Proposal for a New Course

Department of Electrical Engineering
Indian Institute of Technology Kanpur

Course No.: EE798

Course title: Graph Theory and its Applications

Pre-requisites: NA

Credits: 3-0-0-0 [9]

Instructor: Twinkle Tripathy, ttripathy@iitk.ac.in

Course description:

In recent years, graph theory has become an important tool that studies binary relationships between objects. in a wide variety of areas ranging from control theory, computer science and operations research to genetics, chemistry and sociology. This course provides a structured introduction to key graph-theoretic concepts, beginning with foundational topics and progressing to advanced results and applications pertaining primarily to the domain of control theory.

The course starts with covering problems which have important implications in optimization and combinatorial algorithms. Next, connectivity concepts are explored to understand the robustness and structure of networks. Thereafter, graph colouring problems are discussed with applications towards scheduling and resource allocation. The course continues with network flow theory, introducing the max-flow min-cut theorem, circulations, and tensions. Then, we delve into graph centrality measures, studying their role in network analysis. The last part of the course will focus on applications of graph theory in various domains.

Course contents :

Topics	Sub-topics	Number of Lectures
Graph theory	Covering problems	5
	Connectivity	5
	Graph colouring and applications	6
	Network flows	5
	Graph minors	3
	Centrality measures	6
	Applications	10
	Total	40

Remarks : Students from other departments like AE, CSE and ME may be interested in the course.

Reading material :

The initial material will be covered from the following reference books:

[1] R. Diestel, "Graph Theory", Springer-Verlag, 2nd edition, 2000.

[2] N. Alon and J. Spenser, "Probabilistic Methods", John Wiley and Sons, 2nd edition, 2000.

The rest of the material will mostly be taken from several journal articles and conference proceedings available online.

14.02.2025

Signature of the proposer

Convener, DPGC

Chairperson, SPGC

Department of Electrical Engineering