

**MATH 494 (MAST 661/MAST 881) Sec. II**  
Topics in Pure & Applied Mathematics - Numerical Analysis II  
*Winter 2023*

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**Office Hours:** TBA

**Class Schedule:** Tuesdays and Thursdays, 14:45-16:00, LB 759-6 SGW.

**Outline:** This course will illustrate some of the most popular numerical methods used to solve linear algebra problems and differential equations. On the linear algebra side, problems of interest include solving linear systems, computing eigenvalues, and matrix factorizations. On the differential equations' side, the course will present methods for solving ordinary and partial differential equations such as Euler's method, Runge-Kutta, finite differences, and finite elements. The course includes a computational component in MATLAB/Octave language.

**Main textbooks:** *Numerical linear algebra*, by Lloyd N. Trefethen and David Bau III. SIAM, 1997.  
<https://concordiauniversity.on.worldcat.org/oclc/1325661411>

*Scientific computing with MATLAB and Octave*, by Alfio Quarteroni, Fausto Saleri, and Paola Gervasio. Springer, 2006.  
<https://concordiauniversity.on.worldcat.org/oclc/871540072>

*Numerical Analysis*, by Richard L. Burden, J. Douglas Faires and Annette M. Burden, 10th Edition, Cengage, 2016. (The 9th Edition of the textbook is also appropriate)  
<https://www.cengage.com/c/numerical-analysis-10e-burden-faires-burden/9781305253667/>

**Auxiliary books:** *Numerical Models for Differential Problems*, by Alfio Quarteroni. Springer, 2009  
<https://concordiauniversity.on.worldcat.org/oclc/1007295772>

*Finite Difference and Spectral Methods for Ordinary and Partial Differential Equations*, by Lloyd N. Trefethen, unpublished text, 1996  
<http://people.maths.ox.ac.uk/trefethen/pdetext.html>

*Matrix Computations*, by Gene Golub and Charles F. Van Loan. JHU press, 2013.  
<https://concordiauniversity.on.worldcat.org/oclc/824733531>

*Applied Numerical Linear Algebra*, by James W. Demmel. SIAM, 1997.  
<https://concordiauniversity.on.worldcat.org/oclc/36900821>

**Pre-requisites:** Numerical Analysis (MATH 354/MAST 334) or equivalent. Good command of basic linear algebra.

**Assignments:** Homework will contain both theoretical and computational problems.

**Exams:** There will be no exams. Instead, students will be required to complete an independent project on a topic approved by the instructor and based on research papers in the field. The project will be presented in the form of an oral presentation *and* submitted as a written report. The focus of the project can be theoretical or computational, based on student's background and interests.

**Grading Scheme:** 30% Homework assignments + 70% Project (proposal, oral presentation, written report).

PhD students will be required to do additional work (to be determined) compared with their MA/MSc classmates.

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

**Communication:** Communication between the students and the instructor will take place in class, via Moodle announcements, or emails. Students are responsible for reading and taking note of all electronic communication from the instructor and the University.

### **Academic Integrity and the Academic Code of Conduct**

This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: [concordia.ca/students/academic-integrity](http://concordia.ca/students/academic-integrity)." [*Undergraduate Calendar, Sec 17.10.2*]

### **Use of Zoom**

**Note: Zoom is included as an institutionally-approved technology. This means we have been assured of the privacy protections needed to use freely within the classroom)**

Zoom might be used in this course to facilitate learning at a distance. It may be used to record some or all of the lectures and/or other activities in this course. If you wish to ensure that your image is not recorded, speak to your instructor as soon as possible.

Also, please note that you may not share recordings of your classes and that the instructor will only share class recordings for the purpose of course delivery and development. Any other sharing may be in violation of the law and applicable University policies, and may be subject to penalties.

### **Behaviour**

All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the [Code of Rights and Responsibilities](#) which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

### **Intellectual Property**

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the [Academic Code of Conduct](#) and/or the [Code of Rights and Responsibilities](#). As specified in the [Policy on Intellectual Property](#), the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

### **Extraordinary circumstances**

In the event of extraordinary circumstances and pursuant to the [Academic Regulations](#) the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.