King Fahd University of Petroleum and Minerals
Department of Mathematics & Statistics
Syllabus MATH 645
AY: 2023-2024 (T231)
Dr. Othman Echi
Office : 319-Building 5

Title: Combinatorics & Graph Theory

Textbook: Applied combinatorics (6th ed), Alan Tucker, Wiley, 2012.

Description: Enumerative analysis, generating functions. Sorting and searching. Theory of codes. Block design. Computational combinatorics. Methods of transforming combinatorial ideas into efficient algorithms. Algorithms on graphs, network flow.

Office Hours: Every Monday from 10:00 to 11:00 AM

Grading Policy:

Exam 1	Exam 2	Exam 3	HW	Presentations	Final Exam
20%	20%	20%	5%	5%	30%
tba	tba	tba			tba

Week	Topics
1, 2	**Elements of Graph Theory:** Graphs, Isomorphisms, Hamiltonian Graphs, Fleury's algorithm, planar graphs, subdivision, minor, dual of a graph, maximal planar graphs, Euler's formula, …
3,4	**Covering circuits and Graph colouring:** Eulerian and semi-Eulerian graphs, colouring, colouring theorems.
5, 6	**Trees:** Properties of trees, shortest paths, the traveling Salesperson Problem, minimum spanning trees
7,8	**General Counting Methods for arrangements and selections:** Counting principles, Binomial Identities, multinomial coefficients, …
9	**Generating Functions:** Calculating coefficients of generating functions, exponential generating functions
10	**Recurrence Relations:** Recurrence relations models, linear recurrence relations, recurrence relations and generating functions.
11	**Mobius Inversion Formula in Posets:** Incidence algebra of a poset, Mobius inversion formula,eExclusion-inclusion.
12, 13	**Polya's Enumeration Formulas:** Group action, Burnside's Formula, Polya's formula.
14, 15	**Introduction to Combinatorics on Words:** Primitive words, languages, counting special kinds of words, codes, …