University of Alberta
Department of Mathematical & Statistical Sciences

Math 334 Section A1
Introduction to Differential Equations
Fall Semester, 2020

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Online Office Hours: Mondays 6:00 – 8:00 pm, Thursdays 6:00 – 7:00 pm, or by appointment.

Lectures: **There will be no live lectures. Lecture notes will be posted on eClass**

Textbook: *Elementary Differential Equations and Boundary Value Problems,* 11th Ed, by W. E. Boyce and R. C. DiPrima

Course Web Page: eClass website

Course Description:

First order equations, linear equations of higher order. Power series solutions. Laplace transform methods. Introduction to linear systems. Applications of Differential Equations. Mechanical systems.

Course Prerequisites:

MATH 125 or 127 and one of MATH 209, 214 or 217.
Note: This course may not be taken for credit if credit has already been obtained in MATH 201.

It is important to prepare yourself for this course through a review of the prerequisite material. Students who do not have the required prerequisites at the time of taking this course should not expect supplementary professorial tutoring from the instructor.

Course Objectives and Expected Learning Outcomes:

Students are expected to understand the basic concepts and terminologies of differential equations such as order, linear or nonlinear, constant or variable coefficients, the general solution and a particular solution. Students are expected to be able to solve analytically the following important types of differential equations: first order differential equations, linear differential equations of constant coefficients using the method of characteristic equations (for homogenous equations) and methods of undetermined coefficients and variation of parameters (both for inhomogeneous equations), certain class of linear differential equations of variable coefficients using series solutions, coupled systems of linear equations of constant coefficients. Students are also expected to learn the method of Laplace Transform and how to use it to solve initial value problems of linear differential equations of constant coefficients. Students are expected to be able to apply the theory of differential equations to understand different behaviours in linear oscillators. Evaluation of learning outcomes will be based on a student's ability in solving important classes of differential equations correctly using standard methods.

Grade Evaluation:
The course mark will be calculated based on the following breakdown:

Course Components	Weight	Date
Assignments	15%	Due on Fridays before 5:00 pm on Assign2
Midterm Exam	35%	October 14, Wednesday, online. Time: TBA
Final Exam	50%	December 14, Monday, online. Time: TBA

Note: The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this document. Students must verify this date on BearTracks when the Final Exam Schedule is posted.

The final letter grade will be determined based on the course mark. An overall course mark of 50% or more guarantees a passing grade of at least D. An overall course mark of 90% or more guarantees a grade of at least A-.

Grades are unofficial until approved by the Department and/or Faculty offering the course.

Assignments and Exams:

Weekly homework assignments and solutions will be posted on the eClass website as they become available. Homework assignments are due on **Fridays by 5:00 pm on Assign2**. No late assignments are accepted. Due to the large class size, the grader will be instructed to choose up to one third (1/3) of the questions to mark from each assignment. The selection of the questions to be marked can be random, and a student's grade for an assignment will be based on the mark obtained for the questions selected by the grader. Solutions to all homework questions will be posted after each homework is due.

Homework and Exam questions will be a **mixture of short-answer, multiple-choice, and long-answer formats.**

Note: Some of you might have used CrowdMark for homework submission in the past. For cast-saving reasons, we will use Assign2 this term for homework submission.

Past (or Representative) Evaluative Material:

Sample midterm and final exam questions or practice questions will be posted on the eClass website two weeks before the exam.

Calculators and Formula Sheets:

Calculators and formula sheets will **NOT** be allowed for exams.

Missed Exams:

A student who cannot write the midterm exam due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for an excused absence. To apply for an excused absence, a student must inform the instructor within two working days following the scheduled date of the exam missed, or as soon as the student is able, having regard to the circumstances underlying the absence. In all cases, instructors may request adequate documentation to substantiate the reason for the absence at their discretion.

An excused absence is a privilege and not a right; there is no guarantee that an absence will be excused. Misrepresentation of Facts to gain an excused absence is a serious breach of the *Code of Student Behaviour*.

There will be **no deferred midterm examination**. If an excused absence has been granted, then the weight of the midterm exam will be transferred to the final exam.

Missed Final Examination:

A student who cannot write the final examination due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for a deferred final examination. Students who failed at the start of term to request exam accommodations for religious beliefs are expected to follow the normal deferred final examination process. Such an application must be made to the student's Faculty office within two working days of the missed examination and must be supported by a Statutory Declaration or other appropriate documentation (Calendar section 23.5.6). Deferred examinations are a privilege and not a right; there is no guarantee that a deferred examination will be granted. Misrepresentation of Facts to gain a deferred examination is a serious breach of the *Code of Student Behaviour*.

The deferred final examination is scheduled as follows:

Date: **Saturday January 9th, 2021**
Time: **9:00 am** (Edmonton time)
Location: Will be delivered remotely

Re-examination:

A student who writes the final examination and fails the course may apply for a re-examination. Re-examinations are rarely granted in the Faculty of Science. These exams are governed by University (Calendar section 23.5.5) and Faculty of Science Regulations (Calendar section 192.5.3). Misrepresentation of Facts to gain a re-examination is a serious breach of the *Code of Student Behaviour*.

STUDENT RESPONSIBILITIES

Academic Integrity:

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the *Code of Student Behaviour* (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All forms of dishonesty are unacceptable at the University. Any offense will be reported to the Associate Dean of Science who will determine the disciplinary action to be taken. Cheating, plagiarism and misrepresentation of facts are serious offenses. Anyone who engages in these practices will receive at minimum a grade of zero for the exam or paper in question and no opportunity will be given to replace the grade or redistribute the weights. As well, in the Faculty of Science the sanction for **cheating** on any examination will include **a disciplinary failing grade** (NO EXCEPTIONS) and senior students should expect a period of suspension or expulsion from the University of Alberta.

Collaboration on Assignments:

Collaborative learning and collaboration on assignments are encouraged. Each student should write their own solutions. Copying of homework solutions are strictly forbidden.

Every term there are several students who receive academic penalties for copying assignments. Here are some tips to avoid copying on assignments:

1) Do not write down something that you cannot explain to your TA or instructor.
2) When you are helping other students, avoid showing them your work directly. Instead, explain your solution verbally. Students whose work is copied also receive academic sanctions.
3) If you find yourself reading another student's solution, do not write anything down. Once you understand how to solve the problem, remove the other person's work from your sight and then write up the solution to the question yourself. Looking back and forth between someone else's paper and your own paper is almost certainly copying and will result in academic sanctions for both you and your fellow student.
4) If the instructor or TA writes down part of a solution in order to help explain it to you or the class, you cannot copy it and hand it in for credit. Treat it the same way you would treat another student's work with respect to copying, that is, remove the explanation from your sight and then write up the solution yourself.
5) There is often more than one way to solve a problem. Choose the method that makes the most sense to you rather than the method that other students happen to use. If none of the ideas in your solution are your own, there is a good chance it will be flagged as copying.

Exams:

Your student photo I.D. is required at exams to verify your identity. Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must remain in the exam room until at least 30 minutes has elapsed. Electronic equipment cannot be brought into examination rooms and hats should not be worn.

A remote proctoring system will be used for remotely delivered exams.

Cell Phones:

Cell phones are to be turned off during lectures, labs and seminars. Cell phones are not to be brought to exams.

Distribution of Course Materials:

Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Students Eligible for Accessibility-Related Accommodations (students registered with Specialized Support & Disability – SSDS):

Eligible students have both rights and responsibilities with regard to accessibility-related accommodations. Consequently, scheduling exam accommodations in accordance with SSDS deadlines and procedures is essential. Please note adherence to procedures and deadlines is required for U of A to provide accommodations. Contact SSDS (www.ssds.ualberta.ca) for further information.

Student Success Centre:

Students who require additional help in developing strategies for better time management, study skills, or examination skills should contact the Student Success Centre (2-300 Students' Union Building).

Policy about course outlines can be found in section 23.4(2) of the University Calendar.

Disclaimer:
Any typographical errors in this Course Outline are subject to change and will be announced in class.

TENTATIVE COURSE SCHEDULE

Week/Date	Section	Topic	
1. Sept. 1-4	1.1	Basic mathematical models	
	1.2	Solutions of differential equations	
	1.3	Classification of differential equations	
2. Sept. 7-11	2.1	Linear differential equations	
	2.2	Separable equations	
	2.3-2.5	Modeling using 1st order differential equations	
	2.6	Exact equations	
3. Sept. 14-18	2.7	Numerical methods	
	2.8	Existence and uniqueness theorems	
	3.1	Homogeneous equations with constant coefficients	1-
4. Sept. 21-25	3.2	The Wronskian	
	3.3-3.4	Characteristic roots: complex roots and repeated roots	
	3.5	Nonhomogeneous equations: Undetermined coefficients	
5. Sept. 28-Oct. 2	3.6	Nonhomogeneous equations: Variation of parameters	
	3.7-3.8	Mechanical systems	
	4.1	Higher order linear differential equations	
	4.2	Homogeneous equations of constant coefficients	
6. Oct. 5-9	4.3	Non-homogeneous linear equations: undetermined coefficients	
	4.4	Non-homogeneous linear equations: variation of parameters	
7. Oct. 12-16	**Midterm Exam (Wednesday, October 14, Time: TBA)**		
	5.1	Review of power series	
	5.2-5.3	Series solutions near ordinary points	
8. Oct. 19-23	5.4	Euler equations	
	5.5-5.6	Solutions near regular singular points	
	5.7	Bessel's equations	
9. Oct. 26-30	6.1	Laplace transforms and inverse transforms	
	6.2	Solving initial value problems using Laplace transforms	
	6.3	Transform of step functions	
10. Nov. 2-6	6.4	Differential equations with discontinuous forcing functions	
	6.5	Impulse functions	
	6.6	Convolution	
11. Nov. 9-13	**Fall term reading week, no classes**		
12. Nov 16-20	7.4	First order linear systems	
	7.5	Homogeneous systems of constant coefficients	
	7.6	Complex eigenvalues	
13. Nov. 23-27	7.7	Fundamental matrices	
	7.8	Repeated eigenvalues	
14. Nov. 30-Dec.7	7.9	Nonhomogeneous equations	
	Review		
December 14	**Final Exam**	(Monday, Time: TBA, online)	