**CONCORDIA UNIVERSITY**
**GINA CODY SCHOOL OF ENGINEERING AND COMPUTER SCIENCE**
**APPLIED ADVANCED CALCULUS- ENGR 213 – Winter 2023**

## IMPORTANT NOTES

1) **This course outline has THREE pages, with critical and equally important information with regard to this course.**
2) **Please note important implications of the Covid-19 pandemic as may affect the delivery and examination of this course. Such implications will be communicated as the circumstances change during the term.**
3) **Changes to the information in the course outline, if any, will be announced through Moodle may override the course outline information accordingly.**
4) **All materials related to the delivery of this course (live recording and/or pre-recorded lectures, IF applicable; lecture notes; etc. but not the textbook) will be uploaded to the course Moodle website.**

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**Section** :
Lectures:
Professor:
E-mail:
Office Hours:
Tutorials:

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**Course coordinator**: Dr. Emre Erkmen E-mail: emre.erkmen@concordia.ca

**WeBWorK administrator:** Masood Shamsaiee E-mail: masood.shamsaiee@mail.concordia.ca

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**Lectures**: Two and a half hours per week **Tutorial:** Two hours per week

**Prerequisite**: *MATH 204* (cégep Mathematics 105) previously or concurrently; *MATH 205* (cégep Mathematics 203).

**Textbook:** Advanced Engineering Mathematics, by Dennis G. Zill and Warren S. Wright, **7th Edition**[1], Published by Jones and Bartlett.

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**Course Description:** This course introduces Engineering students to the theory and application of ordinary differential equations. Definition and terminology, initial-value problems, separable differential equations, linear equations, exact equations, solutions by substitution, linear models, orthogonal trajectories, complex numbers, form of complex numbers: powers and roots, theory: linear equations, homogeneous linear equations with constant coefficients, undetermined coefficients, variation of parameters, Cauchy-Euler equation, reduction of order, linear models: initial value, review of power series, power series solutions, theory, homogeneous linear systems, solution by diagonalization, non-homogeneous linear systems. Eigenvalues and eigenvectors.

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**Grading Scheme:**

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|---|---|---|---|
| 1. | Assignments (WeBWorK) | 10% | |
| 2. | Pop-up Quizzes | 10% | (during lectures or tutorials, 20 min, 1-2 problems) |
| 3. | Team projects (2) | 5% | (2.5% each, 1 hour; during tutorials in teams of 2 or take home) |
| 4. | Mid-Term exams (2) | 20% | (10% each, during tutorials, 60 min each, see next page for details) |
| 5. | Final exam | 60% | |

**The grading scheme implies 5% bonus. However, the maximum combined mark for the first three components (WebWork + Quizzes + Projects) is 20%.**
**Important Notes:**

[1] Please note that 5th and 6th editions have very minimal difference with the 7th section. Some exercises at the end of each section might have been re-ordered.

- If your total score before the final exam is less than 40% and you decide to defer the final exam, you will receive an ***R*** grade which prevents you to defer the final exam
- In order to pass the class, both your cumulative score and the final examination must be **above 50%**
- In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

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**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 your 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 WeBWorK administrator is Mr. Masood Shamsaiee; email: masood.shamsaiee@mail.concordia.ca, any questions related to WeBWorK assignments should be directed to him.
- **Students are also responsible for topics covered in assignments that have not been presented in either the regular lectures or during tutorials.**

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**General rules:**

- If the student misses one mid-term test for a valid reason, acceptable by the course coordinator, including illness, then the final examination will count for 70% of the total grade. **Students cannot miss both midterms.**
- 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.

**NOTE: Electronic communication devices** (including cellphones) **will not be allowed** during examinations and are prohibited in the examination rooms. Only “Faculty Approved Calculators" will be allowed for midterm and final exams [SHARP EL-531 or CASIO FX-300MS].

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**GRADUATE ATTRIBUTES**

ENGR213 emphasizes and develops the CEAB (Canadian Engineering Accreditation Board) graduate attributes and indicators: Knowledge base for engineering -Problem Analysis (Problem identification, Modeling, Problem solving) -Life-long Learning.

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**COURSE LEARNING Outcomes (CLOs)**

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

- Apply multivariable calculus to engineering problems. Extract all the pertinent information *vis-à-vis* the physics and practicality of the problem. This component is examined through 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 that material being lectured on.

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**Extraordinary circumstances:**

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.

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## Schedule, topics, and recommended problems:

**Week 1 (Sep 6-9):** Review of the following topics:

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 (Sep 12-16):** 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 (Sep 19-23):** 2.5 Solutions by Substitution (Bernoulli, homogeneous, linear substitution); problems: 5,7,9,13,17,19,21,25,27
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 4 (Sep 26-30)** 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 5 (Oct 3-7):** 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 6 (Oct 13-14):** 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 7 (Oct 17-21):** 3.5 Variation of Parameters; problems: 1,13,15,23
3.6 Cauchy Euler Equations; problems: 5,7,11,23,45

**Week 7/8: Midterm 1 (during tutorials)**:

**on material until the end of Week 6**

**Week 8 (Oct 24-28):** 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 9 (Nov -1-4):** 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:

**Week 10 (Nov 7-11):** 5.1.2 Power Series Solutions; problems: 17,21,27

**Week 10/11: Midterm 2 (during tutorials)**:

**on material of until the end of Week 9**

**Week 11 (Nov 15-18):** 10.1 Theory of Linear Systems; problems: 1,3,7,18

**Week 12 (Nov 21-25):** 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 (Nov 28- December 7):** Make-up for any cancelled classes and Revision