LNMIIT Course Information Form

Course Number: Title of the course: Advanced Data Structures and Algorithms

A. **Course Category: Program Elective for UG 4th and Core for PG**
B. **If CORE, which stream(s): PG 1st year CSE**
C. **If Program Elective, which stream(s): Computer Science & Engineering**
D. **Target Audience (Year and Branch): B. Tech 4th Year, PG, Ph.D**
E. **Besides UG 4th year, can PG Students be permitted to register? Yes**
F. **Pre-requisites (Subject Name and Code): Data Structures & Algorithms, Discrete Mathematics**
G. **Total contact hours: Lectures 40**
H. **Total number of credits: 4**
I. **Objectives and/or special features of the course (~100 words):**

Computer Programs constitute the basic building block in the gamut of Information Technology and it comprises of Data Structures and Algorithms. Data Structures enrich the representation of Information and Algorithms offer automatable logic to solve business or scientific or social problems. Designing efficient algorithms to problems is the essential skill needed by a computer professional to be competent. Efficient algorithms require very appropriate data-structures. Thus, there is a need to study a variety of data-structures and their usage in efficient algorithms. This course takes off from the background study of elementary Data Structures and Algorithms and introduces some advance Data Structures and Algorithms or their application in newer problems. The objective of this course is to strengthen the foundation of PG students and give opportunity to UG students to further sharpen their skills in Data Structures and Algorithms design.

J. **Course Outcome**

After the Completion of the course: The students will be able to do the following:

CO1: Analyze the complexity of algorithms with asymptotic notations.

CO2: Describe and explain important data structures and algorithms.

CO3: Apply important algorithmic design paradigms to relevant problems.

CO4: Synthesize efficient algorithms in common engineering design situations.

K. **Proposed Curriculum (Separated into 4-5 (not more than that) units each corresponding to approximately 10 contact hours):**

UNIT I: Review of elementary data structures and algorithm complexity analysis. Search Trees – BST, AVL Tree, 2-3 trees, Red-black trees, Skip lists, Heaps: binary, binomial and Fibonacci heaps. Data structures for maintaining disjoint sets with applications.

UNIT II: Divide and Conquer: Quick Sort, Integer multiplication, Counting inversions, Closet Pair of point in 2 Dimensions etc. Greedy Algorithms: Job scheduling, Huffman Coding, Fractional Knapsack etc. Dynamic Programming: Weighted interval scheduling, 0-1 Knapsack Problem, Matrix- chain multiplication etc.

UNIT III: Backtracking method: N-Queens's problem, Graph Coloring, Hamiltonian cycle. Randomized algorithms, Stochastic algorithms, Approximation algorithms, Amortized analysis, Probabilistic analysis. Text Processing: Pattern Matching – KMP algorithm, Boyer Moore algorithm, Tries- Standard Tries, Compressed Tries, Suffix tries**.**

UNIT IV: Graph Algorithms: adjacency list and adjacency matrix representations of graphs, Breadth First Search (BFS) and Depth First Search (DFS) and their applications (topological sort, finding strongly connected components). Minimum Spanning Tree: Kruskal's Algorithm, Prim's Algorithm. Shortest Path problems: Bellman ford algorithm, Dijkstra's Algorithm, Floyd-Warshall.

L. Grading Policy (With Weightage)

- **Mid semester : 25%**
- **End semester : 50%**
- **Quiz: 15%**
- **Assignments, presentation etc. 10%**

M. Suggested Readings: (APA Style/ IEEE format)

Text Books:

1. Algorithm Design: by Kleinberg and Tardos, Low Priced Ed. by Pearson.
2. Introduction to Algorithms by Cormen, Leiserson and Rivest, Stein, Pub: MIT Press (Indian reprint by Prentice Hall)

Reference Books:

1. Algorithms by Dasgupta, Papadimitriou and Vazirani, Pub: Tata McGraw-Hill.
2. The Design and Analysis of Computer Algorithms by Aho, Hopcroft and Ullman, Pub-Addison Wesley
3. The Algorithm Design Manual by Steve Skiena. Pub: Springer

N. Content Last Modified: 16 Feb 2015

O. Instructor(s) names: