

**CO 442/642 – GRAPH THEORY**  
**SYLLABUS – FALL 2020**

The following is an overview of the course and a detailed week-by-week syllabus. Homeworks are due at **4pm ET** on selected Mondays. **Please note that this syllabus is tentative.** It may be necessary to make changes to the topics – we will make every effort to keep to this schedule.

1. OVERVIEW OF SYLLABUS

Here is a coarse breakdown of the course topics:

- (1) Colorings : 5 weeks
- (2) Minors : 3 weeks
- (3) Extremal Graph Theory and Probabilistic Methods : 3 weeks
- (4) Flows : 1 week

2. DETAILED SYLLABUS

- (1) **8 Sep - 9 Oct, Weeks 1-5:** Coloring: Brooks' Theorem, Vizing's Theorem, Thomassen's 5-List-Coloring Theorem, Discharging, Surfaces

**21 Sep: Assignment 1 Due**

**5 Oct: Assignment 2 Due**

**12 Oct - 16 Oct: Reading Week (No Lectures)**

- (2) **19 Oct - 6 Nov, Weeks 6-8:** Minors: Tree-width, Graph Minors Structure Theorem, Erdős-Pósa, Hadwiger's Conjecture

**26 Oct: Assignment 3 Due**

- (3) **9 Nov - 27 Nov, Weeks 9-11:** Extremal Graph Theory: Ramsey's Theorem, Turan's Theorem, Regularity Lemma; Probabilistic Methods: Expectation and Alteration

**16 Nov: Assignment 4 Due**

(4) **30 Nov-4 Dec, Week 12:** Flows: Group Flows, Flow-Coloring Duality

**30 Nov: Assignment 5 Due**

**CO 442/642 - GRAPH THEORY**  
**COURSE OUTLINE FOR FALL 2020**

1. THE BASICS

1.1. **Time and Place.** Lectures are in prerecorded video format and can be found on the learn website for the course. Note that following university guidance, the lectures will be shorter in duration. Note that the videos and/or slides are copyright of the professor and may not be distributed to others or posted online in any form.

1.2. **Instructors.** The professor responsible for the course is

Luke Postle: [lpostle@uwaterloo.ca](mailto:lpostle@uwaterloo.ca)

1.3. **Text and other Materials.** The official text for this class is Diestel (the standard textbook for graduate graph theory), 5th edition. An online PDF version of the book can be bought from Diestel's website relatively inexpensively. Note that students are not required to buy a copy of the textbook as homeworks and/or lectures are essentially self-contained. However, the book is a great reference for proofs from class as well as much additional material we will not be able to cover due to time constraints.

1.4. **Course Description.** This is a graduate topics core course for students in Combinatorics and Optimization.

Prerequisite: **Undergraduate Graph Theory.** 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), 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 1.1-1.8 of Diestel.

Concerning placement in the course, **if you have any questions, please see the instructor immediately.**

1.5. **Evaluation.** The overall course grade is determined as follows:

- Assignments: 70%
- Final: 30%

The date and time of the final exam will be determined in the middle of the term. The final exam will be a take home exam with at least a three day time window to allow for conflicts. It will be an essentially longer form of assignment submitted in the same online fashion as an assignment.

## 2. OFFICE HOURS AND REVIEWS

**2.1. Office Hours.** Dr. Postle will have a scheduled online office hour each week as follows:

*Fridays 12:10-1: CO 442 Fridays 1:10-2: CO 642*

You can also contact the course instructor by email to schedule an online appointment at another time. Use the email address at the beginning of this document.

When you have questions about course material from the lectures or readings, please see the course instructor. If you have trouble understanding concepts or doing the assignments, you should make every effort to meet with or contact the instructor.

## 3. INTERNET AND TECHNOLOGY USE

Assignments and course information for the course will be posted online.

**3.1. Other Technology.** Students are expected not to collaborate on assignments and final exam and not to use external resources for help completing them.

## 4. ASSIGNMENTS

**4.1. Homework Assignments.** There will be 5 homework assignments to be turned in at **4pm ET** via email on selected Mondays. I will assign about 3-4 problems, usually drawn from the current topics, of which all must be completed. The problems will be announced at least a week prior to being due. Assignments will count as 70% of the final grade.

**No late assignments will be accepted, a late homework will result in a 0 score.**

The schedule of Homework Assignments will be as follows:

- (1) Sep 21: Assignment 1
- (2) Oct 5: Assignment 2
- (3) Oct 26: Assignment 3
- (4) Nov 16: Assignment 4
- (5) Nov 30: Assignment 5

4.2. **Scoring.** Each problem from an assignment will be graded on two qualities: correctness of solution and writing. A combined score on a scale of 0 to 10 will be given for each problem. Students will receive a grade of at least 2 for attempting a problem.

4.3. **Format.** Assignments should be a PDF with **each problem starting on its own new page** and meet the following format:

- typed (preferably LaTeX),
- on 8.5 inch by 11 inch letter paper,
- 12 or 11 pt Times New Roman, Arial, or one of the default latex fonts,
- single spaced (except for separated equations),
- 1 inch margins **on all sides**,
- name, course number (442 for undergraduate; 642 for graduate) and assignment number on top of first page,
- the PDF should be given the name “LastSectionAX” where Last is your last name, Section is either 442 or 642, and X is the assignment number.

4.4. **Collaboration.** Students may not collaborate with anyone else for assignments/exam in any way. Similarly, students may not use any resources outside of Diestel’s textbook and course materials from this class, e.g. they may not solicit help from online forums, etc.

## 5. UNIVERSITY OF WATERLOO ACADEMIC RULES AND POLICIES

5.1. **INC policy.** In case of serious illness leading to an inability to complete the final exam, you need to be in reasonable standing before an instructor can grant a grade of INC. To be in reasonable standing means having passing grades for the assignments.

5.2. **Academic Integrity.** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. For more information, check

[www.uwaterloo.ca/academicintegrity](http://www.uwaterloo.ca/academicintegrity).

5.3. **Grievance.** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4,

<http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>.

When in doubt please be certain to contact the department’s administrative assistant who will provide further assistance.

5.4. **Discipline.** A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline,

<http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>.

For typical penalties check Guidelines for the Assessment of Penalties,

<http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm>.

5.5. **Appeals.** A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals,

<http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>.

5.6. **Students with disabilities.** The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.