राष्ट्रीय प्रौद्योगिकी संस्थान पटना / NATIONAL INSTITUTE OF TECHNOLOGY PATNA
(शिक्षा मंत्रालय, भारत सरकार के अधीन एक राष्ट्रीय महत्व का संस्थान / An Institute of National Importance under Ministry of Education, Gov. of India)
संगणक विज्ञान एवं अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
अशोक राजपथ, पटना - ८००००५, बिहार / Ashok Rajpath, Patna- 800005, Bihar
Tel. No. – 0612-2372715, 2370419 (Ext-200) email- cseoffice@nitp.ac.in

CSXX0253: Tensor: Techniques, Algorithms and Applications

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

Pre-requisites: Design and analysis of Algorithm, Data Structure, Basics of Discrete mathematics.

Objective:

Upon completion of this course, students will be able to do the following:

- To provide a solid foundation in algorithm design and analysis.
- 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 able to:

Sl. No.	Outcome
CO1	Enhance the students' expertise in algorithm design techniques and analysis the performance of an algorithm.
CO2	Students' can argue the correctness of an algorithm using proof
CO 3	Ability to apply the concepts learned in various domains like Networks, GIS, Robotics, VLSI etc.
CO 4	Explain the major network flow algorithms and their analyses. Employ flow graphs to model engineering problems, when appropriate.
CO 5	Explain the different ways to analyse randomized algorithms (expected running time, probability of error).

Course Outcomes–Cognitive Levels–Program Outcomes Matrix –
[H: High relation (3); M: Moderate relation (2); L: Low relation (1)]

Course Outcomes			Program Outcomes											
	PO-1 (Engineering knowledge)	PO-2 (Problem analysis)	PO-3 (Design/development of solutions)	PO-4 (Conduct investigations of complex problems)	PO-5 (Modern tool usage)	PO-6 (The engineer and society)	PO-7 (Environment and sustainability)	PO-8 (Ethics)	PO-9 (Individual and team work)	PO-10 (Communication)	PO-11 (Project management and finance)	PO-12 (Life-long learning)	PSO1	PSO2
CO-1	1	3	2	2	-	-	-	-	2	-	-	3	3	3
CO-2	1	3	3	2	-	-	-	-	2	-	-	3		3
CO-3	1	3	3	3	-	-	-	-	2	-	-	3	3	2

CO -4	1	3	3	3	-	-	-	-	2	-	-	3	3	
CO -5	1	3	3	3	-	-	-	-	2	-	-	3	3	3

UNIT I Network flow algorithms: 10
Lectures

Ford-Fulkerson method, Maximum capacity augmentation (Edmonds and Karp), Minimum path length augmentation (Edmonds and Karp), Dinic algorithm, Preflow-Push Maximum flow algorithm.

UNIT II Maximal matching: 8
Lectures

Matching for Bipartite graph, using network flow algorithm, Hungarian's algorithm, Maximum matching for general graph.

UNIT III Online algorithm: 6
Lectures
Example: Paging algorithm, bin packing, load balancing, and convex hull.

UNIT IV Randomized algorithm: 10
Lectures
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.

UNIT IV Incremental Algorithm: 4
Lectures
Convex hull, minimum enclosing circle

Unit V Approximation Algorithm:
Vertex cover problem, set cover problem, Travelling Salesman problem. **4 Lectures**

Text Books:

[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.
[4] V. Vazirani, “ Approximation Algorithm”