| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DC | **NMCC509** | Advanced Data Structures and Algorithms | 3 | 1 | 0 | 4 |

| **Course Objective** |
|---|
| • The objective of the course is to present the advanced data structures and algorithms in practice. |
| **Learning Outcomes** |
| Upon successful completion of this course, students will:<br>• have the practical implementation of algorithms using efficient data structures.<br>• be capable of analyzing, design and implementing advanced algorithms<br>• be exposed to the various methods of designing techniques |

| Unit No. | Topics to be Covered | Contact Hours | Learning Outcome |
|---|---|---|---|
| 1 | Review of Basic Concepts, Asymptotic Analysis of Recurrences. | **5L+2T** | Understanding of asymptotic notations and basic mathematical preliminaries used in analyzing algorithms. |
| 2 | Randomized Algorithms. Randomized Quicksort, Analysis of Hashing algorithms. Algorithm Analysis Techniques - Amortized Analysis. Application to Splay Trees. | **6L+2T** | This unit will help the students in understanding the randomized algorithms and amortized analysis of running time. |
| 3 | External Memory ADT - B-Trees. Priority Queues and Their Extensions: Binomial heaps, Fibonacci heaps, applications to Shortest Path Algorithms. | **6L+2T** | This will help in understanding the concepts and use of B-trees and various heaps. |
| 4 | Partition ADT: Weighted union,path compression, Applications to MST. | **5L+2T** | Understanding of union and path data structures and their applications to MST. |
| 5 | Algorithm Analysis and Design Techniques. Dynamic Programming-Bellman-Ford, Greedy Algorithms. | **6L+2T** | To understand different algorithm designing techniques. |
| 6 | Network Flows-Max flow, min-cut theorem, Ford-Fulkerson, Edmonds-Karpalgorithm, Bipartite Matching. | **6L+2T** | This will help students in knowing the concepts of network flows and their use in designing various graph algorithms. |
| 7 | NP-Completeness and Reductions, Cook's theorem, Satisfiability, | **4L+1T** | To know the concept of NP-completeness. |
| 8 | Beyond NP-completeness, Introduction to different algorithms paradigms | **4L+1T** | Help the students in understanding what can be done beyond NP-completeness. |
| **Total** | | **42L+14T** | |

Text Books:

1.T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein: Introduction to algorithms, PHI, 3rd Edition, 2010.

**Reference Books:**

1. A. V. Aho, J. E. Hopcroft, J. D. Ullman, Data Structures and Algorithms, Addison-Wesley, 1st Edition, 1982
2. J. Kleinberg, E. Tardos, Algorithm Design, Addison-Wesley, 1st Edition, 2005