Department of Statistical and Actuarial Sciences
Advanced Mathematics for Statistical Applications, Statistical Sciences 2503B, Section 001

Course outline for Winter 2021

Although this academic year might be different, Western University is committed to a **thriving campus**. We encourage you to check out the Digital Student Experience website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: https://www.uwo.ca/health/.

Technical Requirements and Important Dates:

Stable internet connection

Laptop or computer

Working microphone

Working webcam

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
January 11	February 15 - 19	April 12	April 13	April 14 - 30

* March 15, 2021: Last day to drop a second-term half course or a second-term full course without penalty

1. Course Information

- Course name: SS2503B, Advanced Mathematics for Statistical Applications (Term 1209).
- Lecture hours: Mon, Wed, Fri, 1:30-2:30 pm,
- Lecture delivery mode: Online via Zoom

List of Prerequisite(s)
Calculus 2402A/B or (Calculus 2502A/B and Calculus 2503A/B) or (Calculus 2502A/B and Mathematics 2123A/B), Mathematics 1600A/B (or the former Linear Algebra 1600A/B) or Applied Mathematics 1411A/B, Statistical Sciences 2857A/B (or the former Statistical Sciences 2657A), or Economics 2122A/B. In each course a minimum mark of 60% is required.

List of Antirequisite(s)
The former Applied Mathematics 2503A/B.

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

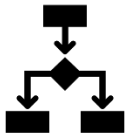| Instructor	Contact Information
Javad Rastegari	jrastega@uwo.ca

Office Hours	Zoom or MS Teams or in Person
TBA (on OWL)	Zoom

- Any changes will be announced on OWL course website.
- Appointments are required for office hours.
- Students must use their Western (@uwo.ca) email addresses with subject line "**SS2503…**" when contacting their instructors or teaching assistants.

3. Course Syllabus, Schedule, and Delivery Mode

This course will consist of two parts. The first part (approximately nine weeks) is on differential equations. It will constitute an introduction to first-order ordinary differential equations (ODEs) and related topics, with emphasis placed on applications. Specific topics include linear and separable differential equations, qualitative analysis and stability, modeling deterministic systems (in particular population growth and savings/investment), and linear systems of ODEs. We will also discuss second-order ODEs, Laplace transforms and moment generating functions. The second part of the course (approximately four weeks) will constitute an introduction to discrete-time Markov chains. Specific topics include the Chapman-Kolmogorov equations, classification of states, stationary distributions and ergodic theorems. If time is permitted, continuous-time Markov chains and the Poisson process will be discussed.

Type	Mode	Dates	Time	Frequency
Lecture	Synchronous online	Mon/Wed/Fri	1:30-2:30 pm	weekly

☒ Lectures will NOT be recorded.
☒ Class notes and annotated slides will be posted after each lecture.

Learning Outcomes

Upon successful completion of this course, students will be able to:
- Solve a variety of first order ODE's and second order linear ODE's.
- Apply differential equations to model deterministic dynamical systems.
- Calculate the Laplace transform and moment generating function.
- Use Laplace transform to solve ODE's.
- Solve basic systems of linear equations.
- Apply Markov chains to model stochastic dynamical systems.

Tentative Table of Contents and Schedule

Week	Dates	Topic
1	Jan 11 – 15	First order equations
2	Jan 18 – 22	First order equations
3	Jan 25 – 29	First order equations, Applications
4	Feb 1 – 5	Second order equations
5	Feb 8 – 12	Second order equations
6	Feb 15 – 19	---- [Reading Week]
7	Feb 22 – 26	Second order equations
8	Mar 1 – 5	Laplace transform
9	Mar 8 –12	Laplace transform
10	Mar 15 – 19	Linear systems
11	Mar 22 – 26	Moment generating functions, Markov chains
12	Mar 29 – Apr 2	Markov chains
13	Apr 5 – 9	Markov chains
14	Apr 12	Markov chains

Solution to practice questions or midterm tests will not be provided. Students can use office hours to ask their questions or review their tests.

Online Participation and Engagement

☒ Students are expected to participate and engage with content as much as possible

☒ Students can also participate by interacting in the forums with their peers and instructors.

4. Course Materials

The first part of the course (Differential equations) is based on the following textbook:

- *Differential Equations with Boundary Value Problems,* 2nd Edition by John Polking, Albert Boggess, and David Arnold, Pearson (ISBN: 9780134689500).

The material for the second part of the course (Markov chains) will be uploaded to OWL.

Students should check OWL (http://owl.uwo.ca) 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. Students are responsible for checking OWL on a regular basis.

All course material will be posted to OWL: http://owl.uwo.ca. Any changes will be indicated on the OWL site and discussed with the class.

If students need assistance, 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.

Google Chrome or Mozilla Firefox are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click here.

5. Methods of Evaluation

Students will be evaluated on the basis of Assignments, two Midterm Tests and a Final Exam. The overall course grade will be calculated as listed below:

Component	Weight	Schedule
Assignments	20%	TBA on OWL
Test 1	20%	TBA by Office of Registrar
Test 2	20%	TBA by Office of Registrar
Final Exam	40%	TBA by Office of Registrar

Assignments: There will be approximately 4 written assignments to be submitted. Details on the setup, submission method and due dates of assignments will be posted on OWL. Note that the number of assignments is subject to change.

Tests and Final Exam: Midterm tests and the final exam will be held online. The exact time of Midterm test and Final exam is scheduled by Office of Registrar and will be announced on OWL. The final exam will be cumulative testing all material covered in the course. To pass the course, students need to complete the final exam. See "Academic Policies" for more details on online examinations.

Click here for a detailed and comprehensive set of policies and regulations concerning examinations and grading.

Accommodated Evaluations
- There will not be any make-up tests. For those who do legitimately miss a midterm test and obtain a valid academic accommodation, the weight of the midterm will be transferred to the remaining tests and final exam. See Section 6 for details on accommodation.
- Late submission of assignments is subject to a late penalty of 25% if submitted within 24 hours of the deadline, and will result in a grade of 0 if submitted later than 24 hours past the deadline. (Unless a valid academic accommodation is obtained. See Section 6 for details on accommodation).

- If you are unable to submit an assignment by the due date/time, you must seek approval for the absence as soon as possible and contact your instructor immediately. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. New deadline (for assignment submission) for those students obtaining such appropriate accommodation will be within 24 hours of the end of the accommodation period. Failure to submit a missed assignment by the new deadline will result in a late penalty of 25% if submitted within 24 hours of the new deadline, and will result in a grade of 0 if submitted later than 24 hours past the new deadline.
- An assessment cannot be submitted after it has been returned to the class. The weight of a legitimately missed assignment will be transferred to the remaining tests and final exam.

Rounding of Marks Statement

Across the Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. *Final grades* on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g. a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

6. Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf
and for the Student Medical Certificate (SMC), see:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation
Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:
https://multiculturalcalendar.com/ecal/index.php?s=c-univwo

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

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 Academic Calendar for details (under Special Examinations).

7. Academic Policies

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

In accordance with policy, http://www.uwo.ca/its/identity/activatenonstudent.html, 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 his/her official university address is attended to in a timely manner.

Participants in this course are **not** permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

Only **non-programmable calculators** may be used for tests and exams. Other electronic devices such as PDA's, cell phones, etc., will be **not** be allowed for exam. Softwares, packages, spreadsheets, online calculators, etc., will **not** be allowed for exam.

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.

Online Examinations

Tests and examinations in this course will be conducted using both Zoom and the remote proctoring service, such as Proctortrack.

When Zoom is used for exam invigilation, **you will be required to keep your camera on for the entire session**, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session using Zoom will not be recorded.*

Proctortrack will require you to provide **personal information** (including some biometric data). The session will be **recorded**. By taking this course, you are consenting to the use of this software.

More information about remote proctoring is available in the Online Proctoring Guidelines at the following link:
https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf

Completion of this course will require you to have a reliable internet connection and a device that meets the system and technical requirements for both Zoom and Proctortrack. Information about the system and technical requirements are available at the following links:
https://www.proctortrack.com/tech-requirements/
https://support.zoom.us/hc/en-us

* Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.

Professionalism & Privacy

Western students are expected to follow the Student Code of Conduct. Additionally, the following expectations and professional conduct apply to this course:

☒ Students are expected to follow online etiquette expectations provided on OWL

☒ All course materials created by the instructor(s) are copyrighted and cannot be sold/shared

☒ Recordings are not permitted (audio or video) without explicit permission

☒ Permitted recordings are not to be distributed

☒ Students will be expected to take an academic integrity pledge before some assessments

☒ All recorded sessions will remain within the course site or unlisted if streamed

Copyright Statement

Please be aware that all course materials created by the instructor(s) are copyrighted and cannot be **sold/shared**. Those include materials used in tests/quizzes, midterms, and finals. Any posting/sharing of such materials in part or whole without owner's consent is considered as violation of the Copyright Act and will be considered as a scholastic offence.

In addition, online services such as Chegg are actively monitored. Any questions that are coming out during midterms and finals and are posted to an online service will be searched. Such an activity will be considered as a scholastic offence and will result in academic penalty.

8. Support Services

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

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 Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

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/.

Learning-skills counsellors at the Student Development Centre (http://www.sdc.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.

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

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