

Graph Theory CO 442/642 Fall 2022

This course is the fourth-year undergraduate and first-year graduate course in Graph Theory. Its aim is to cover several of the major areas of graph theory, from their classical beginnings to more recent developments. A particular emphasis will be placed on introducing some of the important methods used, and their links with other areas of mathematics. These include probabilistic, algebraic and topological methods, the regularity method, and various methods used in graph colouring. Specific topics will include the following.

1. Colouring: vertex and edge colouring, Brooks' Theorem, Vizing's Theorem and extensions, list colouring, total colouring, colouring Kneser graphs.
2. Flows in graphs: Integer and group-valued flows, the flow polynomial, the 6-flow theorem.
3. Ramsey theory: upper and lower bounds, explicit constructions, graph Ramsey theory.
4. Extremal graph theory: Turán's theorem, $ex(n, H)$, stability and the Erdős-Stone Theorem.

There is no required textbook for this course. The text "Graph Theory" by Reinhard Diestel is a useful reference. A copy can be found at <http://diestel-graph-theory.com>

Basic knowledge of elementary graph theory will be assumed, such as the material covered in CO342. Recommended reading for this background material can be found in Sections 1.1–1.7, 2.1–2.2, 3.1 and 3.3, and 4.1–4.4 of Diestel's textbook.