RAMDEOBABA UNIVERSITY
[RBU]
NAGPUR – 440013

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

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	50	50	100	-
10	OEC	24CS60TH1280	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)	
24CS60TH1280-1	Introduction to Machine Learning
24CS60TH1280-2	Introduction to Natural Language Processing
24CS60TH1280-3	Text Mining Applications

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	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

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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	50	-
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	Supply Chain & CRM fundamentals
24CS60TH1476-3	Blockchain Technology

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

Course Code	Elective Lab-IV
24CS60PR1476-1	Internet of Things Lab
24CS60PR1476-2	Supply Chain & CRM fundamentals Lab
24CS60PR1476-3	Blockchain Technology 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 systemStatistical 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.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: 24CS60TH1280-1 **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

Section -I *(Weightage – 15%, Minimum Teaching Hours -6)*

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

Section-II *(Weightage – 70%, Minimum Teaching Hours -28)*

Decision Tree Learning: Representation, Basic Decision Tree Learning Algorithm
Artificial Neural Network basics - Introduction to artificial neural networks, Linear Perceptron and Multi-Layer Perceptron, Feed Forward Network, Backpropagation
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

Section-III *(Weightage – 15%, Minimum Teaching Hours -6)*

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: 24CS60TH1280-2 **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: 24CS60TH1280-3 **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