CONCORDIA UNIVERSITY
FACULTY OF ENGINEERING AND COMPUTER SCIENCE
APPLIED ORDINARY DIFFERENTIAL EQUATIONS - ENGR 213 – section G

Instructor: Dr. Sam Eskandarian
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Lectures: Every TUE and THU 2:45 PM – 4:00 PM
Location: **H 937 SGW**
TA (section, room): Section GA (MON 4:10 – 5:50 PM in **H-521 SGW**) by
Alessio Bressan < alebre16@gmail.com >
Section GB **(**FRI 5:45 – 7:25 PM in **H-607 SGW)** by
Sheze Tabataei < sheze.tb@gmail.com >
Section GC **(**MON 4:10 – 5:50 PM in **H-544 SGW)** by
Mohammad Daneshvar <mohammadrezadaneshvar1994@gmail.com>
Section GD **(**FRI 5:45 – 7:25 PM in **H-513 SGW)** by
Khreis Mamon < khreismamon@gmail.com >
Office hours: Every TUE 9:00 – 11:00 AM (ZOOM: https://concordia-ca.zoom.us/j/6325554501)
In-person meetings can also be scheduled by email reservation.

Course coordinator: Ciprian Alecsandru (ciprian.alecsandru@concordia.ca)
WeBWorK admin: Masood Shamsaiee (webwork.engr@concordia.ca)

Course Description:

This course introduces first year engineering students to the theory of ordinary differential equations and their applications to mathematical models. The main topics include: Basics of general theory of differential equations; special types of first order equations (separable, linear, exact, homogeneous, Bernoulli); linear equations of higher order (homogeneous and non-homogeneous); Cauchy-Euler equations; non-linear equations of second order; systems of linear differential equations; linear and non-linear mathematical models of first and second order.

Lectures: three hours per week. Tutorial: two hours per week. NOTE: Students who have received credit for EMAT 212 and 232 may not take this course for credit. (Prerequisite: MATH 204 (cégep Mathematics 105) previously or concurrently; MATH 205 (cégep Mathematics 203)).

Textbook: Advanced Engineering Mathematics, by Dennis G. Zill, 6th Edition, Jones and Bartlett, 2016.

Grading Scheme:

Midterm exam	20%, (during a tutorial period, 90 minutes)
Assignments (WeBWorK)	10%
Pop-up Quizzes (4)	10% (2.5% each, during lectures, 20 min each quiz)
Final exam	60% (3 hours)
Team projects (2)	5% (2.5% each, teams of 2 students, problems solving during tutorials)

WeBWorK: Every student will be given access to an online system called WeBWorK. Students are expected to submit assignments online using WeBWorK. Late assignments will not be accepted. Assignments contribute 10% to the final grade. Working regularly on the assignments is essential for success in this course. Students are also strongly encouraged to do as many problems as their time permits from the chapters of the textbooks listed below in this outline.

The grading scheme shown above includes 5% bonus.

STUDENTS MUST PASS THE FINAL EXAM (i.e. 50% or better) TO PASS THE COURSE

If a student misses the mid-term test for any reason, including illness, then the final examination will count for 80% of the final grade. Since there is a 5% team projects bonus allocation, there will be no replacements of quizzes for any reason, including illness. Students are responsible for finding out the date of the final exam. The Examination Office posts the time and place of the final exam once the schedule becomes available. Any conflicts or problems with the scheduling of the final exam must be reported directly to the Examination Office. Students are expected to be available until the end of the final examination period. Conflicts due to travel plans will not be accommodated.

PLEASE NOTE: Electronic communication devices **of any type** are not allowed in examination rooms. Only "Faculty Approved Calculators" will be allowed in examination rooms [the two main types are: SHARP EL-531 or CASIO FX-300MS, and the full list can be found at: https://www.concordia.ca/ginacody/aits/calculators.html]

Topics and recommended problems (7th Edition):

Week 1: 1.1 Definition and Terminology; problems: 1,3,5,6,8,12,13,15,16,23,25
1.2 Initial Value Problems; problems: 7,9,11,12,17,18
2.1 Solution curves without a solution; problems: 3, 4, 26, 27
Week 2: 2.2 Separable Equations; problems: 7,9,13,19,25,27
2.3 Linear Equations; problems: 7,9,23,27,31
2.4 Exact Equations, integrating factors; problems: 3,5,9,15,27,29,33
Week 3: 2.5 Solutions by Substitution (Bernoulli, homogeneous, linear substitution); problems: 5,7,9,13,17,19,21,25,27
Week 4: 1.3 Differential Equations as Mathematical Models; problems: 1,2,3,5,7,9,1013,15,16,19
2.7 Linear models (growth/decay, heating/cooling, circuits, mixtures); problems: 3,5,11,17,19,25,27,31,33
Week 5: 2.8 Non-linear models (Population dynamics, logistic equation, chemical reaction, leaking tank); problems: 2,3,13,16,19
[Team Projects to be assigned]
17.1 Complex numbers; problems: 5,1,11,15,19,29,33,35,37,41,45
Week 6: 17.2 Powers and Roots; problems: 3,7,9,15,21,31,33,35
3.1 Theory of Linear Equations; problems: 1,9,23,27
Week 7: 3.3 Homogeneous Linear Equations with Constant Coefficients problems: 3,5,9,13,15,17,21
3.4 Undetermined Coefficients; problems: 1,3,7,11,15,19,23,31
Week 8 **Midterm Exam** (during tutorials) **on material of Weeks 1-6 (excluding section 3.1)**
3.5 Variation of Parameters; problems: 1,15,17,27
3.6 Cauchy Euler Equations; problems: 5,7,11,23,45
Week 9: 3.7 Nonlinear Equations, Reduction of Order; problems: 3,7,9
3.8 Linear Models. Initial Value Problems (mass-spring systems, free motion) problems: 1,7,12,21,31
Week 10: 3.8 Linear Models. Initial Value Problems (driven motion and LRC-circuits) problems: 33,45,47,51
3.11 Non-linear models (telephone wires, rocket motion, pulled rope) problems: 9, 10, 13, 15, 16
[Team Projects to be assigned]

Week 11: 5.1.2 Power Series Solutions; problems: 19,23,29
10.1 Theory of Linear Systems; problems: 1,5,9,20
Week 12: 10.2 Homogeneous Linear Systems; problems: 1,3,7,9,21,31,35,37,48
10.4 Non-Homogeneous Linear Systems; problems: 1,3,7,17,30
Week 13: Review

Students are also responsible for any applicable topics covered in assignments that have not be presented in either the regular lectures or during tutorials.

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

GRADUATE ATTRIBUTES

ENGR213 emphasizes and develops a subset of the graduate attributes and indicators as required by the CEAB (Canadian Engineering Accreditation Board):

ATTRIBUTE	INDICATOR	LEVEL OF KNOWLEDGE
A knowledge base for engineering *Demonstrated competence in university-level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.*	Knowledge-base for specific engineering field	INTRODUCTORY
Problem analysis An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.	Problem identification and formulation	INTRODUCTORY
	Modelling	INTRODUCTORY
	Problem solving	INTERMEDIATE
Individual and team work *An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.*	Cooperation and work ethics	INTRODUCTORY

COURSE LEARNING Outcomes (CLOs)

Upon successful completion of ENGR213, the students will be able to:

- Solve differential equations that will be essential knowledge to many engineering core courses.
- Model from prior knowledge in physics using differential equations. Use various solution methods to extract all the pertinent information *vis-à-vis* the physics and practicality of the problem. This component is examined trough an applied problem in the final exam.
- Learn how to work within a team. This is done through one or two Team Projects.
- Acquire new knowledge by self-study. This is accomplished by making students responsible for certain material on assignments and exams, without being lectured on that specific material.

ADDENDUM - IMPORTANT COURSE RULES:

1. 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 changes.
2. Content belonging to instructors shared in online/in-person 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/in-person 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.
3. Plagiarism:
   The most common offense under the Academic Code of Conduct is plagiarism, which the Code defines as "the presentation of the work of another person as one's own or without proper acknowledgement."
   This includes material copied word for word from books, journals, Internet sites, professor's course notes, etc. It refers to material that is paraphrased but closely resembles the original source. It also includes for example the work of a fellow student, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased from any source. Plagiarism does not refer to words alone –it can refer to copying images, graphs, tables and ideas. "Presentation" is not limited to written work. It includes oral presentations, computer assignments and artistic works. Finally, if you translate the work of another person into any other language and do not cite the source, this is also plagiarism.
   In Simple Words:
   Do not copy, paraphrase or translate anything from anywhere without saying where you obtained it.
   (Source: The Academic Integrity Website: concordia.ca/students/academic-integrity)
4. Virtual Environment Ethics, when applicable:
   It is expected that all participants to virtual, remotely delivered lectures and tutorials abide by the same civil behavior as they are required to do during in-person classes. Unethical behavior or harassment of any kind are not tolerated and will be dealt with in accordance to the Academic Code of Conduct and/or the Code of Rights and Responsibilities.

5. **Examinations:**
   This course will be taught, and all assessments will be in-person. Any subsequent changes will be announced in advanced according to the University regulations.

Please note the following with respect to online exams, when applicable:

- That the exam will take place during the exam period at the designated date and time set by the professor (midterm) or the Exams office (final). All exam times will be set to Eastern Standard/Daylight Time.
- That you are very **strongly recommended** to enter the virtual test site found at the COLE website and become familiar with the software that will be used for your exam before starting the exam.
- That you will need a quiet place within which to take the exam. Earplugs or noise-cancelling headphones that are not connected to a device may also be used to allow you to focus for the duration of the exam.

Students who require additional accommodations for their exams due to a documented disability should contact the Access Centre for Students with Disabilities as soon as possible (acsdinfo@concordia.ca).

If you face issues during the exam, you should inform your professor of those issues immediately. Please note that there are in-exam supports you should spend time getting to know. Visit the COLE website for more information.