



**B. P. Poddar Institute of Management & Technology**  
**Department of Electronics & Communication Engineering**  
**Academic Year: 2024-25**



**LESSON PLAN**

**Course Planner**

**Design & Analysis of Algorithms (2<sup>nd</sup> Year 2<sup>nd</sup> Semester)**

Code: ESCS 401 (3L)

Credits: 3

**Teacher: MOSTAFA SEIKH (MS2)**

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Lecture 1: Introduction to Course

Lecture 2-4: Module 1 – Algorithm Analysis: Asymptotic notations, Time & Space complexity, Best case, worst case and average case complexity analysis illustration with examples of Selection Sort and Insertion Sort

Lecture 5-10: Module 1 – Merge Sort Analysis and Introduction to Recurrence Relation, Divide &

Conquer Methods & their recurrence models, Solution Methods to Recurrences – Substitution Method, Recursion-Tree Method and Master's Theorem.

Lecture 11: Module 2 – **Brute Force** Algorithm – Closest Pair of Points, **Greedy** Algorithm – Job

Sequence with Deadlines

Lecture 12-15: Module 2 – **Dynamic Programming** – Knapsack Problem, All Pair Shortest Path Problem, Travelling Salesman Problem, Matrix Chain Multiplication.

Lecture 16-19: Module 2 – **Branch & Bound Technique**: 4-Queens Problem, 0/1 Knapsack Problem

**Back-Tracking Technique**: 4-Queens, 8-Queens, N-Queens Problem, Knapsack Problem

Lecture 20-22: Module 3 – Revision of Graph Theory with Problem Solving – Terminologies, Important Theorems, Hamiltonian Graph, Vertex Cover, Edge Cover, Vertex Coloring, Edge Coloring, and Traversal Algorithms: DFS, BFS.

Lecture 21-30: Module 3 – **Minimum Spanning Tree**: Prim's Algorithm, Kruskal's Algorithm  
**Shortest Path Algorithms**: Dijkstra's Algorithm, Bellman-Ford Algorithm, Floyd

Warshall Algorithm and brief introduction to Advanced Algorithms: A\* Search Algorithm, Viterbi Algorithm.

**Graph Network Flow**: Ford-Fulkerson Algorithm, Max-Flow Min-Cut Theorem. Transitive Closure.

Lecture 31-36: Module 4 – Computability, P, NP, NP-Complete, NP-Hard Algorithms, Cook’s Satisfiability Theorem and Reducibility, DNF Satisfiability. Proof of the following:

NP-hard	(a) Chromatic Number Decision Problem (b) Node Cover Decision Problem
NP-complete	(a) Clique Decision Problem (b) Directed Hamiltonian Cycle Decision Problem

Lecture 37-41: Module 5 – Approximation Algorithms:

Absolute Approximation	(a) Planar Graph Coloring (b) Chromatic Number Decision Problem – NP-Hard (c) Directed Hamiltonian Cycle Decision Problem – NP-Complete
NP-hard Absolute Approximation	(a) 0/1 Knapsack Problem
NP-hard $\epsilon$ -Approximation Algorithm	(a) Travelling Salesman Problem (TSP)
Polynomial Time Approximation Algorithm	(a) Independent Task Scheduling Problem using LPT
Fully Polynomial Time Approximation Scheme	(a) 0/1 Knapsack Problem

Lecture 42-44: Module 5 – Probabilistic Methods, Randomized Algorithms:

Motivation for Randomization	(a) Random Walk & Electrical Networks
Probabilistic Methods	(a) Max-Cut Problem
Randomized Algorithms	(a) Quick Sort (b) Matrix Multiplication

Lecture 45: Module – Beyond Syllabus: (1) Minimum Spanning Tree based Image Segmentation

Lecture 46: Module – Beyond Syllabus: (2) Max-Flow Min-Cut based Image Segmentation

Lecture 47: Module – Beyond Syllabus: (3) Randomized Algorithms in Quantum Computing

Note: Students are advised to carry this course planner in the theory classes.

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Mr. Mostafa Seikh