CO442/642 Graph Theory

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This course is an introduction to classical graph theory with a bias toward graph colouring.

Topics include:

- **Graph Minors**: Mader's theorem, Tree-width, Hadwiger's Conjecture.
- **Colouring**: Brooks' theorem, Vizing's theorem, the Four Colour Theorem (proof sketch)
- **Nowhere-zero Flows**: Duality with colouring, the Six Flow Theorem.
- **Extremal Graph Theory**: Turán's Theorem, Erdös-Stone Theorem, Ramsey's Theorem
- **Probabilistic Method**: Lower bounds for Ramsey numbers, graphs with large girth and chromatic number

Suggested reading.
- *Graph Theory*, Second Edition, Reinhard Diestel. Available on-line.
- *Graph Theory*, J.A. Bondy and U.S.R. Murty.

Prerequisites. Students who have no prior exposure to graph theory should read Sections 1.1-1.7 and Section 3.3 of Diestel. The course will be mostly self-contained, but it is designed as a second course in graph theory, and so it skips a number of important topics. It is assumed that students are familiar with matching (see Sections 2.1 and 2.2 of Diestel), Euler tours (Section 1.6 of Diestel), connectivity (Section 3.1, 3.2, and 3.3 of Diestel), and planar graphs (Sections 4.2, 4.3, 4.4 and 4.6 of Diestel). Students who have no prior exposure to graph theory should also read Sections 1.1-1.7 of Diestel.