Concordia University

Faculty of Engineering and Computer Science

Course Outline

ENGR 213- Applied Ordinary Differential Equations- Winter 2017

INSTRUCTORS:

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Office Hours: T W TH from 12-13:30

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.

TEXTBOOK:

Advanced Engineering Mathematics by Dennis G. Zill and Warren S. Wright, 5rd edition, Jones and Bartlett Publisher, 2014

COURSE MATERIAL

Week	Theme	Text Ref	Exercise Assignment
1	1.1 Definition and Terminology 1.2 Initial Value Problems	pp. 03-12 pp. 12-18	**Section 1.1:** 1, 2, 6,10, 11, 23 **1.2:** 7, 12, 18
2	2.2 Separable Equations 2.3 Linear Equation	pp. 42-49 pp. 50-57	**Section 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	**Section 2.4:** 9, 17, 21, 29, 31 **2.5:** 5, 13, 19, 23, 27
4	2.7 Linear Models (Growth and Decay, Newton's Law of Cooling) 17.1 Complex Numbers 17.2 Powers and Roots	pp. 72-83 pp. 793-796 pp. 796-801	**Section 2.7:** 3, 13, 17 **17.1:** 1, 7,13,23, 33, 37 **17.2:** 1, 7, 11, 17, 21
5	**Midterm Test 1 on February 5** 3.1 Theory of Linear Equations 3.2 Reduction of Order	 pp. 104-115 pp. 115-118	**Section 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	**Section 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 Cauchy Euler Equations	pp. 134-139 pp. 139-145	**Section 3.5:** 1, 5, 7, 19 **3.6:** 1, 5, 11, 19, 21
8	Mid Term Break- No lecture or Tutorial classes		
9	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	pp. 145-150 pp. 150-165 pp. 165-174	**Section 3.7:** 1, 3, 7 **3.8:** 3, 5, 9 **3.9:** 3, 5(a,b)
10	**Midterm Test 2 on March 12** 5.1.1 Review of Power Series 5.1.2 Power Series Solutions	 pp. 255-256 pp. 257-264	**Section 5.1:** 1, 3, 17, 19, 21, 25
11	10.1 Theory of Linear Systems 10.2 Homogeneous Linear Systems (begin)	pp. 577-583 pp. 583-596	**Section 10.1:** 1, 5, 11, 13
12	10.2 Homogeneous Linear Systems (end) 10.3 Solution by Diagonalization	pp. 583-596 pp. 596-598	**Section 10.2:** 1, 13, 21, 23, 35, 37 **10.3:** 1, 3, 5
13	10.4 Non-Homogeneous Linear Systems	pp. 599-606	**Section 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 Monday **January 9** Each tutorial section will be run by a tutor. Check below the day, time and room number of your tutorial section.
- 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 submission 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 of the grades of the tutorial workshop that you earn for the problems.
- **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 homework exercise assignments. The tutorial problems by themselves do not prepare you sufficiently for the final exam. **You must do the homework exercise assignments.**

EXERCISE ASSIGNMENTS:

- There will be a total of **10 to 11** assignments.
- Engineering is learn-by-doing! You will learn the course material by doing the exercise assignments week-by-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 each exercise assignment will be posted on your course Moodle (My Concordia) the week after it is specified in the Corse Outline.
- Exercise assignments are not to be handed in or graded. Check the correctness of your worked out assigned problems by comparing them with the exercise assignment solutions posted on the course Moodle.
- You cannot learn the course material by reading the solutions to the exercise assignments. 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 at appropriate times during the term.
- You will be required to submit the team assignment to your tutor who will be then grade it and return to you.

MIDTERM TESTS:

There will be two midterm tests of one hour and fifteen minutes' duration
Midterm Test 1, based on the material in Sections. 1.1, 1.2, 2.2, 2.3, 2.4, and 2.5
Date: Sunday February 5
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, 3.3, 3.4, 3.5, and 3.6
Date: Sunday March 12
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 Examination Office. Any conflicts or problems with the scheduling of the final exam must be reported directly to the Examination 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

Tutorial problems	10%
Team Assignment	5%
Midterm Test 1	15%
Midterm Test 2	15%
Final examination	55%
Total	100%

Scheme B

Tutorial problems	10%
Team Assignment	5%
Best of Midterms	15%
Final examination	70%
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 because of 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.

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 or leader in teams, preferably in a multi-disciplinary setting.

The requirement of item 1 is met partially through the applied problems of the course included in the textbook and those covered by the instructor during lectures. The requirements items 2 and 3 are met through team assignments.

NOTES:

1.Students are responsible for topics covered in workshop problems, assignments and team assignment even that topics are not cover in the regular 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. No one can learn if you are chatting to your neighbor!

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 dismissal 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**.