University
College /Faculty
Department of Mathematics

Program	Under graduate Mathematics
Module Name	**Combinatorics and Graph Theory**
Module No.	03
Module code	**Math-M2031**
Course Title	**Introduction to Combinatorics and Graph Theory**
Course Code	Math 2031
Course EtCTS	5
Module coordinator	
Instructor's Information	Name---------- Office No. ---------- Phone No.---------- E-mail:---------- Consultation hours:--------

workload (in hours)

Lecture	Tutorial	Lab Work	Assessment	Home study	Total study
48	32	0	8	47	135

Lecture	Day	Hour	Room
Tutorial	Day	Hour	Room

Target Group	Second year mathematics students
Semester	II
Pre-requisites	None
Status of the Course	Compulsory

Course description

This course deals with review of sets and functions, fundamental principles of Counting, generating functions and recurrence relations, graph theory and its application.

Course Objectives

On completion of the course, successful students will be able to:

- know basic concepts of discrete mathematics,
- understand the principles of counting, recurrence relations and generating functions,
- understand the basic concepts of graph and their types,
- know the basic algorithms on graphs,
- use the methods and principles of Combinatorics,
- apply Combinatorics in counting problems,
- solve simple counting problems,
- Construct graphs with given degree patterns,
- apply graph theory to solve network oriented problems

Time	Contents	Methodology	Teacher's Activity	Student's Activity
Week 1	**Chapter 1: Elementary counting principles** 1.1 Basic counting principle	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Week 2	1.2 Permutations and combinations 1.3 The inclusion-exclusion principles	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Week 3	1.4 The pigeonhole principle 1.5 The binomial theorem	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Test I				
Week 4	**Chapter 2: Elementary probability theory** 2.1 Sample space and events	Lecture Method, Discussion and Presentation, questioning and answering	Giving lecture Grouping the students for discussion and presentation Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Week 5	2.2 Probability of an event 2.3 Conditional probability	Lecture Method, Discussion and Presentation, questioning and answering	Giving lecture Grouping the students for discussion and presentation Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Week 6	2.4 Independent events 2.5 Random variables and expectation	Lecture Method, Discussion and Presentation, questioning and answering	Giving lecture Grouping the students for discussion and presentation Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Assignment				
Week 7	**Chapter 3: Recurrence relations** 3.1 Definition and examples 3.2 Linear recurrence relations with constant	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and	Taking Lecture notes, Discussion with group members, answering and asking an clear

	coefficient		directing Students	ideas
Week 8	3.3 Solutions of linear recurrence relations 3.4 Solutions of homogeneous and nonhomogeneous recurrence relations	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Take home exam				
Week 9	**Chapter 4: Elements of graph theory** 4.1 Definition and examples of a graph 4.2 Matrix representation of a graph 4.3 Isomorphic graphs	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	• Giving lecture • Grouping the students for discussion Asking and directing • Students	Taking Lecture notes, Discussio n with group members, answering and asking an clear ideas
Week 10	4.4 Path and connectivity of a graph 4.5 Complete, regular and bipartite graphs 4.6 Eulerian and Hamiltonian graphs	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussio n with group members, answering and asking an clear ideas
Week 11	4.7 Trees and forests (Rooted and Binary trees) 4.8 Planar graphs 4.9 Graph coloring	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussio n with group members, answering and asking an clear ideas
Test 2				
Week 12	**Chapter 5: Directed graphs** 5.1 Definition and examples of digraphs 5.2 Matrix representation of digraphs	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas

Week 13	5.3 Paths and connectivity	Lecture Method, Discussion, problem solving method, Reading assignment, questioning and answering	Giving lecture Grouping the students for discussion Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Week 14	**Chapter 6: Weighted graphs and their applications** 6.1 Weighted Graphs 6.2 Minimal Spanning trees	Lecture Method, Discussion and Presentation, problem solving method, Reading assignment, questioning and answering	Giving lecture, Grouping the students for discussion and Presentation, Asking and directing `Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Week 15	6.3 Shortest path problem 6.4 Critical Path Problem	Lecture Method, Discussion and Presentation, problem solving method, Reading assignment, questioning and answering	Giving lecture, Grouping the students for discussion and Presentation, Asking and directing Students	Taking Lecture notes, Discussion with group members, answering and asking an clear ideas
Week 16	**Revision and Presentation**			

Final- Exam: 50%	
Assessment/Evaluation & Grading System	1. Quiz (1&2) ……..10% 2. Assignment (1) ……..10% 3. Test (1&2)……20% 5. Presentation ……..10% 6. Take home exam……..10% 7. Final Exam ……..50% Total……..100%
Course Policy	**A student has to:** ❖ **At attend at least 85% of the classes.** ❖ **Take all continuous assessments.** ❖ **Take final examination.** ❖ **Respect all the rules and regulations of the University**

Text Books

- Steven Roman, **An Introduction to Discrete Mathematics**
- Mattson, H.F., **Discrete Mathematics with Application**

References:

- N. CH SN Iyengar et al, **Discrete mathematics**, Vikas publishing house PVT LTD, 2004
- S. Roman, **An introduction to discrete mathematics**, CBS College publishing, 1986
- B. Harris, **Graph Theory and its applications**, Academic press, 1970
- Iyengar, S. N, **Elements of Discrete Mathematics**
- Lipschutz, S., **Schaum's outline series, Discrete Mathematics**
- Oystein Ore, **Theory of graphs**, American mathematical Society, 1974