GANPAT UNIVERSITY

FACULTY OF COMPUTER APPLICATIONS

Programme	Master of Computer Applications	**Branch/ Spec.**	Computer Application
Semester	III	**Version**	1.0.0.0
Effective from Academic Year	2024-25	**Effective for the batch Admitted in**	June 2024
Subject Code	P13A4DAA	**Subject Name**	Design and Analysis of Algorithms

Teaching scheme						**Examination scheme (Marks)**			
(Per week)	**Lecture (DT)**		**Practical (Lab.)**		**Total**		**CE**	**SEE**	**Total**
	L	TU	P	TW					
Credit	2	0	2	0	4	Theory	40	60	100
Hours	2	0	4	0	6	Practical	20	30	50

Objective:

- The objective of the course is to introduce students to the design of computer algorithms and analysis of sophisticated algorithms.
- Analyze the asymptotic performance of algorithms, apply important algorithmic design paradigms and methods of analysis.
- To develop proficiency in problem solving and programming and to carry out the Analysis of various Algorithms for mainly Time and Space Complexity.
- Develop and implement learned/new algorithm using appropriate techniques to solve problems.

Pre-requisites:

- Basic of Programming Language such as C, C++, Python, Java and Data Structure.

Course Outcomes :

- **1 = Slight (Low); 2 = Moderate (Medium); 3 = Substantial (High), "-" = no correlation.**

Name of CO	**Description**

CO1	Explain and analyze algorithmic concepts, design techniques, and asymptotic notations to evaluate algorithm efficiency.
CO2	Design and analyze algorithms using divide-and-conquer and greedy strategies for sorting, searching, and optimization problems.
CO3	Apply and analyze greedy algorithms to solve minimum spanning tree and shortest path problems.
CO4	Develop and analyze efficient solutions using dynamic programming, backtracking, and branch-and-bound techniques.

Mapping of CO and PO

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	1	2	–	–	–	2
CO2	3	3	2	2	–	–	–	2
CO3	3	3	2	2	–	–	–	2
CO4	3	3	3	2	–	–	–	3

Content:

Unit	SECTION-I	Hrs
1	**Introduction:** Algorithms, Algorithms as a technology, Analyzing algorithms, Designing algorithms, Asymptotic notation, Standard notations and common functions.	5
2	**Divide-and-Conquer Algorithm:** Introduction, Problem Solving using divide and conquer algorithm - Binary Search, quick sort, Merge sort, Max-Min problem, The maximum-subarray problem, Strassen's algorithm for matrix multiplication, Analysis of divide and conquer run time recurrence relations. **Greedy Algorithms and Amortized Analysis:** General Characteristics of greedy algorithms, An activity-selection problem, Elements of the greedy strategy and Huffman codes.	11
	SECTION-II	
3	**Greedy Algorithms and Amortized Analysis: Minimum Spanning Trees and Single-Source Shortest Paths:** Growing a minimum spanning tree, The algorithms of Kruskal and Prim, The Bellman-Ford algorithm, Single-source shortest paths in directed acyclic graphs, Dijkstra's algorithm.	7
4	**Dynamic Programming:** Introduction, difference between dynamic programming and divide and conquer, Principle of Optimality, Knapsack problem , Rod cutting, Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence, Optimal binary search trees. **Backtracking & Branch and Bound:** Basic Idea, 8 Queens Problem, Graph Coloring, Hamiltonian cycle and Knapsack problem.	9

Practical Content:

- List of programs specified by the subject teacher based on above mentioned topics.

Text Books:

1	T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein. *Introduction to Algorithms*, 3rd edition, MIT Press, 2009
2	Introduction to Algorithms, 2nd Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, PHI.

Reference Books:

1	A. V. Aho, J E Hopcroft, J D Ullman, "Design and Analysis of Algorithms", Addison-Wesley Publishing 1974.

2	Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press (2008).
3	Parag Dave & Himanshu Dave, "Design and Analysis of Algorithms", Pearson Education (1 January 2007).
4	Michel Goodrich, Roberto Tamassia, "Algorithm design-foundation, analysis & internet examples", Wiley; 1st edition (1 January 2006).
MOOC/Certification Courses:	
1	https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2	https://www.edx.org/course/algorithms-design-and-analysis-part-2-2?index=product_value_experiment_a&queryID=91ac76d136f71e38181f80824420769b&position=3
3	https://www.vlab.co.in/
4.	https://nptel.ac.in/courses/106106131

Question Paper Scheme:

University Examination Duration: 3 Hours

Note for Examiner: -

(I) Questions 1 and 4 are compulsory with no options.

(II) Internal options should be given in questions 2, 3, 5 and 6.

SECTION – I

Q.1 –8 Marks

Q.2 –11 Marks

Q.3 –11 Marks

SECTION - II

Q.4 –8 Marks

Q.5 –11 Marks

Q.6 –11 Marks