

## Math 2156 Course Outline

### 1. Course Information

**Course information:**

Math 2156B: Mathematical Structures II, January-April 2023

Section 001: In-person lectures, MWF 10:30-11:20am, Natural Science Centre, Room 7

**List of Prerequisites:** Mathematics 2155F/G.

Unless you have either the requisites for this course or written special permission from your dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

### 2. Instructor Information

Instructor	Email	Office	Office Hours
Michael Francis	<a href="mailto:mfranc65@uwo.ca">mfranc65@uwo.ca</a>	MC 133	See OWL

Please use your Western ([@uwo.ca](mailto:@uwo.ca)) email addresses when contacting me and include “Math 2156” in the subject line of your email.

Office hours, two per week, will be held in room 133 of Middlesex College (the photogenic building with the clock tower) at times to be posted on OWL following a poll of the class. You may also contact me to make an appointment outside of regularly scheduled office hours.

Information about the math help centre and other departmental supports for students can be found here: [https://www.uwo.ca/math/undergraduate/current\\_students/Help%20Centre.html](https://www.uwo.ca/math/undergraduate/current_students/Help%20Centre.html)

### 3. Course Syllabus, Schedule, Delivery Mode

**Lectures:** Lectures are conducted in-person MWF 10:30-11:20am in Natural Science Centre, Room 7.

**Course description:** This course continues the development of logical reasoning and proofs begun in Mathematics 2155F/G. Topics include elementary number theory (gcd, lcm, Euclidean algorithm, congruences, Chinese remainder theorem) and graph theory (connectedness, complete, regular and bipartite graphs; trees and spanning trees, Eulerian and Hamiltonian graphs, planar graphs; vertex, face and edge colouring; chromatic polynomials).

**Learning outcomes:** After passing this course, the student will have solidified their ability to read and write proofs, learned the basics of number theory and graph theory, and surveyed some classical results from those subjects.

**Key Sessional Dates:**

- Classes begin: January 9, 2023
- Spring Reading Week: February 18 – 26, 2023
- Classes end: April 10, 2023
- Exam period: April 13 – 30, 2023

**Contingency plan for an in-person class pivoting to 100% online learning:**

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

## 4. Course Materials

- For the Part I of the course (number theory and modular arithmetic), the primary source will be notes distributed through OWL.
- For Part II of the course (graph theory), the primary source will be:  
**“Combinatorics and Graph Theory” (Second Edition) by Harris, Hirst & Mossinghoff**
- For Part II of the course, we will occasionally use the following secondary source for certain topics not treated in our primary source:  
**“Graph Theory” by Bondy & Murty**

Both books can be accessed for free on the UWO libraries page. The libraries page will allow you to download PDFs for offline viewing (recommended). Note that, while Harris, Hirst & Mossinghoff's book is pitched at an introductory level and should make for fairly accessible reading, Bondy & Murty's book is more advanced. We will, however, only use Bondy & Murty sparingly for specific topics.

**Approximate schedule of Topics:**

- **Part I: Number Theory and Modular Arithmetic (Week 1-4)**  
divisibility, prime numbers, Euclidean algorithm, fundamental theorem of arithmetic, Mersenne/Fermat primes, linear congruences, Chinese remainder theorem.
- **Part II: Graph Theory (Week 5-12)**  
Harris, Hirst & Mossinghoff, Chapter 1.1-1.7

Topics may be added or subtracted as time permits. Sections may also be covered out of order.

Any other course materials will be posted to OWL: <http://owl.uwo.ca>. Students are responsible for checking the course OWL site on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk by phone at 519-661-3800 or ext. 83800.

**Technology requirements:**

Computer or laptop access and a stable internet connection

Paper, pencils, and erasers

Recommended but not required: access to a printer

## 5. Methods of Evaluation

**Grading Scheme:**

Assignments (6)	30%
Midterms (2)	30%
Final Exam	40%

**Assessment Schedule:**

<b>Week 1</b> (Jan 9-13)	
<b>Week 2</b> (Jan 16-20)	
<b>Week 3</b> (Jan 23-27)	Assignment 1 due Monday, January 23
<b>Week 4</b> (Jan 30-Feb 3)	
<b>Week 5</b> (Feb 6-10)	Assignment 2 due Monday, February 6
<b>Week 6</b> (Feb 13-17)	<b>Midterm 1 on Wednesday, February 15</b>
<b>Spring Reading Week: Feb 18-26</b>	
<b>Week 7</b> (Feb 27-Mar 3)	Assignment 3 due Monday, February 27
<b>Week 8</b> (Mar 6-10)	
<b>Week 9</b> (Mar 13-17)	Assignment 4 due Monday, March 13
<b>Week 10</b> (Mar 20-24)	<b>Midterm 2 on Wednesday, March 22</b>
<b>Week 11</b> (Mar 27-31)	Assignment 5 due Monday, March 27
<b>Week 12</b> (Apr 3-7)	

Assignment 6 will be due Monday, April 10<sup>th</sup> (the last day of classes).

**Assignments:** The assignments are equally-weighted and consist of about one question for every hour of class time. They should be submitted on Monday before the lecture begins. Late assignments submitted the same day may be accepted with a 25% grade deduction.

Problems must be completed neatly and contain thorough explanations. You are expected to convey your ideas in a clear and concise way without leaving gaps for the reader to fill in. Answers without explanations will receive no marks, and full credit will not be awarded for work that is messy, vague or incomplete. Collaboration with other students when working on assignments is permissible (encouraged even), but the solutions you submit must be written up in your own words and reflect your own understanding of the problem. Plagiarism is a serious scholastic offence carrying serious consequences.

In addition to the assignments, it is highly advised to frequently complete additional problems appearing in the course notes and textbook(s). Doing so will give you the practice needed to succeed in the course. You should expect some exam problems to be based on problems encountered in the course materials and examples worked out in class.

**Midterms:** There will be two equally-weighted, in-class midterms, 50 minutes in duration. Midterm 1 will cover Week 1-4. Midterm 2 will cover Week 4-8. Use of a calculator or other aids is not permitted. A student who obtains an academic consideration to miss a midterm test from their faculty counselling office will be given the opportunity to write a makeup within 1 week. If an academic consideration is obtained for the makeup as well, the student is assigned a score in such a way that their class rank on the midterm matches their class rank on the final exam.

**Final Exam:** The final exam is cumulative and 3 hours long. It will be scheduled by the university during the final exam period **April 13 – 30, 2023**. You should not make travel arrangements until you know the timing of all of your exams.

## 6. Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

### **Assessments worth less than 10% of the overall course grade:**

Your instructor is empowered (but not obliged) to grant academic considerations for the assignments in this course. Considerations may take the form of assignment extensions or, in exceptional circumstances, the omission of an assignment. Note that in all cases where documentation (medical or otherwise) is required, it can only be collected by the student's Dean's Office Academic Counselling unit.

### **Assessments worth 10% or more of the overall course grade:**

Your instructor is not empowered to grant an academic consideration for work totalling 10% or more of the final course grade. You must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf).

The Student Medical Certificate is available at

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

## **Absences from Final Examinations**

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

## **7. Accommodation and Accessibility**

### **Religious Accommodation**

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

### **Accommodation Policies**

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf).

## **8. Academic Policies**

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

[https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf),

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Calculators and other aids are not permitted during final exams, midterm tests and in-class quizzes.

**Scholastic offences** are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

In the event that in-person quizzes and examinations become prohibited (e.g. in the event of a health lock-down), tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

<https://remoteproctoring.uwo.ca>.

## 9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

[https://www.uwo.ca/health/student\\_support/survivor\\_support/get-help.html](https://www.uwo.ca/health/student_support/survivor_support/get-help.html).

To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

[http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html)

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.