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***CSX446 Advanced Algorithms***

**L-T-P-Cr: 3-0-0-3**

**Pre-requisites:** None

**Objectives/Overview:**

* Write rigorous correctness proofs for algorithms.
* Demonstrate a familiarity with major algorithms and data structures.
* Apply important algorithmic design paradigms and methods of analysis.
* Synthesize efficient algorithms in common engineering design situations.

**Course Outcomes:**

At the end of the course, a student should:

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| **Sl. No.** | **Outcomes** | **Mapping to POs** |
| 1. | Expertise in algorithm design techniques and analysis the performance of an algorithm. | PO1, PO3, PO5 |
| 2. | Able to argue the correctness of an algorithm using proof. | PO2, PO3, PO5 |
| 3. | Ability to apply the concepts learned in various domains like Networks, GIS, Robotics, VLSI etc. | PO1, PO3, PO5 |
| 4. | Explain the major network flow algorithms and their analyses.  | PO1, PO4, PO5 |
| 5. | Explain the different ways to analyze randomized algorithms (expected running time, probability of error). | PO2, PO4, PO5 |

**UNIT I: Lectures: 10**

**Network flow algorithms:** Ford-Fulkerson method, Maximum capacity augmentation, Minimum path length augmentation, Dinic algorithm, Preflow-Push Maximum flow algorithm.

**UNIT II: Lectures: 10**

**Matching Algorithms:** Matching for Bipartite graph, using network flow algorithm, Hungarian's algorithm maximum matching for general graph.

**UNIT III: Lectures: 10**

**Online algorithms:** Paging algorithm, convex hull, load balancing, and bin packing.

**UNIT IV: Lectures: 12**

**Randomized algorithms:** Monte carlo algorithm, Las Vegas algorithm; Example: Skip List, Approximate median finding algorithm, Quick Sort, Selection, Global Min-Cut, Max 3-CNF, Finding Closest pair of points, Incremental Algorithm: Convex hull, minimum enclosing circle.

**Text/ Reference Book:**

1. Introduction to Algorithms by T.H. Cormen, C. E. Leiserson, R.L. Rivest, PHI/Pearson.
2. J. Kleinberg, E. Tardos, “Algorithm Design”, Addison Wesley, 2005.
3. M. H. Alsuwaiyel, “Algorithms: Design Techniques and Analysis”, World Scientific Publishing Co-Pvt Ltd, 1999.