RK UNIVERSITY

SYLLABUS

Course Title	*Advanced Algorithms*	
Course Code	**CP103**	
Course Credit	Lecture	: 04
	Practical	: 01
	Tutorial	: 00
	Total	: 05

Course Objective

At the end of the course, students will be able to:

- **Demonstrate** a familiarity with major algorithms and data structures.
- **Apply** important algorithmic design paradigms and methods of analysis.
- **Analyze** the asymptotic performance of algorithms.
- **Understand and design** algorithms using greedy strategy, divide and conquer approach, dynamic programming, and max flow - min cut theory.
- **Synthesize** efficient algorithms in common engineering design situations
- **Understand** basic knowledge of graph and matching algorithms.
- **Analyze** lower-bounds and the theory of NP-completeness

Detailed Syllabus

Sr. No.	Name of chapter &details	Hours Allotted
	SECTION-I	
1	**Pre-requisite of Data Structure & Analysis of Algorithms:** Overview of Data Structures, Space & Time Complexity, Asymptotic Notations (Growth of Functions), Average and worst case analysis, Elementary operation, Analyzing control statement, Amortized analysis, Sorting Algorithms, Binary Tree Search.	**8**
2	**Recurrences** Intelligent guesswork, Homogeneous recurrences,Inhomogeneous recurrences, Change of variable, Range transformations, Recurrence tree	**10**

3	**Divide & Conquer** Overview of divide and conquer technique, Multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Sorting (Merge Sort, Quick Sort), Matrix Multiplication, Exponential.	**10**
	SECTION-II	
4	**Dynamic Programming** Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming Calculating the Binomial Coefficient, Making Change Problem, Assembly Line-Scheduling, Knapsack problem, Shortest path, Matrix chain multiplication, Longest Common Subsequence.	**6**
5	**Greedy Algorithms** 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), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem.	**5**
6	**Introduction to Graph and Graph Algorithms** Introduction, Storage Representation for Undirected Graph & Directed Graph, Traversing Techniques – DFS & BFS,Backtracking: The Eight queens problem, General Template.	**6**
7	**Introduction to NP-Completeness** The class P and NP, Polynomial reduction, NP- Completeness Problem, NP-Hard Problems.	**3**
8	**External-Memory Algorithms** Accounting for the Cost of Accessing Data from Slow Memory, Buffer Trees,Cache-oblivious Algorithms for Matrix Multiplication. **Computational Geometry** Convex Hull, Line-segment Intersection, Sweep Lines, Voronoi Diagrams, Range Trees, Seidel's Low-dimensional LP Algorithm.	**8**

Instructional Method and Pedagogy

- Lectures will be conducted with the aid of multi-media projector, blackboard, OHP etc.
- Assignments based on course contents will be given to the students at the end of each unit/topic and will be evaluated at regular interval.

Reference Books
• Thomas Coremen, Introduction to ALGORITHMS, PHI, 3rd Edition • Gilles Brassard & Paul Bratley,Fundamental of Computer Algorithmics, PHI • Aho, Hopcroft and Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley • Computer Algorithms, Ellis Horowitz , SartajSahni , SanguthevarRajasekaran,
Additional Resources
▪ NPTEL Lecture Series on Data structure and Algorithm in Computer Science and Engineering, By Naveen Garg, IIT Delhi.