ANNEXURE-2

Syllabi
of
M.C.A. III Semester

68242101
Algorithms Design for Computer Applications

OBJECTIVES:

- To demonstrate performance of algorithms with respect to time and space complexity.
- To explain the concepts greedy method and dynamic programming. Applying for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP and so on respectively.
- To Illustrate the methods of backtracking and branch bound techniques to solve the problems like n-queens problem, graph colouring and TSP respectively.
- To familiarize the concepts of deterministic and non-deterministic algorithms.

UNIT-I

Analyzing algorithms Algorithm types, Recurrence Equations, Growth function: Asymptotic notation, Standard notation & common functions, Recurrence relation, different methods of solution of recurrence equations with examples.

UNIT-II

Introduction to Divide and Conquer paradigm, maximum sub-array problem, Quick and merge sorting techniques, the basic divide and conquer algorithm for matrix multiplication Strassen Multiplication.

UNIT-III

Greedy Algorithm, General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm, Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Knapsack Problem, Job Scheduling Problem, Huffman code.

UNIT-IV

Introduction to Dynamic Programming, General method, applications - optimal binary search trees, All pairs shortest path problem, Matrix chain multiplication, Traveling salesman Problem, longest Common sequence, 0/1 knapsack.

Introduction to Backtracking and Branch and Bound, The Eight queens' problem, Knapsack problem, Travelling Salesman problem, Minimax principle.

UNIT-V

The class P and NP, Polynomial reduction, NP- Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem, Cooks Theorem.

List of textbooks /references

1. Introduction to Algorithms (Eastern Economy Edition) by Thomas H Cormen and Charles E Leiserson.
2. Design and Analysis of Algorithms by S Sridhar.
3. Design and Analysis of Computer Algorithms by AHO.

Course Outcomes:

Students would be able to

CO1: **Design** various Time and Space complexities of various algorithms. (BL 6)

CO2: **Apply** different methods to solve real-time problems. (BL3)

CO3: **Evaluate** different complexities of various methods for real-world problems. (BL 5)

CO4: **Assess** some Backtracking, Dynamic Programming, Branch and Bound concept for societal needs. (BL 5)

CO5: **Analyze** of non-deterministic algorithms on real-world problems. (BL4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1
CO1	3	3	3	2	2	3	3	3	3	2	3
CO2	3	3	2		2	2	2	2	3		3
CO3		3		2		2	3		2	2	
CO4	2	2	2	2		3	2	2	3	3	2
CO5	2	2		2	2	2		2	3		2

68242102
Artificial Intelligence and Machine Learning

UNIT-I
An Overview of AI:
Definitions, Foundations of AI: Philosophy, Mathematics, Psychology, Computer Engineering, linguistics, History of AI, Applications of AI, AI Production system and Intelligent Agents.

UNIT-II
AI Search and Control Strategies:
Exploring alternatives: Finding a path: Depth first search, hill climbing, breadth first search, beam search, best first search; Finding the best Path: The British Museum search, Branch and Bound Search, A* Search, AO* Search; Game Playing: Minmax search, Alpha-beta pruning, Progressive deepening, Heuristic Pruning.

UNIT-III
Knowledge Representations:
First order predicate calculus, Clause form representation of WFFs, resolution principle & unification, inference mechanism, semantic networks, frame systems and value inheritance, scripts, conceptual dependency.

UNIT-IV
Expert systems and Soft Computing:
Introduction and applications of expert systems, Rule-based System Architecture, Non-production system architecture, Expert system shells, Introduction to Some of the AI Techniques like Fuzzy sets and Fuzzy logic, neural networks, genetic algorithms and pattern recognition.

UNIT-V
Machine Learning:
Definition and importance of ML, Differences between AI, ML, and DL, Types of learning: Supervised, Unsupervised and Reinforcement, Applications of Machine Learning, Features, Labels, and Datasets, Training vs. Testing Data, Overfitting and Under-fitting, Model Evaluation: Accuracy, Precision, Recall, F1 Score.

Books:
1. Introduction to AI and Expert Systems: D.W. Patterson PHI.
2. Artificial Intelligence: P.H. Winston, Addison Wesley.
3. Principles of AI: N.J. Nilsson, Springer-Verlag
4. Artificial Intelligence: A Modern Approach: Stuart Russell and Peter Norvig, Pearson Education

Course Outcomes:

CO1: **Develop** the knowledge of the building blocks of AI, evolution and production system
CO2: **Analyze** and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3: **Design** the schemes for representing real world knowledge using sematic nets and predicate calculus.
CO4: **Attain** the capability of developing expert systems and logical reasoning using sift computing techniques.
CO5: **Formulate** and understand the problem of machine learning, datasets and model evaluation.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1
CO1	2			2		3		3	2	3	2
CO2	3	2	3	1			3		2	2	3
CO3	3	3	2	2	1	2		2	3	2	3
CO4		3	3			3		3		1	
CO5	2	3		3				3	2	3	2

68242109

Full Stack

OBJECTIVES:

- Understand best technologies for solving web client/server problems
- Analyze and design real time web applications
- Use Java script for dynamic effects and to validate form input entry
- Analyze to Use appropriate client-side or Server-side applications

UNIT I

HTML & CSS: Browsers and HTML, Tags, Attribute and Elements, Doctype Element, Comments, Headings, Paragraphs, and Formatting Text, Lists and Links, Images and Tables, Applying CSS to HTML, Selectors, Properties and Values, CSS Colors and Backgrounds, CSS Margins, Padding, and Borders, CSS Text and Font Properties

UNIT II

Javascript: Applying JavaScript Syntax, Introduction to Document and Window Object, Variables and Operators, Data Types and Type Conversion, Math and String Manipulation, Objects and Arrays, Conditional Statements, Looping in JS, Components, State and Props, Lifecycle of Components, Error Handling, Routers, Service Side Rendering. Unit Testing

UNIT III

NodeJS: Node js Overview, Node js - Basics and Setup, Node js Console, Node js Command Utilities, Node js Modules, Node js Concepts, Node js Events, Node js Database Access

UNIT IV

MongoDB: SQL and NoSql Concepts, Create and Manage MongoDB, Migration of Data into MongoDB, MongoDB with PHP, MongoDB with NodeJS, Services Offered by MongoDB

UNIT V

Web development: Collaborative project work, Building full-stack web applications, Integrating Front-end and Back-end, Bootstrap Basics - Bootstrap Themes, Bootstrap CSS, Bootstrap JS, Data - insert, delete, update.

Books :

1. Web Development with Node and Express, Ethan Brown, Oreilly
2. Web programming with HTML, XHTML and CSS, 2e, Jon Duckett, Wiley India
3. An Introduction to Web Design + Programming, Paul S.Wang, India Edition

Course Outcomes:

Student would be able to

CO1: **Evaluate** web application architecture, technologies, services and frameworks.

CO2: Integrate javascript, server side scripting languages to develop web applications.

CO3: Apply the knowledge of web technology in developing web applications.

CO4: Implement small to large scale projects to provide live solutions in web application development fields.

CO5: Evaluate different solutions in the field of web application development.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1
CO1	3		1								2
CO2	2		3	2			2	2			2
CO3	2	2	3	3			2	2		2	3
CO4	3	2	3	3	2	3	2	2	3	2	3
CO5	3	2	3	2	3	2	2	2	3	2	3

68242110

Data Analytics and Visualization

OBJECTIVES:

1. To introduce the foundational concepts of data analytics and various programming languages used in the data analytics process
2. To develop the ability to identify and clean dirty data using string operations for preparing accurate and reliable datasets.
3. To develop skills in exploratory data analysis and data visualization using Python, Power BI, and Tableau
4. To analyze data, extract features, and evaluate models effectively.
5. To provide a model evaluation for solving real-world data analytics problems.

UNIT-I

Introduction: What is Data Analytics, Types of Analytics (Descriptive, Diagnostic, Predictive, Prescriptive), Analytics in the Real World (Business, Healthcare, Finance, etc.).
The Data Analytics Road Map: Frame the problem, Understand the Data, Data wrangling overview, Feature Understanding & Extraction, Interpreting Results & Drawing Insights, Communicating Findings.

UNIT-II

Programming Languages and Python Essentials: Available Programming Languages (Python, R, Scala etc) and why python, Python Libraries for Analytics (NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn), Data Structures for Analysis (DataFrames, Series, Grouping, Joining), Working with External Data - Reading CSV, JSON and Web APIs, Python Ecosystem and Resources.

UNIT-III

Overview of Data Munging: Recognizing Dirty Data, Key Data Content Problems (Duplicate Entries, Missing or Null Values, Outliers, Outdated Records etc), Common Formatting Issues,
Exploratory Data Analysis (EDA): Purpose and mindset of EDA, Strategies (Looking for Distributions, Outliers and biases, Correlations and grouping behaviour, Checking assumptions for modelling), Creating derived metrics/features, EDA as hypothesis generator, Hands-on: summary statistics, slicing, grouping in Pandas.

UNIT-IV

Visualizations and Simple Metrics (Python): Tool (Matplotlib & Seaborn), Pie, Bar, Histogram, Boxplot, Scatterplots, Log Scales, Scatter Matrices, Heatmaps, Time Series Plots, Correlation Plots, Choosing the Right Visual tool for the Data.
Power BI: Interface, data import, modeling with DAX, visualizations, dashboards, and publishing.
Tableau: Interface, data connection, visualizations, filters, dashboards, and sharing.

UNIT-V

Natural Language Processing: Software and Datasets, Tokenization, Word Weighting: TF-IDF, Stop Words, Lemmatization and Stemming, Part of Speech Tagging, Common Problems, Search Sentiment Analysis, Entity Recognition and Topic Modelling.

Case Study: Sentiment Analysis on Stock Market Articles

Books:

1. Field Cady: The Data Science Handbook;
2. Wes MCKinney: Python for Data Analysis
3. Foster Provost and Tom Fawcett: Data Science for Business
4. Hadley Wickham: R for Data Science
5. Nathan Yau: Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics
6. Alberto Ferrari & Marco Russo: Introducing Microsoft Power BI
7. Joshua N. Milligan: Learning Tableau 2022

Outcomes:

Student would be able to:

CO1: Analyse the concepts of data analytics, types of analytics, and the structured analytics process followed in real-world applications.
CO2: Assess suitable programming languages and its libraries for data manipulation analytics and visualization.
CO3: Evaluate the data cleaning techniques and pre-processing tasks to prepare datasets for analysis.
CO4: Create effective data visualizations using Python, Power BI, and Tableau**.**
CO5: Apply NLP for visualization and Analytics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1
CO1	3		1	2	1	2	1	2		3	3
CO2	3						2		2	3	3
CO3		2			1			1	2	3	2
CO4	2		3	2		1				3	1
CO5		2		2	1		1		2	3	1

68242111

Algorithms Design for Computer Applications Lab

Programming of linear and linked data structures – Arrays, Stacks, Queues, Linked List

Divide and Conquer Method – Implementations of various searching/sorting algorithms- Quick sort, Merge sort, Heaps Priority queues, Heap sort, linear time sorting, Linear Search, Binary search trees etc.

Greedy algorithms – Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm)

Dynamic Programming (DP) based algorithms – All pairs shortest path problem, Matrix chain multiplication.

Course Outcome:

Students would be able to

CO1 **Implement** searching and sorting algorithm.
CO2 **Build** different programming approaches.
CO3 **Develop** solutions for real-world problems.
CO4 **Implement** dynamic programming-based solutions.

Experiment List-

1.Implementation and Time analysis of sorting algorithms- Bubble sort, Selection sort, Insertion sort, Merge sort and Quicksort
2. Implementation and Time analysis of linear and binary search algorithm.
3. Implementation of max-heap sort algorithm
4. Implementation and Time analysis of factorial program using iterative and recursive method
5. Implementation of a knapsack problem using dynamic programming.
6. Implementation of chain matrix multiplication using dynamic programming.
7. Implementation of making a change problem using dynamic programming
8. Implementation of a knapsack problem using greedy algorithm
9. Implementation of Graph and Searching (DFS and BFS).
10. Implement prim's algorithm
11. Implement kruskal's algorithm.
12. Implement LCS problem.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1
CO1	3	3	3		3				2	3	3
CO2	3	3	3	2	3				3	2	3
CO3	3	3	3	3	3	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	3

Recommended in the Board of Studies Meeting of department of Computer Science and Engineering held on 09-06-2025

68242112

Artificial Intelligence and Machine Learning Lab

Objectives

- Implement fundamental AI and ML algorithms using Python.
- Develop problem-solving skills through practical applications of AI and ML techniques.
- Evaluate and interpret the performance of various AI and ML models.

Lab Experiments and Sample Problems

Below is a list of lab experiments along with sample problems to be addressed:

1. Python Basics for AI and ML

- **Objective:** Familiarize with Python programming essentials.
- **Sample Problems:**
  - Write a Python program to perform matrix operations using NumPy.
  - Implement data manipulation tasks using Pandas.

2. Search Algorithms

- **Objective:** Implement search strategies for problem-solving.
- **Sample Problems:**
  - Develop a program to solve the 8-puzzle problem using BFS and DFS.
  - Implement the A* algorithm for pathfinding in a maze.

4. Supervised Learning Algorithms

- **Objective:** Apply supervised learning techniques for classification and regression.
- **Sample Problems:**
  - Implement linear regression to predict housing prices.
  - Use decision trees to classify iris flower species.

5. Unsupervised Learning Algorithms

- **Objective:** Explore clustering and dimensionality reduction techniques.
- **Sample Problems:**
  - Apply k-means clustering to group customers based on purchasing behavior.
  - Use PCA for dimensionality reduction on a high-dimensional dataset.

6. Neural Networks and Deep Learning

- **Objective:** Understand and implement basic neural network models.
- **Sample Problems:**
  - Build a simple feedforward neural network for digit recognition using the MNIST dataset.
  - Implement a convolutional neural network (CNN) for image classification.

7. Model Evaluation and Validation

- **Objective:** Assess the performance of AI and ML models.
- **Sample Problems:**
  - Calculate accuracy, precision, recall, and F1-score for a classification model.
  - Perform k-fold cross-validation to evaluate model robustness.

8. Real-world Project

- **Objective:** Develop a comprehensive AI/ML application.
- **Sample Problems:**
  - Create a sentiment analysis tool for social media posts.
  - Develop a recommendation system for an e-commerce platform.

Textbooks:

- **Artificial Intelligence: A Modern Approach** by Stuart Russell and Peter Norvig
- **Machine Learning** by Tom M. Mitchell
- **Python Machine Learning** by Sebastian Raschka and Vahid Mirjalili
- **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow** by Aurélien Géron

Tools and Technologies

- **Programming Language:** Python
- **Libraries:** NumPy, Pandas, scikit-learn, Matplotlib, TensorFlow/Keras
- **Development Environment:** Jupyter Notebook, Google Colab

Course Outcomes

Upon successful completion of this lab course, students will be able to:
CO1: **Apply** AI search algorithms (uninformed, informed, heuristic) to solve problems.
CO2: **Implement** supervised and unsupervised machine learning algorithms.
CO3: **Utilize** Python libraries such as NumPy, Pandas, scikit-learn, and Matplotlib for data analysis and visualization.
CO4: **Develop** AI and ML solutions for real-world problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1
CO1	3	2	1	1						2	2
CO2	3	2	3	1			3		2	2	3
CO3	3	3	2	2	1		2			2	3
CO4	2	3	1	3					2	3	2

68242113
Capstone Project

Course outcomes:

Student would be able to

CO1: Organize, summarize and interpret technical literature with the purpose of formulating a project proposal.
CO2: Write a technical report summarizing state-of-the-art on an identified topic.
CO3: Apply SDLC, modern tools and technologies.
CO4: Recognize the professional ethics and team management principles.

Sample List of Projects

1. Design Whiteboard Collaboration Platform
2. Development of Online Employee Leave Management System
3. Design Canteen Management System
4. Design Online Donation Management System
5. Development of Car Rental System
6. Development of Vaccination Management System
7. Development of Student Attendance System
8. Design & Develop Android Chatbot for counselling of Farmers in Native language
9. Development of Online Hospital Management System
10. Development of Book exchange and acquisition system
11. Design of Donation Assistant
12. Development of Dress Rental Management System
13. Design Employee Performance Analysis
14. Designing of Green coins - Web App
15. Development of Online Complaint Registration and Management System
16. Development of Crime reporting and online complaint, FIR system
17. Design Missing Person Reporting System
18. Design Animal Healthcare System
19. Design a Customer Churn prediction model using Machine learning
20. Designing of Community based Lost and Found Portal
21. Development of Banking System
22. Development of Parking Management System
23. Design and development of Car Wash Management System
24. Development of Admission Portal
25. Design Garbage Management System
26. Development of GYM Management System
27. Development of Goods Transport Management System
28. Development of Library Management System
29. Development of School Management System

30. Development of Credit Card fraud detection system
31. Design Student Grade System
32. Design of Tour and Travel Management System
33. Development of Onroad breakdown assistant finder
34. Design Doorstep Delight Services System
35. Development of Hostel Management System
36. Development of Event Management System
37. Development of Rental Management System
38. EZYSTOCK: Stock Analysis Tool
39. Edubridge: A learning portal Tutor finder website
40. Development of Blood Bank Management System

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1
CO1	3	2	2	3	3	3	2	3	3	2	3
CO2	2	1	3	2	2	2	2	3	2	3	3
CO3	2	2	3	3	2	2	2	2	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3