on the concepts of arrays, sorting, searching and various linked list algorithms.
2. Demonstrate programs on stacks mechanism and queues.
3. Formulate the problem related to data structure and hashing techniques to devise an algorithm and transform into code.

Syllabus

Minimum 10 practicals and assignments based on but not limited to the following topics:

1. Arrays
2. Sorting and Searching Techniques
3. Link list
4. Stacks
5. Queues
6. Trees
7. Hashing Techniques

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1178 **Course : Analysis of Algorithms**

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

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.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1178 **Course : Analysis of Algorithms Lab**

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

Course Objectives

To understand and differentiate between the different algorithm design paradigms. This will be helpful to identify the application areas for these algorithm design techniques.

Course Outcomes

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

1. Design algorithms using different algorithm design techniques.
2. Compare the time complexities and develop efficient programming solutions for real time problems.

Syllabus

Practical Examples based on but not limited to following:

1. Sorting problems and time complexity.
2. Multiplication of Large Integers and its time complexity.
3. Calculating the Greatest Common Divisor and calculating time complexity.
4. Calculating the Fibonacci Sequence and calculating time complexity.
5. Depth-First Search, Breadth-First Search on directed and undirected graphs,
6. Binary Searching, Sorting by Merging, Quicksort, Selection sort using Divide and conquer and calculating time complexity.
7. Greedy Algorithms for Minimal Spanning Trees, Shortest Path problems, Scheduling problems, Knapsack Problem.
8. Dynamic programming algorithms for Colouring a Graph, The Travelling Salesperson Problem, Knapsack Problem.
9. Simulating 4 Queen's problem or any other variant.
10. Simulating Tic-Tac-Toe.

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.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60TH1179 **Course : Foundation of Data Science**
L: 3 Hrs, P: 0 Hr, Per Week **Total Credits : 3**

Course Objectives

This course will provide knowledge of statistical data analysis techniques utilized in business decision making. Students can use principles of Data Science and use data mining software to solve real-world problems.

Course Outcomes

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

1. Explore the needs and importance of Data Science concepts.
2. Apply the various statistical measures on data set.
3. Work with data science platform for data preprocessing steps.
4. Demonstrate supervised algorithms for mining the data from large volumes.
5. Demonstrate unsupervised algorithms for mining the data from large volumes.

Syllabus

Unit- I:

Introduction: What is Data Science? Big Data and Data Science – Datafication – Current landscape of perspectives – Skill sets needed. Data Science Platform – Challenges of Conventional Systems -Intelligent data analysis – Nature of Data
Data Visualization: Basic principles, ideas and tools for data visualization.

Unit - II:

Statistics: Descriptive Statistics-Correlation-distributions and probability – Statistical Inference: Populations and samples – Statistical modelling – probability distributions – fitting a model – Hypothesis Testing.

Unit - III:

Data preprocessing: Data cleaning – data integration – Data Reduction Data Transformation and Data Discretization. Evaluation of classification methods – Confusion matrix, Students T-tests and ROC curves-Exploratory Data Analysis – Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA – The Data Science Process.
Mining Frequent Patterns: Basic Concepts, Frequent Itemset Mining Methods, Pattern Evaluation Methods.

Unit - IV:

Basic Machine Learning Algorithms: Linear Regression- Logistic Regression – Classifiers – k-Nearest Neighbors (k-NN), k-means -Decision tree – Naive Bayes- Ensemble Methods – Random Forest. Feature Generation and Feature Selection – Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.

Unit - V:

Clustering: Choosing distance metrics – Different clustering approaches – hierarchical agglomerative clustering, k-means (Lloyd's algorithm), – DBSCAN – Relative merits of each method – clustering tendency and quality.

Text Books

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
2. Jiawei Han, Micheline Kamber and Jian Pei, " Data Mining: Concepts and Techniques", Third Edition. ISBN 0123814790, 2011.
3. Mohammed J. Zaki and Wagner Miera Jr, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2014.

Recommended books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60PR1179 **Course : Foundation of Data Science Lab**
L:0 Hrs, P: 2 Hr, Per Week **Total Credits : 1**

Course Objective

This course will render to explore the social, business, technical based problems. Students can apply proper techniques for the analysis of various data sets and to interpret the outcomes of the analysis so as to take correct decisions.

Course Outcomes

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

1. Describe the structure and characteristics of the data sets.
2. Achieve a basic understanding of statistical techniques.
3. Demonstrate and interpret the results of the outcomes.

Minimum 10 practicals based on but not limited to the following topics:

1. Introduction to Statistics I– Types of variables, descriptive statistics and explorative statistics.
2. Introduction to Statistics II– Correlation, Regression and Predictive analysis.
3. Data Preprocessing steps, Data handling and exploring data for missing values and outliers.
4. Data visualization and normalizing data techniques.
5. Inferential statistical approach-ANOVA one way and Two way and Chi-square test .
6. Predictive analysis: multivariate and Logistics regression.
7. Supervised Learning Algorithms
8. Association Rules Algorithms
9. Unsupervised Learning Algorithms
10. Mini project based on above topics
11. Note : Programming is to be done using Google Sheets/LibreOffice/Excel and R Programming/Python

SYLLABUS OF SEMESTER - I, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60PR1180 Course : Fundamentals of Web Development Lab
L: 0 Hrs, P: 2 Hr, 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 20 Practicals 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: 24CS60TH1275 **Course : Database Management Systems**
L: 4 Hrs, P: 0 Hr, Per Week **Total Credits : 4**

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, Intermediate SQL and Relational Database Design:

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*

SYLLABUS OF SEMESTER - II, MCA (MASTER OF COMPUTER APPLICATIONS)
(Artificial Intelligence and Machine Learning)
Course Code: 24CS60PR1275 **Course : Database Management Systems Lab**
L: 0 Hrs, P: 2 Hr, Per Week **Total Credits : 1**

Course Objective

This course will help student to give a good formal foundation on the relational model of data, to present SQL, procedural interfaces to SQL comprehensively and to introduce the concepts and techniques relating to query processing by SQL Implementations.

Course Outcomes

1. Design and implement a database schema, database objects for a given problem-domain.
2. Declare and enforce business rules on a database using RDBMS.
3. Normalize a database, populate and query a database using SQL DML/DDL commands.

Syllabus

Minimum 4 practicals and assignments based on but not limited to the following topics:

- **SQL:** Overview of SQL, DDL, integrity constraints, DML, set operations, null values, aggregate functions, sub-queries.
- **Intermediate SQL:** Joins, Views, Indexes, Abstract Data type

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1276 **Course : Artificial Intelligence**

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

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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1276 **Course : Artificial Intelligence Lab**

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

Course Objectives

To learn various AI search algorithms, fundamentals of knowledge representation, inference, theorem proving and learn to build simple knowledge-based systems.

Course Outcomes

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

1. Use key logic-based techniques in a variety of research problems.
2. Communicate scientific knowledge at different levels of abstraction.
3. Build knowledge based systems.

Syllabus

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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1277 **Course : Advanced Web Development Lab**

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

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 Practicals 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)

Course Code: 24CS60TH1278-1 **Course : Image Processing**

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

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.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1278-2 **Course : Operations Research**

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

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.

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

Course Code: 24CS60TH1278-3 **Course : Pattern Recognition**

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

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.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1278-1 **Course : Image Processing Lab**

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

Course Objectives:

To introduce the basics of digital image and highlight their applications in different areas.

To introduce different color modeling, how to convert color model and and different standards of color television.

To understand the different image processing techniques.

To understand the different image filtering and their use.

Course Outcomes:

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

1. Able to apply different edge detection and segmentation techniques for a given image.
2. Able to implement different arithmetic operations in an image. Able to understand the different image enhancement techniques in different domains.
3. Able to apply different encoding and decoding techniques of image compression for a given problem

Minimum 8 practicals and assignments based on the Theory Topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1278-2 **Course : Operations Research Lab**

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

Course Objectives

This course will help students to explore the social, business, technical based problems. This course navigates the proper optimisation techniques for the analysis of various models. The students can interpret the outcomes of the analysis to take correct decisions.

Course Outcomes

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

1. Identify the various optimisation models of Operations research.
2. Demonstrate various optimisation models for decision making.
3. Interpret the results of the outcomes.

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: 24CS60PR1278-3 **Course : Pattern Recognition Lab**

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

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.

Minimum 8 practicals and assignments based on the Theory Topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24HS02PR1275 **Course : Communication Skills for Employability**

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

Course Outcomes:

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

1. Apply effective listening and speaking skills in professional and everyday conversations.
2. Apply various techniques and tools for effective correspondence.
3. Demonstrate the techniques of effective Presentation Skills.
4. Analyse and apply the effective strategies for Group Discussions.
5. 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

To be implemented from the session 2024-25

Syllabus of Semester I/II PG Program

COURSE: SPORTS-YOGA-RECREATION			
L: 1 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week			Total Credit: 1
	Course Code	**Credit**	**No. of Lecture/Practical**
Practical	24HS04PR1275	1	2 Hour per week

Aim of the Course: The course aims to foster Health and wellness through Healthy and Active Lifestyle and creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness through practical experiences and hands on activities.

Objectives of the Course:

1. To impart the students with Practice of Sports, Yoga and Recreational activities for health and wellness.
2. To promote appreciation and interest for indigenous games, sports and yogic Exercises.
3. To make students capable of imparting knowledge about health, hygiene and nutrition
4. To enable Students to develop personality, character, willpower, Group Dynamics and positivity towards games and sports.

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

1. Practically learn the principles of implementing general and specific conditioning of physical exercises and yoga.
2. Develop Health-related fitness and Body-mind co-ordination through various fitness activities, sports, recreational games and yoga.
3. Practice Healthy & active living with reducing Life style diseases
4. Understand Physical Efficiency Test Administration and organization

Course Content:

Unit 1:

- Warm up and Cool Down and Stretching Exercises.
- General and Specific Exercises.
- General and Specific exercises for strength, Speed, Agility, Cardiovascular Endurance, Flexibility, Coordinative abilities.
- Practice of Fundamental Skills of selected Games.
- Test administration and organization
- Basics of Nutrition

Unit 2:

- Yoga: Standing, Sitting, Prone & Supine positions.
- Suryanamaskar
- Pranayama, Meditation and Relaxation Techniques.
- Recreational Games, Mental Health
- Practice of Selected Games

- Health related Physical Fitness Test./Endurance Test

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Physical Efficiency Test – 30 Marks Sports/Games skill Activity/Project – 10 Marks Yoga Activities – 10 Marks	50
		Total – 50 Marks

References:

1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
3. AAPHERD "Health related Physical Fitness Test Manual."1980 Published by Association drive Reston Virginia
4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana.
5. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS 'Science)

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

Open Elective

Course Code: 24ID160TH1275-1 **Course : Introduction to Machine Learning**

L: 3 Hrs, P: 0 Hr, 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: 24ID160TH1275-2 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:

4. Perform basic text processing at the word level.
5. Perform Part-of-Speech, Named Entity Tagging and apply production rules of context free grammar.
6. Apply lexical, vector semantics as well as perform word sense disambiguation.
7. 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: 24ID160TH1275-3 **Course : Text Mining Applications**

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

Course Objectives

5. To understand the concepts of Text Mining.
6. To develop the ability for solving various Text Mining Problems.
7. 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:

8. Identify the nature and characteristics of the Text data set.
9. Apply and evaluate the Text Mining Problems with proper tools and techniques.
10. 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: 24CS60TH1375 **Course: Machine Learning**

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

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.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1375 **Course: Machine Learning LAB**

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

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

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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1376 **Course : Computer Networks**

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

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 develop 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.

Minimum 6 to 8 Practicals based on theory topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1376 **Course: Computer Networks Lab**

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

Course Objective

The objective of the course is to understand different networking techniques for switching, and
routing and packet trafficking using different protocols.

Course Outcomes

On successful completion of the course, students will be able to:
1. Implementing different networking techniques for switching and routing.
2. Simulate efficient packet trafficking using several Routing algorithms in practice and knowing TCP, UDP protocols in Transport Layer.

Syllabus

Minimum 8 practicals based on theory topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1377 **Course : Business Analytics and Intelligence**
L: 3 Hrs, P:0 Hr, Per Week **Total Credits : 3**

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.

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

Course Code: 24CS60PR1377 **Course : Business Analytics and Intelligence Lab**
L: 0 Hrs, P: 2 Hr, Per Week **Total Credits : 1**

Course Objectives

This course aims to provide hands-on training in business intelligence and analytics tools using such as Power BI, Tableau, or Excel. This course also helps the students develop the ability to analyze business data and generate dashboards and reports.
strategy.

Course Outcomes

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

1. Use BI tools to connect to various business data sources to create interactive dashboards and business reports using KPIs and metrics.
2. Apply concepts like data cleaning, data aggregation, and dimensional modeling in BI contexts.
3. Analyze and visualize structured business data to support strategic decisions to Interpret data insights and communicate them effectively through reports and visualizations.

Syllabus

Minimum 8 practicals based on theory topics.

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

Course Code: 24CS60TH1378-1 **Course : Information Security**

L: 03 Hrs, P: 0 Hr, Per Week **Total Credits : 3**

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:

4. Describe and apply appropriate encryption techniques to solve problems.
5. Apply techniques of number theory in cryptography
6. Apply various public key cryptography techniques and understand the usability of key management and distribution.
7. Analyze various message authentication codes and hash functions.
8. 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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1378-2 **Course : Computer Vision**
L: 3 Hrs, P: 0 Hr, Per Week **Total Credits : 3**

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.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1378-3 **Course :Distributed Systems**

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

Course Objectives

To explore the differences between concurrent, networked and distributed systems. Learn and analyse the concept of resource allocation, distributed deadlock detection, avoidance techniques and commit and voting protocols.

Course Outcomes

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

1. Describe the architectures and components of distributed computing environment.
2. Understand the correlation between the various distributed algorithms and recent programming aspects.
3. Analyze the importance of the resource management, recovery and fault tolerance issues in distributed systems.
4. Implement the distributed computation services using case studies.

Syllabus

Unit - I: Introduction and Models

Examples of Distributed System, Resource Sharing and the Web-Challenges, case study on World Wide Web. System Models: Introduction, Architectural Models, Fundamental Models, Remote Invocation: Remote Procedure Call. Distributed Operating Systems: Introduction, Issues, Inherent Limitation, Clock Synchronization, Lamport's Logical Clock; Vector Clock;

Unit - II: Distributed File Systems

Architecture, Mechanisms, Design Issues, Case Study: Sun Network File System. Distributed Shared Memory: Architecture, Algorithms, Memory Coherence: Protocols, Design Issues.

Unit - III: Distributed Scheduling, Deadlock, Mutual Exclusion

Distributed Scheduling: Issues, Components, Load Distributing Algorithms, Load Sharing Algorithms. Distributed Deadlock Detection: Issues, Centralized Deadlock, Detection Algorithms, Distributed Deadlock, Detection Algorithms. Distributed Mutual Exclusion-Non-Token based Algorithms, Token based Algorithms.

Unit - IV: Recovery & Fault Tolerance

Recovery: Introduction, Basic Concepts, Classification of Failures, Backward Error Recovery: Basic Approaches, Recovery in Concurrent Systems.Fault Tolerance: Introduction, Issues, Commit Protocols, Non-Blocking Commit Protocols, Voting Protocols, Dynamic Voting Protocols.

Unit - V: Designing Distributed System

Google Case Study: Introducing the Case Study: Google- Overall architecture and Design Paradigm, Communication Paradigm, Data Storage and Coordination Services, Distributed Computation Services.

Text Books:

1. Distributed Systems Concepts and Design: *George Coulouris, Jean Dellimore and Tim KIndberg, Pearson Education,5th Edition.*
2. Advanced Concepts in Operating Systems: *Mukesh Singhal and N.G.Shivaratri, McGraw-Hill*.
3. Distributed Operating Systems: *Pradeep K. Sinha, PHI,2005*

References Books:

1. Distributed Computing-Principles,Algorithms and Systems: *Ajay D.Kshemkalyani and Mukesh Singhal Cambridge University Press.*
2. Distributed Algorithms, *Nancy A.Lynch, Morgan Kaufmann Publishers*.
3. Grid Computing: *Joshy Joseph and Craig Fellenstein , IBM Press*.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1378-1 **Course : Information Security Lab**

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

To understand the basics of cryptography concepts. It aims to identify and analyse the cryptography algorithms to use them in different applications and also to learn the ideas about key exchange, hash function, and digital signature.

Course Outcomes

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

1. Understand various mathematical techniques for cryptography
2. Apply various Symmetric and Public key cryptography techniques.
3. Implements Hashing and Digital Signature techniques

Syllabus

Minimum 8 practicals based on theory topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1378-2 **Course: Computer Vision Lab**

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

Course Objectives

To make the students experiment with Computer Vision techniques, so as to gain practical knowledge about visual representations and processing.

Course Outcomes

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

4. Implement and test fundamental image processing and computer vision techniques.
5. Perform image processing tasks like color image processing, feature extraction and image segmentation.
6. Build applications based on computer vision techniques.

Syllabus

Minimum 8 practical implemented using Python and any open-source image processing software.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1378-3 **Course: Distributed Systems Lab**

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

Course Objectives

To provide practical exposure to the fundamental concepts of distributed systems, including inter-process communication, synchronization, consistency, fault tolerance, and scalability. The lab focuses on implementing distributed algorithms, working with real-world distributed frameworks, and understanding system design challenges in a distributed environment.

Course Outcomes

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

1.Describe fundamental concepts of distributed systems, including communication, synchronization, and consistency.

2.Implement inter-process communication techniques such as sockets, Remote Procedure Calls (RPC), and message passing.

3.Examine and compare different distributed synchronization techniques like logical clocks, vector clocks, and mutual exclusion algorithms

4.Assess fault tolerance mechanisms in distributed environments, including checkpointing, replication, and consensus algorithms

Syllabus

Minimum 8 practicals based on theory topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1379-1 **Course: Software Engineering and Testing**
L: 3 Hrs, P: 0 Hr, Per Week **Total Credits: 3**

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 1: 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 2: 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 3: 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 4: 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 5: 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.

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

Course Code: 24CS60TH1379-2 **Course : Information Retrieval**

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

Course Objectives

This course will help to know how to design, manipulate, manage databases, develop preliminary understandings and skills for designing a database information system. Students can understand implementation of database systems in real world problems.

Course Outcomes

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

1. Design and implement a database schema, database objects for a given problem-domain.
2. Recognize the context, phases and techniques for designing and building database information systems in business.
3. Correctly use the techniques, components and tools to build application for real world problem.

Syllabus

Unit I : Introduction to Information Retrieval: The nature of structured and semi structured text, Inverted Index and Boolean Queries.
Dictionary and Postings: Tokenization, Stemming, Stop words, Phrases, Index Optimization.

Unit II: Dictionaries and Tolerant Retrieval:Wild Card Queries, Permuterm Index, Bigram Index, Spelling Correction, Edit Distance.
Term Weighting and Vector Space Model: Term frequency and weighting, Vector Space model for scoring.

Unit III : Performance Evaluation: Precision, Recall, F-Measure, E-Measure, Normalized recall.
Latent Semantic Indexing: Eigenvectors, Singular Value Decomposition, Lower rank approximation.

Unit IV:Probabilistic Information Retrieval: Probability ranking principle, The Binary Independence Model, Bayesian Network for text retrieval.
Text Classification: Introduction to text classification, Naïve Bayes text classification, Vector space classification, Support Vector Machine.

Unit V : Web Information Retrieval: Introduction to web search basics, Web crawling and indexes, LinkAnalysis**.**

Text Books:

1. An Introduction to Information Retrieval: Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, Cambridge, England, 2009

2. Information Retrieval: Implementing and evaluating search engines: Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack, MIT Press, 2010

Reference Books :

1. *Information Retrieval: Algorithms and Heuristics : David A. Grossman, Ophir Frieder, Springer.* Database Management System: *Raghu Ramkrishan, Johannes, McGraw Hill.*
2. Information Retrieval: Data Structures and Algorithms by Frakes, Pearson.
3. Soumen Chakrabarti, Mining the Web, Morgan-Kaufmann Publishers, 2002.

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

Course Code: 24CS60TH1379-3 **Course : Advanced Databases**
L: 3 Hrs, P: 0 Hr, Per Week **Total Credits : 3**

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)

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1379-1 **Course: Software Engineering and Testing Lab**
L: 0 Hrs, P: 2 Hr, Per Week **Total Credits: 1**

Course Objectives

The laboratory course aims to provide hands-on experience in implementing software engineering principles and testing techniques. It enables students to design, analyze, develop, and test software systems using appropriate tools and methodologies.

Course Outcomes

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

1. Develop software models and specifications using various software engineering tools.
2. Apply design and coding principles to create modular and efficient programs.
3. Execute and analyze test cases using different testing techniques and tools.
4. Implement automated testing using industry-standard tools.
5. Demonstrate effective teamwork and project management skills in software development projects.

Syllabus

Minimum 8 practicals based on theory topics.

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

Course Code: 24CS60PR1379-2 **Course: Information Retrieval Lab**

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

Course Objectives

This course will help to know the basics of Information Retrieval System, to understand the concept of Vocabulary and Terms. Students can learn the concept of Scoring, Term-Weighting and Vector-Space Model.

Course Outcomes

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

1. To implement basics of Information Retrieval System
2. To learn and implement concept of Vocabulary and terms.
3. To implement Scoring, Term-Weighting and Vector-Space Model.

Syllabus

Minimum 8 practicals based on theory topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1379-3 **Course: Advanced Databases Lab**

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

Course Objectives

To provide hands-on experience with advanced database techniques and modern database architectures.

Course Outcomes

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

1. Implement and analyze different database system architectures, including client-server, parallel, and cloud-based databases.

2.Develop and implement various data storage models, including relational, key-value, document-based, column-family, and graph databases.

3.Design and execute queries in object-based and temporal databases using SQL and object-relational mapping techniques.

4.Implement mobility and personal database applications, addressing routing, disconnection, and data consistency challenges.

5.Work with NoSQL and geographic databases, performing spatial queries, indexing, and distributed database operations.

Syllabus

Minimum 8 practicals implemented using SQL, NoSQL, and cloud-based databases.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1380 **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: 24CS60TH1475 **Course: Deep Learning**

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

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.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1475 **Course : Deep Learning Lab**

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

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

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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1476-1 **Course: Internet of Things**

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

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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1476-2 **Course : Generative AI and its Applications**

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

Course Objectives

1. To introduce the basic concepts and techniques of generative AI in NLP.
2. To understand encoder and decoder architecture.
3. To identify Large Language Models suitable for natural language generation.

Course Outcomes

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

1. Solve the problems related to the fundamental concepts in Natural Language Processing.
2. Analyse the strengths and weaknesses of various Encoder Decoder Architectures for sequence to sequence problems.
3. Analyse the strengths and weaknesses of various Attention Mechanism for sequence to sequence problems.
4. Implement various Transformer models to efficiently solve real-world 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.

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, Attention Mechanism, Bahdanau Attention Vs Luong Attention, Introduction to Transformers, Problems in encoder decoder architecture with LSTM.

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 Encoding, Requirements of the Positional Embedding, Formulation of Positional Embedding Vectors, Layer Normalization: Batch Normalization, Internal covariate shift, Implementation of Transformers using PyTorch

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.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60TH1476-3 **Course: Blockchain Technology**

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

Course Objectives

To introduce the fundamental concepts, structure, and functioning of blockchain technology, along with cryptographic techniques and consensus algorithms. To understand cryptocurrency systems like Bitcoin and Ethereum, and develop smart contracts using blockchain development tools. Also explore various real-world applications, platforms, and challenges in blockchain adoption across industries.

Course Outcomes

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

1. To Understand fundamental concepts, architecture, and types of blockchain technology, including cryptographic principles and consensus mechanisms.
2. Analyze the working of Bitcoin and Ethereum, and demonstrate smart contract development
3. Evaluate real-world applications of blockchain in various domains and identify current challenges and trends in blockchain adoption.

Syllabus

Unit - I :

Introduction to Blockchain: Definition and characteristics of blockchain, Evolution of blockchain technology, Distributed ledger technology (DLT), Blockchain vs Traditional technologies (databases, centralized systems), Types of blockchain: Public, Private, Consortium, and Hybrid, Blockchain components: Blocks, Nodes, Peers, Miners, Wallets.

Unit - II :

Cryptography and Blockchain Security: Cryptographic principles: Hashing, SHA-256, Digital signatures, Public key infrastructure (PKI)Merkle Trees and their use in blockchain, Immutability and tamper-proof records, Blockchain security issues and mitigation.

Consensus mechanisms: Proof of Work (PoW), Proof of Stake (PoS), Delegated PoS, Practical Byzantine Fault Tolerance (PBFT).

Unit - III :

Bitcoin and Cryptocurrency Concepts: Overview of Bitcoin, Bitcoin network, transactions, and mining, Structure of a Bitcoin block, Wallets and addresses, Blockchain forks (Soft Fork and Hard Fork), Limitations of Bitcoin.

Introduction to other cryptocurrencies: Litecoin, Ripple, and others.

Unit - IV :

Smart Contracts and Blockchain Platforms: Smart contracts: Definition, benefits, limitations**,** Ethereum platform and architecture**,** Ethereum Virtual Machine (EVM).

Solidity programming basics: Structure, functions, events, deployment Other platforms: Hyperledger Fabric, Corda, Polkadot, Binance Smart Chain**,** Comparison of blockchain platforms.

Unit - V :

Applications and Future of Blockchain: Blockchain in finance (DeFi), supply chain, healthcare, voting systems, identity management, Tokenization and NFTs (Non-Fungible Tokens), Web3 and decentralized applications (DApps), Blockchain scalability and interoperability challenges, Energy and sustainability issues.
Future trends: CBDCs, Blockchain-as-a-Service (BaaS), Regulatory challenges.

Text Books:

1. Mastering Blockchain by Imran Bashir Publisher : Packt publication
2. Blockchain Applications: A Hands-On Approach by Bahga, Vijay Madisetti
3. *Blockchain Basics* by Daniel Drescher publisher : Apress publication
4.

Reference Books :

1. Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, princton

2. Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu.T Books.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1476-1 **Course : Internet of Things Lab**

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

Course Objectives

This course will help to introduce the terminology, technology and its applications, the concept of M2M (machine to machine) with necessary protocols, the Raspberry PI platform, that is widely used in IoT applications. Students can learn to introduce the implementation of web-based services on IoT devices.

Course Outcomes

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

1. Understand the vision of IoT from the industrial perspective.
2. Study different H/W devices used in IoT.
3. Implement a case study in IoT.

Syllabus

Minimum 8 practicals based on the theory Topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1476-2 **Course: Generative AI and its Applications Lab**

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

Course Objectives

1. To introduce the basic concepts and techniques of generative AI in NLP.
2. To understand encoder and decoder architecture.
3. To identify Large Language Models suitable for natural language generation.

Course Outcomes

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

1. Solve the problems related to the fundamental concepts in Natural Language Processing.
2. Analyse the strengths and weaknesses of various Encoder Decoder Architectures for sequence to sequence problems.
3. Analyse the strengths and weaknesses of various Attention Mechanism for sequence to sequence problems.
4. Implement various Transformer models to efficiently solve real-world problems.

Syllabus

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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1476-3 **Course : Blockchain Technology Lab**

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

Course Objectives

To introduce the fundamentals of Blockchain technology, explore its applications in various domains including cybersecurity, evaluate different Blockchain architectures and implementation strategies, and analyze the role of cryptocurrencies like Bitcoin in the global economy.

Course Outcomes

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

1.Demonstrate the basics of Block chain concepts using modern tools/technologies.

2. Analyze the role of block chain applications in different domains including security.

3. Evaluate the usage of Block chain implementation/features for the given problem.

Minimum 8 practicals and assignments based on the Theory Topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1477-1 **Course : Mobile Application Development Lab**
L: 0 Hrs, P: 2 Hr, Per Week **Total Credits : 1**

Course Objectives

To know about various platforms and tools available for developing mobile applications. It is to realize the differences between the development of conventional applications and mobile applications, and also learn programming skills in Android SDK.

Course Outcomes

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

1. Understand Android O.S & SDK.
2. Work with Android Studio for creating Android applications.
3. Create real life Android applications and deploy them.

Syllabus

Minimum 8 practicals and assignments based on but not limited to the following topics:

- Install Android studio and Environment setup
- Android architecture , component and activity life cycle
- Android Layout / User Interface (UI) design
- Android – Sending Email, SMS; Phone call
- Android SQLite database and content provider
- Android Location API
- Google Maps Android API
- Publishing android application
- Machine Learning based Mobile Application Development

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1477-2 **Course : System Administration Lab**

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

Course Objectives

The System Administration Lab aims to equip students with practical skills in managing and administering operating systems (primarily Linux and Windows). Through hands-on exercises, students will learn user management, process handling, file system operations, networking, system monitoring, and automation using shell scripting. By the end of the course, students will be able to perform fundamental system administration tasks and apply them in real-world IT environments.

Course Outcomes

1. Perform basic system administration tasks, including user and group management, file system operations, and permissions.
2. Monitor and manage system resources using process management and system performance tools.
3. Configure network settings and utilize remote access tools for system connectivity and troubleshooting.
4. Analyze system logs and implement system monitoring techniques for diagnosing issues and ensuring system stability.
5. Develop shell scripts to automate routine administrative tasks, improving efficiency and system maintenance.

Syllabus

Minimum 8 Practical as mentioned below but not limited to:

Practical 1: Introduction to Linux/Windows System Administration

Explore basic system administration tasks, including system boot process, logging in, and understanding system directories.

Practical 2: User and Group Management

Create, modify, and delete users and groups. Set permissions and access control using **chmod, chown, chgrp** commands in Linux or **User Management in Windows**.

Practical 3: File System and Disk Management

Work with file system commands such as **ls, cp, mv, rm, df, du** in Linux. Manage disk partitions and file systems using tools like **fdisk and mkfs**.

Practical 4: Process and Task Management

Monitor and manage system processes using **ps, top, kill, nice, renice** in Linux or **Task Manager and Services** in Windows.

Practical 5: Networking and Remote Access

Configure and check network settings using **ifconfig, ip, netstat, ping**. Set up SSH for remote access in Linux or **Remote Desktop in Windows**.

Practical 6: Package Management and Software Installation

Install, update, and remove software using **apt, yum, or dnf** package managers in Linux, and **Windows PowerShell or Control Panel** in Windows.

Practical 7: System Monitoring and Logs

Analyze system logs using **journalctl, dmesg, and /var/log/** in Linux. Use system monitoring tools like **htop, vmstat, and iostat**.

Practical 8: Basic Shell Scripting for Automation

Write and execute simple shell scripts to automate system administration tasks like backups, user creation, and log analysis.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1477-3 **Course : Game Development Lab**

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

Course Objectives

This course aims to introduce students to the core concepts of game development and programming logic. This course also provides hands-on experience in using game engines and frameworks.

Course Outcomes

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

1. Apply programming skills to develop interactive games using a game engine or library.
2. Design and develop 2D or basic 3D game environments with user interaction.
3. Use gaming tools to integrate graphics, audio, and scripting elements.

Sylllabus

Minimum 8 practicals based on the keys of Game Mechanics.

1. Introduction to Game Development frameworks and Architecture.
2. Use of Game Engine platform and its Interface
3. Setting Up a Scene using Lights, Music, Audio and special effects
4. Importing and using Assets for 2D and 3D Models.
5. Creating menus and interface elements.
6. Giving Life to the Game by applying animations & scripts.
7. Building and Running the Game.
8. Mini Project based on above topics.

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1478 **Course : Project Work**

L: 0 Hrs, P: 12 Hr, 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.

Department of Humanities
RBU (Shri Ramdeobaba College of Engineering and Management)

Syllabus for Semester IV, Master of Computer Applications

Course Code: 24HS02PR1475 **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:

1. Understand and evaluate one's personality type to interact effectively in society and at work.
2. Apply strategies for effective goal setting.
3. Evaluate and apply soft skills enhancement techniques in individual as well as team tasks.
4. Understand and apply the techniques for effective time- management.
5. Understand and apply techniques of stress management in personal as well as professional life.
6. 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

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

(Artificial Intelligence and Machine Learning)

Course Code: 24CS60PR1479 **Course : Technical Seminar**

L:0 Hrs, P: 2 Hr, 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