

Mathematics 4122B/9022B Course Outline

1. Course Information

Course Information

Introduction to Measure Theory (Math 4122B/9022B), Winter 2024

Lectures: Mon/Wed/Fri, 11:30am—12:30pm, MC-108

List of Prerequisites

Mathematics 3122A/B

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Counselling) 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

Instructors	Email	Office	Phone	Office Hours
Dr. Janusz Adamus	jadamus@uwo.ca	MC-122	ex.86525	In person, weekly times TBA
TA: TBA				

Students must use their Western (@uwo.ca) email addresses when contacting their instructors.

3. Course Syllabus, Schedule, Delivery Mode

Lebesgue measure, measurable sets and functions, Littlewood principles; the Lebesgue integral, basic convergence theorems, approximation theorems; measure spaces, signed measures, Radon-Nikodym Theorem.

Learning Outcomes. Upon successful completion of this course, students are expected to:

- State the axiomatic definitions and know several examples of a Boolean algebra, σ -algebra, monotone class, measure, and outer measure
- Explain the Caratheodory construction of outer measure and state the Caratheodory Extension Theorem
- State the axiomatic definition, characterization, and explain uniqueness of Lebesgue measure
- Understand the notion of a measurable function and its Lebesgue integral

- Explain the relationship between Riemann and Lebesgue integrals and state the characterization of Riemann integrability in terms of Lebesgue measure
- Apply various limit theorems, such as Monotone Convergence and Dominated Convergence Theorems, to prove standard results
- Demonstrate the knowledge of Lebesgue integration on product spaces (Fubini's Theorem) in solving standard exercises
- Understand signed and complex measures (Hahn and Jordan Decomposition Theorems, Radon-Nikodym Theorem).

Lectures will be held in-person, Mon/Wed/Fri, 11:30am—12:30pm.

Classes begin: January 8, 2024

Reading Week: February 17 – 25, 2024

Classes end: April 8, 2024

Exam period: April 11 – 30, 2024

Contingency plan

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will **not** change. Any assessments affected will be conducted online as determined by the course instructor.

4. Course Materials

Textbook: *Real analysis for graduate students*, R.F. Bass, ver.3.1, 2016 (recommended, available through the course website).

Other suggested reading:

- *Real and complex analysis*, W. Rudin, 3rd edition, McGraw-Hill, 1987.
- *Real and Functional Analysis*, S. Lang, 3rd edition, Springer, GTM 142, 1993.

Course Website: <https://uwo.ca/math/faculty/adamus/teaching/4122B2024/>

Students are responsible for checking the above course website 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.

All course material will be also available via OWL: <http://owl.uwo.ca>.

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. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

In the unlikely event of the course switching to online delivery mode, the students will be expected to have a stable internet connection and access to a computer with working microphone and webcam.

5. Methods of Evaluation

For undergraduate students, the course mark will be based on their term work, 2 term tests, and the final exam, with the following weights:

Term Work	24%	
Midterm Tests (2)	36%	(18% each)
Final Exam	40%	

For graduate students, the final mark will be the weighted average of the above components and the in-class presentation of a selected topic, with weights of 95% and 5% respectively.

The Term Work will consist of bi-weekly assignments or weekly quizzes (depending on the TA support), and will be announced at the beginning of the term.

The **midterm tests** will be held **in class**, on **February 16** and **March 15**. Make-up midterm tests are tentatively scheduled for February 28 and March 20.

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:

For a missed quiz or assignment students should seek an accommodation from the Academic Counselling (see below). In any case, do not send any medical or other supporting documentation to your instructor. Documentation (medical or otherwise) can *only* be collected by the student's Dean's Office Academic Counselling unit.

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

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/academic_consideration.pdf.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Missing a midterm exam, the final exam, or a quiz will result in a grade of zero unless appropriate permission is sought and granted. In the case of quizzes and/or assignments, your Term Work mark will be re-weighted to exclude the missed assessment (if you have appropriate accommodation).

In the case of a missed midterm exam, a makeup test will be arranged. If you miss a term test and the corresponding makeup test and have appropriate permission for both, then the final exam will be re-weighted to include the weight of the missed term test.

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](#)).

6. 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://www.edi.uwo.ca/>.

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.

7. 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,

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.

The use of calculators and other electronic devices during the quizzes, term tests or final exam is prohibited.

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.

In the unlikely event of the course switching to online mode, 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>.

8. 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.

To connect with a case manager or set up an appointment, please contact 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

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.

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