Department of Statistical and Actuarial Sciences

Advanced Mathematics for Statistical Applications, Statistical Sciences 2503B, Section 001

1. Course Information, Winter Term, Year 2022 – 2023

• Course name: SS2503B, Advanced Mathematics for Statistical Applications.
• Lecture hours: Mon, Wed, Fri, 1:30-2:30 pm
• Lecture delivery mode: In person, NCB-113

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.

List of Prerequisites

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 Antirequisites
The former Applied Mathematics 2503A/B.

Senate policy on prerequisites: 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

Instructors	Email	Office	Office Hours
Dr. Mohsen Mollahajiaghaei	mmollaha@uwo.ca	MC 128	Wednesday 11am-1pm

*****Office hours:** Extra office hours may be arranged by appointment.

Email policy

Any email should be sent from the university account (@uwo.ca) and contains
"**Stat2503B**" in **the subject line.** Any email without this, and/or any email sent from other than a UWO email address, risks being directed to spam, deleted unread, or otherwise going missing.

3. Course Syllabus, Schedule, 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.

Important Dates

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
January 9	February 18 - 26	April 10	April 11-12	April 13 – 30

* March 7, 2022: The last day to drop a second-term half course or a second-term full course without penalty.

Learning Outcomes

Upon successful completion of this course, you 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.

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.

Course Content Schedule (Tentative)

Week	Dates	Topic
1	January 9 – 13	First order equations
2	January 16 – 20	First order equations
3	January 23 – 27	First order equations, Applications
4	Jan 30 – Feb 3	Second order equations
5	February 6 – 10	Second order equations
6	February 13 – 17	Second order equations
7	February 18 – 26	Reading Week
8	Feb 27 – Mar 3	Laplace transform
9	March 6 – 10	Laplace transform
10	March 13 – 17	Linear Systems
11	March 20 – 24	Moment generating functions, Markov chains
12	March 27 – 31	Markov chains
13	April 3 – 6, 10	Markov chains

**The above schedule is *tentative*, and minor adjustments may be made as the course progresses. Additionally, lecture content, supplemental notes and suggested exercises corresponding to the various sections of our required text are posted on the OWL site for the course.

Course Design and Expectations

Students are expected to "attend" lectures by completing various activities (reading prescribed sections of the text, for example). A list of suggested exercises from the text will be provided to supplement the weekly lessons. The evaluations (assignments, test, and exam) are based on the course material distributed in this manner.

Students are responsible for checking the course OWL site (http://owl.uwo.ca) on a regular basis for news and updates. Any changes will be indicated on the OWL site and discussed with the class.

If you need assistance, seek support on the OWL Help page. Alternatively, you 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.

Technical Requirements for the Course

- Laptop or computer
- Stable internet connection
- Working microphone
- Working webcam
- Device for scanning (either a scanner or an application that can be used in conjunction with your device's camera).

5. Methods of Evaluation

Below is the summary of graded assessment. Any deviations from this schedule will be communicated and the schedule should be considered tentative until confirmed.

Assessment	Format	Weighting	Date
Assignments	Online	4 Equally weighted assessments totaling 16% of the course grade	TBA
Midterm Test 1	In-person	22%	Saturday, Feb 11, 1 – 3 PM
Midterm Test 2	In-person	22%	Saturday, March 18, 1 – 3 PM
Final Exam	In-person, synchronous	40%	TBA (during the exam period)

Other Information About Tests and Examinations:

- The midterm tests and final exam will be in-person. Virtual proctoring will be employed on the midterm test and the final exam if the course will be run online, otherwise, the test and final exam will be held in classrooms.

- The midterm test will be 120 minutes in duration and will consist of a mixture of short answer and multiple-choice-style questions. *These will be a closed book test.*

- The final exam will be 180 minutes in duration and will consist of a mixture of short answer and multiple-choice-style questions. *This will be a closed book exam.*

- For multiple choice components of tests and the exam: use may be made of software to check for unusual coincidences in answer patterns that may indicate academic integrity violations.

- The use of communication devices (except of what will be indicated in test and exam instructions) during the test and final exam **is prohibited**.

- Missing a test, the final exam, or the due date of a submitted assignment will result in a grade of zero unless appropriate permission is sought and granted. In that case, your mark may be re-weighted, or a makeup evaluation may be arranged.

Communication and Participation

- Students are responsible for monitoring the OWL site(s) for the course and should aim to check for updates every day or two.
- Important updates and announcements will be provided via OWL.
- The course staff will monitor email regularly and reply as promptly as possible, and all students are required to do the same.
- Students are strongly encouraged to post questions about the lessons or homework on the site forum.

Other Helpful Suggestions:

- Success in this course requires some self-direction and independence. In addition to routine practice, students should set aside time each week to try and generate and review their own questions about the course material.
- Always remember to ask questions frequently. If you are struggling with the material, contact your instructor (or teaching assistant(s)).

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 work worth less than 10% of the total course grade, i.e., for assignments and quizzes, you may ask your instructor for a one- or two-days extension in case of illness or other legitimate reasons. For prolonged illness or other circumstances, you should provide valid medical or supporting documents to the Academic Counselling Office. In such a case, if a period of accommodation covers most of time assignment for an assessment, you might be granted an excuse from a quiz or assignment and reweighting of the remaining assessments. Note that this policy can not be applied for the midterm test and final examination.

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.

If a student is granted an academic accommodation from the Academic Counselling Office, then the student will be eligible to take a make-up midterm test of final exam.

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).

Note: missed work can *only* be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is **not** sufficient on its own.

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://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.

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.

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.

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.

The Remote Proctoring Software may be used in this course, including in the event of health lock-down. In such a case, the midterm test and final examination 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.

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/.