CONCORDIA UNIVERSITY
FACULTY OF ENGINEERING AND COMPUTER SCIENCE
APPLIED ORDINARY DIFFERENTIAL EQUATIONS
ENGR 213 – Winter 2016

Course Description: This course introduces first year 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, Preliminary 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, Preliminary Theory, Homogeneous Linear Systems, Solution by Diagonalisation, Non-Homogeneous Linear Systems.
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 and Warren S. Wright, 5th Edition, Published by Jones and Bartlett, 2014.

Grading Scheme:

Midterm exams	20%, 10% each (during the tutorial)
Assignments	10% (handed in and returned during the tutorial)
Final exam	70%

If the grade of the final exam is better than the combined mark of the two mid-term examinations, then it will carry 90% of the final grade. If the student misses a mid-term test for any reason, including illness, then the final examination will count for 90% of the final grade. 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.
(It is proposed to hold the tests during the weeks commencing from Feb.15 and March 14. The exact dates and the syllabus will be made available appropriately)

YOU MUST PASS THE FINAL EXAM TO PASS THE COURSE

PLEASE NOTE: Electronic communication devices (including cellphones) will not be allowed in examination rooms. Only "Faculty Approved Calculators" will be allowed in examination rooms [SHARP EL-531 or CASIO FX-300MS]

Sections Topics

1.1 Definition and Terminology
1.2 Initial Value Problems
2.2 Separable Equations

2.3 Linear Equations
2.4 Exact Equations
2.5 Solutions by Substitution
2.7 Linear Models (Growth and Decay, Newton's Law of Cooling)
17.1 Complex Numbers
17.2 Powers and Roots
3.1 Theory of Linear Equations
3.3 Homogeneous Linear Equations with Constant Coefficients
3.4 Undetermined Coefficients
3.5 Variation of Parameters
3.6 Cauchy Euler Equations
3.7 Nonlinear Equations, Reduction of Order (Examples1, 2)
3.8 Linear Models. Initial Value Problems (Examples 1, 3, 4, 5, 6, 7, 8)
3.9 Linear Models. Boundary Value Problems
5.1.1 Review of Power Series (begin)
5.1.1 Review of Power Series (only radius of convergence)
5.1.2 Power Series Solutions
10.1 Theory of Linear Systems
10.2 Homogeneous Linear Systems
10.3 Solution by Digitalization
10.4 Non-Homogeneous Linear Systems
10.5 Matrix Exponential

Assignments

Assignment 1
Section 1.1: exercises: 1,2,3,5,6,8,10,11,13,14,21,23,24 Section 1.2: exercises: 7,9,11,12,17,18. Section 1.3 exercises: 10, 13.
Assignment 2
Section 2.1: exercises: 3, 4, 26, 27. Section 2.2: exercises: 23, 25, 26. Section 2.3: exercises: 19, 22, 23.
Assignment 3
Section 2.4: exercises: 1, 8, 16, 17, 19, 22, 23. Section 2.5: exercices: 1, 8, 16, 17, 19, 22, 23.
Assignment 4
Section 2.7: exercises 13, 17. Section 2.8: exercises 15, 16, 22.
Assignment 5
Section 3.1 exercises: 1,23,31,34. Section 3.2 exercises: 1, 2,4,17.
Assignment 6
Section 3.3 exercises: 1,2,4,29,31,34,38,41.
Assignment 7
Section 3.4 exercises: 1, 2, 29,31.Section 3.5 exercises: 1,4,22. Section 3.6 exercises: 1,2,4,5.
Assignment 8
Section 3.8 exercises: 1,6, 11, 12, 13.

Assignment 9
Section 5.1 exercises: 17,18, 20,27. Section 6.1 exercices: 1, 2
Assignment 10
Section 10.1: exercises: 5,16,25 Section 10.2: exercises: 2,13,23,37
Assignment 11
Section 10.3: exercises: 2,4 Section 10.4: exercise: 5

In addition there will be one team assignment (to be submitted at an appropriate time). This will be an integral part of the regular assignments.

Tutor: **E-mail:**
Office:

Assignment Marker : **E-mail:**
Office:
(These will be supplied later)

CEAB Graduate Attributes in ENGR 213:

This course emphasizes and develops the following CEAB graduate attributes:

1) **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**.
   Students should be able to take an engineering problem and then formulate from it the underlying mathematical, scientific or engineering science problem. For example, a student learning ordinary differential equations, may have the calculus material driven and illustrated by engineering problems in circuits or mechanics.
2) **Life-long learning: An ability to identify and to address their own educational needs in a changing world, sufficiently to maintain their competence and contribute to the advancement of knowledge.**
   Every technical professional must be able to learn independently. Almost any course in the curriculum could teach, exercise and evaluate this soft skill. For example some instruction could be given on how one can pick out and summarize the important points in a chapter in a textbook. Then students could be told that they are responsible for certain material on an exam, without that material being lectured on
3) **Individual and teamwork: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.**
   Item no. 1 is met partially through the application problems of Applied ODEs to be found in the textbook and course notes for ENGR 213 to be provided by the instructor. Item no. 2&3 will be done through two Team Assignments (over and above to the regular ones).

Students are also responsible for 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.