Course Title: Approximation Algorithms

Credit Structure (L-T-P-Cr): (3-0-0-3)

Course Code: SC469

Prerequisites (if any)/desired skill set: Data Structures, Design and Analysis of Algorithms

Course objective: This course aims to provide a brief introduction to advanced algorithm design and analysis techniques including greedy algorithms, dynamic programming, amortized analysis, and randomization. It also provides an introduction to the complexity theory and NP-harness theory. It provides a rigorous introduction to approximation algorithms for some of the basic and advanced well-studied problems like shortest path, spanning trees, steiner trees, set cover, vertex cover, TSP, shortest super string, matching, network flows, resource allocation, load balancing, network design, and routing, knapsack, bin packing, and many more.

Course content:

The course starts with a brief overviews of the graph theory, algorithm design and analysis techniques like dynamic programming, greedy algorithms and amortized analysis and theory of NP-completeness. The next and the most important content of the course includes both exact and approximation algorithms for well-studied and important problems like shortest paths, spanning and steiner trees, set cover, vertex cover, TSP, shortest super string, matching, network flows, facility location, bin packing, knapsack, resource allocation, and many other.

Course Outcome:

When an algorithmic problem is encountered, the student should be able to analyze it and figure whether it is NP-complete or polynomial time solvable. In case of NP-complete problems, they should be able to address it solution by the various known methods including heuristics approximation, restriction to special cases among others. The students should also be well versed in standard hard problems, ways to approximate them and limits of approximability.

Suggested textbook/references:

2. The Design of Approximation Algorithms by David P. Williamson and David Shmoys
3. Introduction to Algorithms by Cormen, Leiserson, Rivest and Stein