

B. TECH. SEMESTER – V (CE)

SUBJECT: ADVANCED ALGORITHMS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Pract.	Total
4	0	2	6	5.0	60	40	25	25	150

A. COURSE OBJECTIVE

The subject focuses on Advancement in Algorithms along with its applicability and time complexity. It discusses pattern searching algorithms. Geometric algorithms highlight how to find convex Hull from the set of points in the 2-D plane and how to check intersection of two line segments in air-line traffic control. It elaborates the importance of Approximate algorithms for industry problems where exact solution is not possible. Objective of Theory of reduction is to use the solution of one problem for another problem.

B. DETAILED SYLLABUS

[1] **RANDOMIZED ALGORITHM**

Probability and random variables, Probabilistic analysis, Randomized algorithms, Monte Carlo Algorithm, Las Vegas Algorithm, Primality Testing algorithms.

[2] **FLOW NETWORK**

Max Flow Problem, Max Flow - Min Cut duality, Ford Fulkerson Algorithm, Various algorithms to solve Max-Flow problem, Applications of Network Flow problems.

[3] **STRING ALGORITHMS**

Naive String Matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm

[4] **COMPUTATIONAL GEOMETRY**

Line-Segment properties, Determine intersection between line segments, Finding Convex Hull, Finding Closest pair of points.

[5] **REDUCTION**

Theory of reduction, Linear time reduction, Polynomial time reduction, Identifying lower bound using reduction

[6] **NP-HARD AND NP-COMPLETE PROBLEMS**

Unsolvable problem classes, NP-Hard Problems, Proving a problem NP-Hard, NP-Complete Problems, NP-Completeness proof

[7] **LINEAR PROGRAMMING :**

Standard and slack form, Formulating problem as linear programs, The simplex algorithm, Duality, basic feasible solutions.

[8] APPROXIMATION ALGORITHM

Approximation technique to solve hard problems, randomization and linear programming based approximation, Polynomial time approximation

C. RECOMMENDED TEXT / REFERENCE BOOKS

- 1) Introduction to Algorithms, Thomas H. Corman, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, Third addition, PHI Learning private ltd.
- 2) Fundamentals of computer algorithms, Second Edition, Ellis Horowitz, Sartaj Sahni, S. Rajasekaran, Universities Press
- 3) Fundamentals of Algorithmics, Gilles Brassard, Paul Bratley, PHI Learning private ltd
- 4) Algorithm Design, Pearson/Addison-Wesley, Jon Kleinberg, Eva Tardos, Addison-Wesley

D. COURSE OUTCOME

1. The algorithms can be used and interpreted in various ways and will help the students to expand the horizons of their mind.
2. Students can do performance comparisons of various algorithms for the same problem
3. Mathematical model formulation of the industry problem
4. Students can think in the direction of an approximate solution when an exact solution is not possible to achieve.