

CONCORDIA UNIVERSITY
FACULTY OF ENGINEERING AND COMPUTER SCIENCE
APPLIED ORDINARY DIFFERENTIAL EQUATIONS/ ENGR 213/2 Section XX, FALL 2014

Instructor: Dr. Dimiter P. Dryanov

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Lectures for Section XX: Friday from 17:45 to 20:15

Location of the Lectures for Section XX: H-535

Office hours: Monday and Wednesday from 13:30 to 14:30 in LB-915-3

Course coordinator: Dr. Georgios H. Vatistas; Email: vatistas@encs.concordia.ca

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 Diagonalization, Non-Homogeneous Linear Systems.

Lectures: One lecture class per week. **Tutorials:** One tutorial class per week.

Note: Students who have received credit for EMAT 212 and 232 may not take this course for credit.

Prerequisites: MATH 204 (Cégep Mathematics 105) previously or concurrently; MATH 205 (Cégep Mathematics 203).

Texts:

(1) **Advanced Engineering Mathematics**, by Dennis G. Zill and Warren S. Wright, 5th Edition, Published by Jones and Bartlett, 2014.

(2) **Applied Ordinary Differential Equations, Coursepack** by D. Dryanov, Concordia University, 2014. The course pack covers the topics from the Outline of the Course Applied Ordinary Differential Equations, ENGR 213/2, 2014. It contains the basic theory, exercise problems with solutions as well as detailed explanations on different techniques to solve problems.

Grading Scheme:

Midterm exams: 20%, 10% each (during the tutorials)

Assignments: 10% (handed in and returned during the tutorials)

Final exam: 70%

Note: If the grade of the final exam is better than the combined mark of the two mid-term grades, then the grade of the final exam will carry 90% of the final grade. If a student misses a mid-term test for any reason, including illness, then the final examination will count for 90% of the final grade. Note that there is no grading scheme without an assignment grade.

Midterm Tests and Final Exam:

The two midterm tests and the final exam are closed book exams. Any outside materials, books, notes or recorded materials may not be used. The dates for the two midterm tests for Section XX will be announced in class and will be posted on the Moodle site of the Section XX. 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.

YOU MUST PASS THE FINAL EXAM TO PASS THE COURSE

NOTE: Electronic communication devices (including cellphones) will not be allowed in the examination rooms. **Only “Faculty Approved Calculators” will be allowed in the 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 (Examples 1, 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 Diagonalization
- 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: exercises: 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: exercises: 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.

Team Assignment. In addition, there will be **one Team Assignment (to be submitted at an appropriate time)**. The Team Assignment will be an integral part of the regular assignments.

Tutorials, Tutors and Markers:

Subsection XE:

Tutorials, Subsection XE: Friday from 15:45 to 17:25 in H-520

Tutor and Assignment Marker for Subsection XE: Mr. Sadreazami, Hamidreza

Emails: h_sadrea@encs.concordia.ca; sadreazami@gmail.com

Subsection XF:

Tutorials, Subsection XF: Friday from 15:45 to 17:25 in H-420

Tutor and Assignment Marker for Subsection XF: Mr. Yalman, Alain

Emails: a_yalma@encs.concordia.ca; alain.yalman@hotmail.com

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.

- 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 through the application problems of Applied ODEs to be solved in class and tutorials; and to be found in the Course Pack and the Textbook for ENGR 213. Item no. 2&3 will be done through the Team Assignment (over and above to the regular ones).

Students are also responsible for topics covered in the 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.