

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

INTRODUCTION OF NEW COURSE

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| Course Title | Algorithmic Graph Theory | Course No (to be assigned by Academic Cell) | COM5XXX | | | |
| Specialization | Computer Science | Structure (LTPC) | 3 | 0 | 0 | 3 |
| To be offered for | Higher Semester UG, PG, PhD | Status | Core <input type="checkbox"/> | Elective <input checked="" type="checkbox"/> | | |
| Faculty Proposing the course | N.Sadagopan | Type | New <input checked="" type="checkbox"/> | Modification <input type="checkbox"/> | | |
| Date of DAC | 12/10/2018 | Members Present | All Faculty Members of the Dept. Prof. N.S Narayananswamy Dept of CSE, IITM | | | |
| Pre-requisite | Discrete Mathematics, Algorithms | Submitted for approval | 38th Senate | | | |
| Learning Objectives | To introduce and apply algorithmic paradigms for graph theoretic problems. Computability and complexity aspects restricted to graph-theoretic problems shall be explored. Special graphs and their structural properties shall also be explored. | | | | | |
| Learning Outcomes | Tools for design and analysis of algorithms for graph-theoretic problems shall be the key outcome of this course. Art of proof writing and establishing proof of correctness of algorithms shall be the additional outcome. | | | | | |
| Contents of the course (With approximate break up of hours) | <p>This course broadly covers the following modules with in-depth analysis on some specific topics.</p> <p>Module 1: Graph theoretic concepts such as vertex separators, connectivity and treewidth; the complexity of finding vertex connectivity, edge connectivity shall be explored.</p> <p>Algorithmic and complexity aspects of the above concepts - Introduction to special graphs such as chordal graphs, bipartite graphs, chordal bipartite graphs, planar graphs, 2K 2 -free graphs and complexity of vertex separators on these special graphs shall be explored.</p> <p>On the combinatorial front, bounds on vertex separators and the number of vertex separators shall be discussed. (12 hours)</p> <p>Module 2: Structural properties of special graphs and algorithmic aspects along with sophisticated data structures shall be discussed. Complexity of classical problems such as vertex cover, dominating set, treewidth on special graphs shall be explored. (12 hours)</p> <p>Module 3: Introduction to search and spanning tree problems - Variants such as second best spanning tree, K th -best spanning tree, Steiner tree and its complexity analysis in special graphs - Complexity of Hamiltonian cycle/path in special graphs. (10 hours)</p> <p>Module 4: NP-hard reductions - Reductions in special graphs - Gadget reductions - Hamiltonian paths and cycles in Split graphs, chordal bipartite graphs, Steiner tree, Constrained vertex separators - Dichotomy results - Micro level analysis of reductions - Discovery of polynomial-time solvable input instances shall be explored. (8 hours)</p> | | | | | |
| Text Books | <ol style="list-style-type: none"> 1. Martin Charles Golumbic, Algorithmic Graph Theory and Perfect graphs, Annals of Discrete Mathematics, 57, 2004. 2. Research Articles related to Graph theoretic concepts. | | | | | |
| Reference Books | <ol style="list-style-type: none"> 1. Thomas H. Cormen. Charles E. Leiserson. Ronald L. Rivest. Clifford Stein. Introduction to Algorithms. Third Edition. The MIT Press, 2009. 2. Andreas Brandstadt, Van Bang Le, Jeremy P. Spinrad, Graph Classes - A Survey, Monograph, SIAM, 1999. | | | | | |