Title	**Special Topics in Algorithms**	Number	**CS7xxx**
Department	Computer Science	L-T-P [C]	3–0–0 [3]
Offered for	B. Tech., M.Tech., PhD	Type	Elective
Prerequisite	Algorithm Design and Analysis, Maths for Computing	Antirequisite / Preferred Knowledge	None

Objectives

1. The objective of the course is to introduce several advanced algorithmic techniques.

Learning Outcomes

Students will gain the ability to:

1. Learn a new set of techniques to cope with NP-hard problems.
2. Identify novel and significant open research questions in the field.

Contents

Parameterized Algorithms [13 lectures]: Introduction to Parameterized Complexity and basics [2 Lectures]; Branching [4 Lectures]; Iterative Compression [3 Lectures]; Kernelization [4 Lectures]

Approximation Algorithms: [10 lectures]: Greedy Algorithm – Load Balancing, Center Selection Problem, Set Cover [5 Lectures]; The Pricing Method: Vertex Cover, Linear Programming and Rounding: An application to Vertex Cover, Knapsack [5 Lectures]

Randomized Algorithms [10 lectures]: Contention Resolution, Global Mincut, Random Variables and Expectations, Max-3-SAT approximation [7 Lectures]; Color Coding [3 Lectures]

Exact Exponential Time Algorithms [7 lectures]: Exact Algorithms for Coloring, SAT, Directed Feedback Arc Set, Max-Cut, Monotone-Local-Search, Or some other topics of contemporary interest.

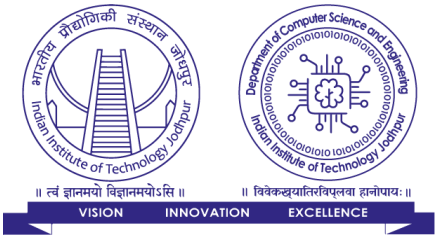
Streaming Algorithms [2 lectures]: Introduction to streaming algorithms and its application to some graph theoretic problems.

Textbooks

1. Marek Cygan, Fedor V. Fomin, Lukasz Kowalik, Daniel Lokshtanov, Daniel Marx, Marcin Pilipczuk, Michal Pilipczuk, Saket Saurabh (2015): Parameterized Algorithms, Springer.
2. Jon Kleinberg, Eva Tardos (2005), Algorithm Design, Pearson Education, 1st Edition.
3. Fedor V. Fomin, Dieter Kratsch (2010), Exact Exponential Time Algorithms, An EATCS Series, Springer.

Self Learning Material

1. https://www.youtube.com/watch?v=Ex8TueBsF1g&list=PLhkiT_RYTEU0gpi97fqjtaHy9Gk47oF85&index=1
2. https://sites.google.com/view/sakethome/teaching/parameterized-complexity?authuser=0
3. https://www.youtube.com/watch?v=S8Acu3EpvsE&list=PLhkiT_RYTEU2itsMqCNdXUg4cdFUWJn3-&index=4
4. https://www.youtube.com/watch?v=jNfQ3GZlrjM&list=PLhkiT_RYTEU3vSaVleEm_-bIPBzCqRQHK



Courses Offered by

Department of Computer Science and Engineering

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