Concordia University

Faculty of Engineering and Computer Science

Course Outline

ENGR 213 – Applied Ordinary Differential Equations – Winter 2017

INSTRUCTOR:

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Office Hours: W & F from 13:00-14:00
Lectures: W & F from 14:45-16:00 in H-937 (Section W)

COORDINATOR:

Dr. Iman Gohar
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Office Hours: T, W& TH from 12:00-13:30
Lectures: T & TH from 14:45-16:00 in FG-C070 (Section G)

COURSE DESCRIPTION:

This course introduces first-year engineering students to the theory and applications of Ordinary Differential Equations (ODEs). The main topics include: Definitions & Terminology, Initial Value Problems, Separable Differential Equations, Linear Equations, Exact Equations, Solutions by Substitution, First-Order Linear Models, Orthogonal Trajectories, Complex Numbers, Forms of Complex Numbers (Powers & Roots), Theory of Linear Equations, Reduction of Order, Homogeneous Linear Equations with Constant Coefficients, Undetermined Coefficients, Variation of Parameters, The Cauchy-Euler Equation, Nonlinear Equations, Higher-Order Linear Models, Review of Power Series, Power Series Solutions, Theory of Linear Systems, Homogeneous Linear Systems, Solutions by Diagonalization, and Non-Homogeneous Linear Systems.

TEXTBOOK:

Zill, D. G., & Wright, W. S. (2014). ***Advanced Engineering Mathematics*** (5th ed.). Burlington, MA: Jones & Bartlett Learning.

COURSE MATERIAL:

Week	Topic	Text Ref.	Suggested Problems
1	1.1 Definition and Terminology 1.2 Initial Value Problems	pp. 03-12 pp. 12-18	**1.1:** 1, 2, 6,10, 11, 23 **1.2:** 7, 12, 18
2	2.2 Separable Equations 2.3 Linear Equations	pp. 42-49 pp. 50-57	**2.2:** 7, 9, 23,25 **2.3:** 7, 9, 19, 23
3	2.4 Exact Equations 2.5 Solutions by Substitution	pp. 58-64 pp. 64-68	**2.4:** 9, 17, 21, 29, 31 **2.5:** 5, 13, 19, 23, 27
4	2.7 Linear Models 17.1 Complex Numbers 17.2 Powers and Roots	pp. 72-83 pp. 793-796 pp. 796-801	**2.7:** 3, 13, 17 **17.1:** 1, 7,13,23, 33, 37 **17.2:** 1, 7, 11, 17, 21
5	**Midterm 1 on February 5th**		
	3.1 Theory of Linear Equations 3.2 Reduction of Order	pp. 104-115 pp. 115-118	**3.1:** 1, 13, 15, 23 **3.2:** 1, 3, 11, 17, 19
6	3.3 Homogeneous Linear Equations with Constant Coefficients 3.4 Undetermined Coefficients	pp. 118-125 pp. 125-134	**3.3:** 1, 5, 9, 29, 31, 33, 39, 41 **3.4:** 1, 5, 11, 15, 23, 29, 31
7	3.5 Variation of Parameters 3.6 The Cauchy Euler Equation	pp. 134-139 pp. 139-145	**3.5:** 1, 5, 7, 19 **3.6:** 1, 5, 11, 19, 21
8	**Midterm Break**		
9	3.7 Nonlinear Equations 3.8 Linear Models: Initial Value 3.9 Linear Models: Boundary Value	pp. 145-150 pp. 150-165 pp. 165-174	**3.7:** 1, 3, 7 **3.8:** 3, 5, 9 **3.9:** 3, 5a, 5b
10	**Midterm 2 on March 12th**		
	5.1.1 Review of Power Series 5.1.2 Power Series Solutions	pp. 255-256 pp. 257-264	**5.1:** 1, 3 **5.1:** 17, 19, 21, 25
11	10.1 Theory of Linear Systems 10.2 Homogeneous Linear Systems	pp. 577-583 pp. 583-596	**10.1:** 1, 5, 11, 13 **10.2:** 1, 13, 21, 23, 35, 37
12	10.2 Homogeneous Linear Systems 10.3 Solution by Diagonalization	pp. 583-596 pp. 596-598	**10.2:** 1, 13, 21, 23, 35, 37 **10.3:** 1, 3, 5
13	10.4 Non-Homogeneous Linear Systems	pp. 599-606	**10.4:** 1, 3, 5, 9, 13, 15, 19
14	10.5 Matrix Exponential	pp. 606-611	

TUTORIAL WORSHOPS:

- Tutorial classes will commence the week of **January 9th**. Each tutorial section will be run by a tutor. Check the day, time and room number of your tutorial section below.
- In each tutorial "workshop" you will be given a set of problems to solve.
- You will solve the set of problems during the tutorial class and hand in your answer at the end of the tutorial. No late submissions will be accepted.
- Students can ask the tutor for help in solving the problems.
- Each workshop tutorial will be graded out of 10.
- Your mark will be calculated by taking the best 10 grades of the tutorial workshops.
- **The tutorial workshop problems** are intended to **get you started** doing problems on each topic of the course so that you can go on to do the suggested problems. The tutorial problems by themselves do not prepare you sufficiently for the final exam. **You must do the suggested problems.**

TUTORIALS:

The following are the tutorial classes that are scheduled for **Section W**:

TUTORIAL WA		**TUTORIAL WB**	
Time:	Fridays, 16:10 – 17:50	Time:	Mondays, 18:00 – 19:40
Room:	MB-S2.401	Room:	H-605
Tutor:	TBA	Tutor:	TBA
Email:	TBA	Email:	TBA

SUGGESTED PROBLEMS:

- There will be a total of **10 to 11** assignments.
- Engineering is learn-by-doing! You will learn the course material by doing the suggested problems week-after-week throughout the term. Go to the tutorial and do the tutorial problems to get started with analyzing and solving problems. Then, do the assigned homework problems each week and check your answers against the solutions posted the following week.
- The solutions to the suggested problems will be posted on your course Moodle (My Concordia) the weeks after they are assigned in the Course Outline.
- The suggested problems are not to be handed in or graded. Check the correctness of your worked out problems by comparing them with the suggested problem solutions posted on the course Moodle.
- You cannot learn the course material by simply reading the solutions to the suggested problems. Even if you think that you understand the solutions, you will be unable to answer the final exam questions.

TEAM ASSIGNMENT:

- There will be **one** team assignment that will be assigned to you during the term.
- You will be required to submit the team assignment to your tutor, after which it will be graded and returned to you.

MIDTERM TESTS:

There will be two midterm tests of one hour and fifteen minutes.
Midterm Test 1: Based on the material in Sections 1.1, 1.2, 2.2, 2.3, 2.4, 2.5
Date: Sunday, February 5th
Time: 4:00 PM to 5:15 PM
Place: To be announced
Midterm Test 2: Based on the material in Sections 2.7, 17.1, 17.2, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6
Date: Sunday, March 12th
Time: 4:00 PM to 5:15 PM
Place: To be announced

FINAL EXAMINATION:

At the end of the course, there will be a 3-hour closed-book final examination. Students are responsible for finding out the date, time and room of the final exam once the schedule is posted by the Examinations Office. Any conflicts or problems with the scheduling of the final exam must be reported directly to the Examinations Office, not to your instructor. It is the policy of the University that students remain available until the end of the final exam period.

GRADING SCHEMES:

SCHEME A		**SCHEME B**	
Tutorial Problems	10%	Tutorial Problems	10%
Team Assignment	5%	Team Assignment	5%
Midterm Test 1	15%	Best of Midterms	15%
Midterm Test 2	15%	Final Examination	70%
Final Examination	55%		
TOTAL	100%	TOTAL	100%

The better of the two schemes will be used in awarding the final letter grade in the course. *If a midterm test is missed for any reason, Scheme B will automatically apply*. No alternate, supplemental or make-up test will be given. During the midterm test and the final examination, only one of the two ENCS-approved calculators, **CASIO FX-300MS or SHARP EL-531**, will be allowed. No other material will be allowed inside the examination hall.

NOTES:

1. Students are responsible for topics covered in workshop problems, suggested problems and team assignments even if those topics are not covered in the lectures.
2. You are being trained to be a professional engineer. Consequently, we expect you to behave like a professional. A professional engineer is polite, considerate and respectful to others. It is rude, inconsiderate, and disrespectful to your fellow students and to the professor to talk in class.
3. All Concordia University students must abide by the University's Academic Code of Conduct (Concordia University Undergraduate Calendar Section 17.10). Any suspected violation of the Code will be turned over to a University Committee for investigation. Penalties can be as severe as expulsion from the University.
4. 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:

ENGR 213 emphasizes and develops the CEAB (Canadian Engineering Accreditation Board) graduate attributes and indicators.

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 a 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 ENGR 213, the students will be able to:

Solve differential equations that will be essential knowledge to many engineering core courses.	**A knowledge base for engineering/** Knowledge base for a specific engineering field **Problem analysis/** Problem identification and formulation
Model from prior knowledge in physics using differential equations. Through solution 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.	**A knowledge base for engineering/** Knowledge base for a specific engineering field **Problem analysis/** Problem identification and formulation **Problem analysis/** Modelling
Learn how to work within a team. This is done through one team project.	**Problem analysis/** Problem identification and formulation **Problem analysis/** Modelling **Individual and Team Work/** Cooperation and work ethics
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.	**A knowledge base for engineering/** Knowledge base for a specific engineering field