SEMESTER 4

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
COM-401	Design and Analysis of Algorithms	PCC	4	3	1	0	50	100	150*

Course Outcomes:

	At the end of the course the student will be able to
CO1	Write algorithms in terms of their composite steps and transformations.
CO2	Analyze time and space complexity of any given algorithm.
CO3	Demonstrate various algorithm design techniques.
CO4	Evaluate P, NP and NP-Complete algorithms and their characteristics.
CO5	Apply algorithms in devising optimal solutions to given problems in diverse domains.

Detailed Syllabus
Section-A

Unit 1: Introduction: What is an Algorithm, Algorithm Specification, Designing and Analysis Framework, Performance Analysis- Space complexity, Time complexity. Growth of Function and Asymptotic Notations- Big-Oh notation (O), Omega notation (), Theta notation (Θ), and Little-oh notation (o), Little-Omega notation (), Recursive Algorithms and Relations- Recurrence relations, substitution method, recurrence trees, master's theorem. **(12 Hrs.)**

Unit 2: Divide and Conquer- General method, Advantages and Disadvantages, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum, Merge sort, Quick sort and its analysis, Stassen's matrix multiplication, fast multiplication of large integers. **(8 Hrs.)**

Unit 3: Greedy Method- General Method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees- Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths- Dijkstra's Algorithm. Optimal Tree problem- Huffman Trees and Codes. Transform and Conquer Approach- Heaps and Heap Sort. **(12 Hrs.)**

Section-B

Unit 4: Dynamic Programming- General Method with Examples, Multistage Graphs. Transitive Closure- Warshall's Algorithm, All Pairs Shortest Paths- Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem, Reliability design. **(12 Hrs.)**

Unit 5: Backtracking- General method, N-Queens problem, Sum of subsets problem, Graph colouring, Hamiltonian cycles. Branch and Bound- Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem, FIFO Branch and Bound solution. NP-Complete and NP-Hard problems- Basic concepts, nondeterministic algorithms, P, NP, NP-Complete, and NP-Hard classes. **(12 Hrs.)**

Text Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Algorithms	T.Cormen, C. Lieserson, R.Rivest, C.Stein	Prentice-Hall/India	4th (2022)
2	Algorithms / Fundamentals of Computer Algorithms	S. Dasgupta, C. Papadimitriou, Umesh Vazirani / Sartaj sahni and Sanguthevar Rajasekaran Ellis Horowitz	McGraw Hill Education / University Press	2nd (2017)

Reference Book

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Algorithms Design: Foundations, Analysis, and Internet Examples	Michael T. Goodrich, Roberto Tamassia	Wiley	1st (2006)
2	The Algorithm Design Manual	Steven S Skiena	Springer	2nd (2008)