SEMESTER	1
Paper Number	MCMS 4111
Paper Title	Design and Analysis of Algorithms
No. of credits	6
Theory / Composite	Composite
No. of periods assigned	Th: 4 Pr: 4
Name of faculty member(s)	
Course description / objectives	On completion of this course, the students will be able to: 1. understand techniques to design algorithms like divide and conquer, greedy algorithms, dynamic programming, branch and bound etc. 2. analyse the strengths and weaknesses of each technique whereby identifying their application areas. 3. derive mathematical expressions to define the time complexities of various classes of algorithms. 4. understand the various advanced algorithms relating to trees and graphs and apply them to various applications. 5. appreciate the theory and applications of P and NP class of problems.
Syllabus	**Theory - 60 marks** Review of basic algorithmic analysis: Asymptotic analysis of upper and average complexity bounds; best, average, and worst-case behaviours; big-Oh, big-Omega and big-Theta; standard complexity classes; empirical measurements of performance; time and space trade-offs in algorithms; recurrence relations Divide and Conquer: Merge Sort. Quick Sort, Selection Problem, Median and Order Statistics, Strassen's Matrix Multiplication, Convex Hull Algorithms. Greedy Algorithm: Knapsack algorithm, Huffman Codes, Task Scheduling Dynamic Programming: Chained matrix multiplication Backtracking Algorithms: 8 queens' problem Branch and Bound: Travelling Salesperson problem. Graph and Tree Algorithms: BFS, DFS, Topological Sort, Minimum Spanning Tree (Prim's and Kruskal's Algorithm), Dijkstra's Algorithm, Bellman Ford Algorithm, Bipartite Graphs, Binary Search Tree, AVL tree, 2-3 Tree, Red Black Tree, Binomial Heaps. Complexity Theory: Tractable and intractable problems, Concepts of computable functions; Polynomial reducibility: P and NP: Definition of the classes P and NP, NP-completeness (Cook's theorem), Standard NP complete problems. **Lab - 40 marks**
Reading/Reference Lists	1. T. H. Cormen et al -Introduction to Algorithms , PHI 2. E. Horowitz, S. Sahani - Fundamentals of Computer Algorithms – Galgotia 3. Bratley et al - Fundamentals of Algorithms-PHI
Evaluation	Total – 100 (Theory – 60, Practical – 40) Theory – CIA – 10 Semester Examination – 50