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

Instructor:	TBD
Office:	TBD
Email:	TBD
Lectures:	TBD
Location:	TBD
TA (section, room):	TBD
Office hours:	TBD

Course coordinator:	Ciprian Alecsandru (ciprian.alecsandru@concordia.ca)
WeBWorK admin:	Siavash Hedayati Nasab (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 exams (2)	20%, (10% each, during tutorials, 90 min each test)
Assignments (WeBWorK)	10%
Pop-up Quizzes (5)	10% (2% each, during lectures or tutorials, 20 min each quiz)
Final exam	60% (3 hours)
Tutorial team projects (2)	5% (2.5% each,1 hour each project to be solved in teams of 2)

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.

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

If the student misses one mid-term test for any reason, including illness, then the final examination will count for 70% 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 [SHARP EL-531 or CASIO FX-300MS]

Topics and recommended problems:

Week 1: 1.1 Definition and Terminology; problems: 1,3,5,6,8,10,11,13,14,21,23
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: 3,5,9,15,27,29,31
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: 3,5,9,15,17,23,25,29,31
Week 5: 2.8 Non-linear models (Population dynamics, logistic equation, chemical reaction, leaking tank); problems: 2,3,11,13,17
17.1 Complex numbers; problems: 1,3,7,11,15,25,27,29,31,35,39
Week 6: Midterm 1 (during tutorials) **on material of Weeks 1-4**
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: 3.5 Variation of Parameters; problems: 1,13,15,23
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
Week 10: 3.8 Linear Models. Initial Value Problems (driven motion and LRC-circuits) problems: 31,33,45,47,49
3.11 Non-linear models (telephone wires, rocket motion, pulled rope) problems: [Projects to be assigned]
Week 11: Midterm 2 (during tutorials) **on material of Weeks 5-9**
5.1.2 Power Series Solutions; problems: 17,21,27
10.1 Theory of Linear Systems; problems: 1,3,7,18
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.