MATH*3100 Differential Equations II

Winter 2020
Section(s): C01

Department of Mathematics & Statistics
Credit Weight: 0.50
Version 5.00 - January 20, 2020

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1 Course Details

1.1 Calendar Description

This course continues the study of differential equations. Power series solutions around regular singular points including Bessel equations are presented. First order linear systems and their general solution by matrix methods are thoroughly covered. Nonlinear systems are introduced along with the concepts of linearization, stability of equilibria, phase plane analysis, Lyapunov's method, periodic solutions and limit cycles. Two-point boundary value problems are discussed and an introduction to linear partial differential equations and their solution by separation of variables and Fourier series is given.

Pre-Requisites: (1 of MATH*1160, MATH*2150, MATH*2160), (MATH*2170 or MATH*2270)

1.2 Course Description

This course utilizes the concepts from your first differential equations course in order to extend these concepts. The main goals of the course are (1) the extension of power series solutions to discuss irregular singular points, (2) then extension of single differential equations to systems of linear differential equations and phase portraits, (3) a study of nonlinear differential equations, linearization, and Lyapunov functions, (4) the possibility of periodic solutions and limit cycles and (5) an introduction to partial differential equations. The objective of the course is to give you a strong background in ordinary differential equations that you will require as you progress through your degree (and beyond), as well as to introduce you to partial differential equations and their role in mathematics.

1.3 Timetable

Timetable is subject to change. Please see WebAdvisor for the latest information.

Lectures		
Monday	8:30am-9:20am	CRSC*116
Wednesday	8:30am-9:20am	CRSC*116

Friday	8:30am-9:20am	CRSC*116
Tutorials		
Wednesday	4:30pm-5:20pm	CRSC*116

1.4 Final Exam

Saturday, April 18, 2020 from 7:00pm-9:00pm. Location to be announced on Courselink and in class.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Kimberly Levere
Email: klevere@uoguelph.ca
Telephone: +1-519-824-4120 x56908
Office: MACN 539
Office Hours: Dates and times are as follows:

Wednesday	11:30am-12:30pm	MACN*539

2.2 Teaching Assistant

John Dewhurst

Office Hours: Monday and Friday 10:00-11:00am in MacNaughton 536

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3 Learning Resources

3.1 Required Resources

Course Manual (Textbook)
*K. Levere, MATH*3100 – Differential Equations II - Course Manual (2nd Edition)*, available at the MacNaughton Book Store. This is the primary resource for the course and functions as the course notes that we will complete together in class as the course progresses. Please be sure that you have the current version, the 2nd edition, (only available in the MacNaughton bookstore) as a number of changes have been made since the last edition.

3.2 Recommended Resources

Elementary Differential Equations and Boundary Value Problems (Textbook)
Boyce, DiPrima & Meade. Any edition is fine; the newest is the 11th. Since I have only

taught this course once, I haven't yet amassed many practice questions. I will post everything I have, but I don't believe that it is enough practice to master the concepts of the course. I will suggest problems from this textbook to supplement the questions that I have created to ensure that you have plenty of practice problems to work with.

3.3 Course Website

Course material, news, announcements, and grades will be regularly posted to the MATH*3100 Courselink website. You are responsible for keeping up-to-date on this site

3.3 Additional Questions/Tests/Exams

Past tests, supplementary questions, and other resources may be posted on the Course website as needed. Again, it is important that you check regularly to keep up-to-date.

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4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Identify ordinary, regular and irregular singular points and find power series solutions where possible.
2. Solve linear homogeneous systems of ODEs, draw their phase portraits, and analyze their stability.
3. Solve linear non-homogeneous systems of ODEs.
4. Solve first-order autonomous nonlinear systems of ODEs via linearization, draw local and global phase portraits and classify local stability.
5. Utilize Lyapunov functions to classify global stability of equilibria.
6. Identify the existence or non-existence of periodic solutions and limit cycles.
7. Solve the heat equation via separation of variables.
8. Present small theoretical proofs regarding existence and uniqueness and other relevant properties.
9. Have a strong understanding not only of HOW to solve a problem, but why the technique works and how it was developed.

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5 Teaching and Learning Activities

(schedule is approximate and subject to change depending on time constraints)

5.1 Lecture

When	Topic
Weeks 1-3	Power Series Solutions to ODEs
Weeks 4-7	Systems of First-Order Linear ODEs
Weeks 8-10	Systems of First-Order Autonomous Nonlinear ODEs
Week 11	Periodic Solutions and Periodic Orbits
Week 12	Introduction to Partial Differential Equations

5.2 Tutorials

A weekly lab session will give you the opportunity to tackle tougher problems or extra practice questions or even brand new, related concepts. I may also use this time to cover course material directly from the Course Manual. It is your responsibility to obtain completed notes from lab tutorials if you cannot attend as these will not be posted online unless otherwise specified. Material covered is fair game for testing or assignments.

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Quiz #1	5
Quiz #2	5
Quiz #3	5
Term Test 1	20
Term Test 2	20
Final Exam	45
Total	100

6.2 Assessment Details

Quiz #1 (5%)

Date: Wed, Jan 22, 4:30 PM - 5:00 PM, CRSC*116 (in lab)

Quiz #2 (5%)
Date: Wed, Feb 26, 4:30 PM - 5:00 PM, CRSC*116 (in lab)

Quiz #3 (5%)
Date: Wed, Mar 25, 4:30 PM - 5:00 PM, CRSC*116 (in lab)

Term Test 1 (20%)
Date: Wed, Feb 5, 4:30 PM - 5:50 PM, CRSC*116
*Note that your lab time has been extended to 5:50pm to give you adequate time to complete your term test.

Term Test 2 (20%)
Date: Wed, Mar 11, 4:30 PM - 5:50 PM, CRSC*116
*Note that your lab time has been extended to 5:50pm to give you adequate time to complete your term test.

Final Exam (45%)
Date: Sat, Apr 18, 7:00 PM - 9:00 PM, TBA
TBA on Courselink and in class.

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7 Course Statements

7.1 Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor at the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

7.2 Missed Assessments

Missed tests will receive a grade of 0%, unless they are missed due to any of the above reasons, in which case the weight of the missed test will be added to the final exam. There will be no makeup tests.

7.3 Other Important Dates

First day of classes: Monday, January 6th, 2020.
Reading Week: Monday, February 17th, 2020 - Friday, February 21, 2020. (no classes)
Last day of regularly scheduled classes: Friday, April 3rd, 2020.

Good Friday: Friday, April 10th, 2020 (no exams scheduled)

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared

responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars
