

MATH*2090*FDE: Matrix Methods and Differential Equations

Fall 2020

Lectures: T, Th 13:00-14:30

Labs: F 13:00-14:00

Lecture Room: N/A (Zoom)

Lab Room: N/A (Zoom)

Instructor: Dr. George Hutchinson

Office Hours: M 13:00-14:00

T 15:00-16:00

(or by appointment)

E-mail: ghutchi1@lakeheadu.ca

Office: N/A (Zoom)

Course Summary

This course will cover topics in the areas of differential equations and matrix theory. Areas of study include: Matrix algebra, determinants, and systems of linear equations; eigenvalues, eigenvectors, and diagonalization; separable and linear ordinary differential equations (ODEs) with constant coefficients; Laplace transforms; systems of linear ODEs; Fourier transforms and Fourier series.

See page 3-4 for a more detailed schedule of topics that we will be covering.

Course Materials

Website: Our Lectures/Labs will take place over Zoom, at the scheduled times (above). The Zoom link is posted on our D2L (Courselink) site, under Course Materials. Courselink will also be the location that grades and important course information will be posted. You are expected to check this website regularly for announcements and materials that you will need to have with you during lecture.

(The website can be found at: www.mycourselink.lakeheadu.ca.)

Required Textbook & Supplementary Material:

Differential Equations and Linear Algebra, by Gilbert Strang

Descriptions of Course Components

Lecture: While I will not be taking attendance, you are strongly encouraged to come to lecture. As we will not be strictly adhering to the textbook, the lectures will be the primary source of material. As well, there will often be important information regarding assignments and tests conveyed in lecture.

NOTE: Prior to each lecture, I will upload a document consisting of partially complete notes for that class. You are expected to bring these notes to lecture, and we will fill them in together.

Lab: While the purpose of the lectures is to introduce new material and discuss mathematical theory, it is in the lab that we will apply the lecture material to solve problems. The notes from these sessions should prove invaluable to you as you work through your online assignments and study for your tests and exam.

Assignments: There will be one online WeBWorK assignment activate from Wednesday to Tuesday each week, except for Week 13,14, and 6 (Fall Study Break Week). While there is a total of 11 assignments, only your best 10 assignments will be graded. A link to WeBWorK can be found on our course website, under "Content".

NOTE: *I am dropping your lowest assignment mark to account for one missed assignment. If more than one assignment must be missed for a legitimate reason which you can document (e.g. doctor's note), the weight of the assignment(s) will be added to the final exam. **Under no circumstances will late assignments be accepted!***

Term Tests: There will be two Term Tests, written during Lecture. These are scheduled for **October 8th** and **November 3rd**. Test #1 will cover Weeks 1-5 and Test #2 will cover Weeks 1-9 with a strong emphasis on Weeks 6-9.

NOTE: *If a term test is missed for a legitimate reason which you can document (e.g. doctor's note), the weight of the test will be added to the final exam.*

Final Exam: There will be a cumulative final exam, the date and time of which will be announced as soon as it is scheduled.

Course Schedule:

We will adhere to the following schedule to the best of our abilities. It may be subject to minor changes due to unforeseen delays and/or expedition.

Week	Topics Covered	Evaluation
W1 Sept 07 – Sept 11 (Classes begin Sept 08)	<u>Introduction to DEs:</u> Basic Definitions and Properties; Direction Fields	WebWork Assignment 1 active Sept. 9-Sept 15
W2 Sept 14 – Sept 18	<u>First Order DEs:</u> Linear Equations; Separable Equations; Exact Equations;	WebWork Assignment 2 active Sept.16 -Sept. 22
W3 Sept 21 – Sept 25	<u>First Order DEs:</u> Substitutions; Intervals of Validity; Applications of First Order DEs	WebWork Assignment 3 active Sept. 23 – Sept. 29
W4 Sept 28 – Oct 02	<u>Second Order DEs:</u> Introduction to 2 nd Order DEs; Real Roots; Complex Roots; Repeated Roots; Reduction of Order	WebWork Assignment 4 active Sept. 30 – Oct. 06
W5 Oct 05 – Oct 09	<u>Second Order DEs:</u> Fundamental Sets of Solutions and the Wronskian	Term Test #1: In class Oct. 08 WebWork Assignment 5 active Oct. 07 – Oct. 13
W6 Oct 12 – Oct 16	STUDY WEEK ENJOY THE BREAK!	None
W7 Oct 19 – Oct 23	<u>Second Order DEs:</u> Nonhomogeneous DEs; Method of Undetermined Coefficients; Variation of Parameters; Applications of 2 nd Order DEs <u>Laplace Transforms:</u> Introduction to Laplace Transforms; Inverting the Laplace Transform	WebWork Assignment 6 active Oct. 21 – Oct. 27
W8 Oct 26 – Oct 30	<u>Laplace Transforms:</u> Solving DEs using Laplace Transforms; Step Functions and Dirac Functions; Applications of Laplace Transforms	WebWork Assignment 7 active Oct. 28 – Nov. 03

<p style="text-align: center;">W9 Nov 02 – Nov 06</p>	<p>Matrix Theory: Systems of Linear Equations; Gauss-Jordan Elimination</p>	<p style="text-align: center;">Term Test #2: In class Nov. 03</p> <p>WeBWork Assignment 8 active Nov. 04 – Nov. 10</p>
<p style="text-align: center;">W10 Nov 09 – Nov 13</p>	<p>Matrix Theory: Basic Matricial Definitions and Operations; Matrix Inversion; The Determinant and its Properties</p>	<p>WeBWork Assignment 9 active Nov. 11 – Nov. 17</p>
<p style="text-align: center;">W11 Nov 16 – Nov 20</p>	<p>Matrix Theory: Eigenvalues and Eigenvectors; Diagonalization</p> <p>Systems of Differential Equations: Introduction to Systems of DEs; Phase Portraits</p>	<p>WeBWork Assignment 10 active Nov. 18 – Nov. 24</p>
<p style="text-align: center;">W12 Nov 23 – Nov 27</p>	<p>Systems of Differential Equations: Systems of DEs with Real Eigenvalues; Systems of DEs with Complex Eigenvalues; Systems of DEs with Repeated Eigenvalues</p>	<p>WeBWork Assignment 11 active Nov. 25 – Dec. 01</p>
<p style="text-align: center;">W13 Nov 30 – Dec 04</p>	<p>Fourier Series: Introduction to Fourier Series and Their Application to ODEs and PDEs</p>	<p style="text-align: center;">None</p>
<p style="text-align: center;">W14 Dec 07 – Dec 11 (Classes end December 07)</p>	<p style="text-align: center;">None</p>	<p style="text-align: center;">None</p>

Evaluation

Your final grade will be comprised of the following components, weighed as indicated:

20% Weekly Assignments (Best 10 out of 11)

20% Term Test 1

20% Term Test 2

40% Final Exam

Course Learning Outcomes:

Upon successful completion of this course, the student will have demonstrated the ability to:

- Identify the properties of a given differential equation, including: Linearity; homogeneity; order; separability; etc.
- Solve many types of first and second order DEs, using a variety of methods.
- Use the Laplace transform to solve a given differential equation.
- Apply Gaussian-elimination to solve linear systems and calculate the inverse of a given matrix.
- Apply the theory of eigenvalues to solve systems of differential equations
- Use Fourier Series to determine the solution of a given ODE or PDE.

Lakehead-Georgian Policies

Academic and Student Code of Conduct Policies:

- Academic and student policies and procedures for those enrolled in the Lakehead-Georgian programs can be found on the [Lakehead-Georgian Student Portal](#).
- All Lakehead-Georgian programs will follow the Lakehead Regulations as list in the Lakehead University [Academic Calendar](#) (http://csdc.lakeheadu.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&loaduseredit_s=False).The University Regulations include but are not limited to Registration, Examinations, Reappraisals and Academic Appeals, Special Examinations, Academic Misconduct, Withdrawal, and Timely Feedback. Additional Faculty Regulations may also apply. Please review the Academic Calendar.
- The Lakehead University [Student Code of Conduct - Academic Integrity](#) (<https://www.lakeheadu.ca/students/student-life/student-conduct>) will apply to all Lakehead-Georgian students regardless of campus of study.
- The Lakehead University [Student Code of Conduct - Appeals](#) (<https://www.lakeheadu.ca/students/student-life/student-conduct>) will apply to all Lakehead-Georgian students regardless of campus of study.
- The Georgian College [Student Code of Conduct](#) (<http://www.georgiancollege.ca/student-code-of-conduct/>) will apply to the Lakehead-Georgian students studying at the Barrie campus. Additional campus policies of [Sexual Violence Procedure and Protocol](#) (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/sexual-violence>), Alcohol, Drugs and Tobacco (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/alcohol-drugs-and-tobacco>), and [Information Technology Acceptable Use Procedure](#) (<http://www.georgiancollege.ca/wp-content/uploads/2-117IT-acceptable-use.pdf>) also apply.

- The Lakehead University [Student Code of Conduct – Non-Academic](https://www.lakeheadu.ca/students/student-life/student-conduct) (<https://www.lakeheadu.ca/students/student-life/student-conduct>) will apply to the Lakehead-Georgian students studying at the Orillia campus.

Plagiarism and academic dishonesty: A breach of Academic Integrity is a serious offence. The principle of Academic Integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should view the [Student Code of Conduct -Academic Integrity](https://www.lakeheadu.ca/students/student-life/student-conduct) (<https://www.lakeheadu.ca/students/student-life/student-conduct>) for a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.

Student Services and Support

Student Advisors (<https://georgiancollege.sharepoint.com/sites/student/Student-Services/StudentAdvisors/SitePages/Home.aspx>)

- Help students build both academic and personal resilience so that they can flourish at Georgian and beyond
- Provide individual, group and web-based advising sessions
- Are housed within the academic areas
- To book an appointment with your advisor go to the **Student Portal (preferred)** or call **705-728-1968 Ext. 1307**

Library (<http://library.georgiancollege.ca/main>)

Customer Service

- Off campus access

Research help

- Help finding books, articles and credible sources.
- Using specialty databases.
- Creating a search strategy.

Academic Success (<https://library.georgiancollege.ca/help/contact-academic-success>)

Writing Centre (http://library.georgiancollege.ca/writing_centre)

- Improve your writing.
- Help with citing sources and laying out your paper.

Math Centre (http://library.georgiancollege.ca/math_centre)

- Make sense of math questions.
- Understand concepts and develop skills.

Tutors (<http://library.georgiancollege.ca/tutoring>)

- Further understand course content.
- Build your study practices.

Accessibility Services (<https://www.georgiancollege.ca/student-life/student-services/accessibility-services/>)

If you are a student experiencing a disability who may require academic accommodations and have not yet registered with Accessibility Services, please contact their office at 705-722-1523, email studentsuccess@georgiancollege.ca, or visit their offices in B110. You must be registered with Accessibility Services to access academic accommodations. Support for those students whose success at college may be affected by a disability include:

- Ongoing support from our Accessibility Advisors including arranging a confidential psychoeducational assessment where required
- Training in the use of specialized computer technology
- Classroom and test accommodations

Testing Services (<http://www.georgiancollege.ca/student-life/student-services/testing/>)

- Accommodated testing
- Missed/Makeup testing
- Proctoring services are also available for external and Ontario Learn exams

Counselling (<http://www.georgiancollege.ca/student-life/student-services/counselling/>)

- Free, confidential counselling is available to all students
- Walk in counselling is available on a daily basis Monday to Friday

Career Success (<http://www.georgiancollege.ca/student-life/student-services/co-op-and-career-services/>)

Career assessments and exploring options

- Job search workshops
- Labour market information
- Resume/cover letter help
- Interview practice
- Graduate employment information
 - Links to job postings and online resource

Campus Safety and Security Syllabus Addendum

Emergency Evacuation (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire>)

- Evacuate buildings when a fire alarm is activated or an official announcement is given. Review [evacuation guidelines](https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire). (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/fire>)
- Students requiring assistance in emergency situations must inform their faculty during the first week of class.
- Familiarize yourself with all fire exit doors of classrooms and buildings you may occupy.

- Do not re-enter a building until instructions are given by the Fire Department or college personnel.

Lockdown (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/lockdown>)

- Lockdown is initiated when there is a potential or actual violent incident on campus that could result in a serious injury or threat to life.
- Students can download the new Safe@Georgian app to stay updated on Campus Safety and Security information including lockdown.
- Familiarize yourself with the [College Lockdown procedure](https://www.georgiancollege.ca/wp-content/uploads/Lockdown.pdf) (<https://www.georgiancollege.ca/wp-content/uploads/Lockdown.pdf>)
- Lockdown tests occur each semester.

Resources:

- [Get Out, Hide, Fight Lockdown Video](http://youtu.be/JA8cckMbVDk) (<http://youtu.be/JA8cckMbVDk>)
- [Lockdown quick reference sheet](http://www.georgiancollege.ca/wp-content/uploads/COM-15-416_LockdownProcedure_Signage_FVR3_print.pdf) (http://www.georgiancollege.ca/wp-content/uploads/COM-15-416_LockdownProcedure_Signage_FVR3_print.pdf)
- Lockdown Model – Get Out, Hide, Fight: Lockdown Tools and Tactics and FAQs.

Unscheduled Campus Closure (<https://www.georgiancollege.ca/about-georgian/campus-safety-services/tab/campus-closures>)

Resources:

- [How to find out if your campus is closed](http://www.georgiancollege.ca/about-georgian/campus-safety-services/#how-to-find-out-if-your-campus-is-closed) (<http://www.georgiancollege.ca/about-georgian/campus-safety-services/#how-to-find-out-if-your-campus-is-closed>)
- [Unscheduled Campus Closure Procedure](https://www.georgiancollege.ca/wp-content/uploads/2-102Unscheduled-college-closure-2018.02.10.pdf) (<https://www.georgiancollege.ca/wp-content/uploads/2-102Unscheduled-college-closure-2018.02.10.pdf>)

Timing of Closures/Notification:

Closure	Decision	Communication / Notification *	Notes
College has made the decision to close a campus or location <u>in the morning</u>:	6:00 a.m.	By 6:30 a.m.	If re-opening for noon or evening classes is being considered, this will be mentioned in the message
College closes a campus(s) in the morning and <u>expects to re-open by 12:00 noon</u>	9:30 a.m.	By 10:00 a.m.	Only affects classes beginning at 12 noon or later
Closure expected to continue <u>past 12:00 noon</u>	9:30 a.m.	By 10:00 a.m.	
College intends to <u>re-open for evening classes</u> which commence at 5 p.m. or later	2:30 p.m.	By 3:00 p.m.	
College intends to <u>NOT re-open for evening classes</u>:	2:30 p.m.	By 3:00 p.m.	

**Notification will be made via:*

- Georgian social media (Facebook, Twitter)
- Safe@Georgian app
- Georgian website (homepage)
- Recorded message when you call into Barrie campus at 705-728-1968
- Student or employee portal
- Georgian email account
- Radio and television announcements through local and regional media

Note: We only announce the names of campuses that are closed. If your campus is not named in a closure, it's open.
