

CURRICULUM TRANSACTIONAL STRATEGY

MMT-C 205: Combinatorics and Graph Theory

Syllabus

Prerequisites: Undergraduate level Discrete Mathematics.

COURSE OBJECTIVES

- To get introduced to the elementary principles of Combinatorics.
- To find polynomial expression by Newton's Binomial theorem and Multinomial theorem.
- To employ ordinary and exponential generating functions for counting purposes
- To get introduced with the linear recurrence relation and the technique to solve it
- To study special numbers like Stirling, Catalan, Schroeder numbers.
- To understand the principles of Inclusion and Exclusion for counting purposes
- To get introduced with Möbius inversion formula and derangement.
- To get introduced with the Polya Theory of enumeration.
- To Understand the Pigeon hole principles and its plain and strong form
- To get introduced with the elements of Ramsey Theory.
- To understand the idea of Isomorphism in graphs.
- To understand Incidence and Adjacency matrices of Graphs and construct such matrices in different types of graphs.
- To understand the concept of degree sequences in graphs and their characterizations.
- To understand the concept of minimum spanning trees and their applications. To understand the concept of cut vertices and cut edges in graphs.
- To develop the idea of Eulerian and Hamiltonian graphs.
- To get an idea about travelling salesman problem.
- To develop the idea and study vertex coloring, edge coloring and region coloring of graphs.
- To understand the concept of planarity in graphs, study six and five color theorem and get the idea of four color theorem.
- To understand the idea of tournaments in graphs.

COURSE OUTLINE

UNIT I

- Elementary principles of combinatorics. Newton's Binomial theorem Multinomial theorem.
- Generating functions.

- Linear recurrence relations
- Special numbers like Stirling Catalan and Schroeder numbers.

UNIT II

- Inclusion and exclusion principles Möbius inversion formula and derrangements
- Polya Theory of enumeration
- Pigeonhole principle
- Elements of Ramsey theory.

UNIT III

- Isomorphism in graphs.
- Connectedness in graphs.
- Edge form of mengers theorem.
- Degree sequence and their characterization.
- Trees and their characterizations.
- Minimum spanning trees.
- Connectivity in graphs.

UNIT IV

- Eulerian and Hamiltonian graphs.
- Coloring of graphs.
- Planer graphs.
- Directed graphs.
- Tournaments

Classroom Transaction

Unit	Topic	Activity	No. of Tutorials	No. of lectures
I	Elementary Principles of Combinatorics	Assignment	01	01
	Newtons Binomial theorem and Multinomial theorem	Assignment	03	02
	Generating functions	Assignment	01	02
	Linear recurrence relations	--	01	02
	Stirling numbers Catalan numbers Schroeder numbers	Assignment and Presentation	04	04

Unit	Topic	Activity	No. of Tutorials	No. of lectures
II	Inclusion and Exclusion principles	Assignment	02	01
	Möbius inversion formula	Assignment and Presentation	02	02
	Derrangements	Assignment	02	03
	Polya Theory of enumeration	Assignment	01	03
	Pigeonhole Principle	--	01	02
Unit	Topic	Activity	No. of Tutorials	No. of lectures
II	Elements of Ramsay theory	Assignment	01	03

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Unit	Topic	Activity	No. of Tutorials	No. of lectures
III	Definition of Graphs and isomorphism in graphs	Assignment	02	01
	Matrices in graphs	Assignment	02	05

	Degree sequences, Havel Hakemi theorem and ErdosGallai theorem	Assignment and Presentation	01	03
	Minimum spanning trees, Kruskal's algorithm	Assignment	02	02
	Connectivity in graphs, Menger's theorem			

Unit	Topic	Activity	No. of Tutorials	No. of lectures
IV	Definition of Euler graphs, Euler's theorem	Assignment and Presentation	03	06
	Definition of Hamiltonian graph, Dirac's theorem	Assignment	02	03
	Coloring of graphs and related theorems	Assignment	02	03
	Definition of Chromatic number	Assignment	02	02
	Planer graphs and Kurataowski's characterization	Assignment		
	Directed graphs and related results	Assignment		

Suggested Books:

1. R.Balakrishnan, K.Ranganathan, A Text Book of Graph theory, Springer-Verlag, New York.

2. B.Bollobas, Extremal Graph theory, Academic Press.
3. R.Brualdi, Introductory Combinatorics, Pearson India
- 4 S.Sane, Combinatorial Techniques, TRIM Series
5. Narsing Deo, Graph theory with Applications to Engineering and Computer Science, Prentice Hall.
- 6.S.Pirzada, An Introduction to Graph theory, Universities Press, Orient Blackswan.
- 7.D.B.West, Introduction to Graph theory, Prentice Hall.