Math 2280 Section 002 [SPRING 2013]

Instructor: Christopher Kocs

Office: JWB 205
Office Hours: W,F 10:00 AM - 11:00 AM or by appointment
Email: kocs@math.utah.edu

Course Information

Lectures: M,T,W,F 12:55 PM - 1:45 PM
Place: LS 111
Webpage: http://www.math.utah.edu/~kocs

Prerequisites: A “C” or better in Math 2270 (linear algebra) and either Math 1260, 1280, or 2210 (i.e., you are expected to know multivariable calculus).

Course Content: This course is an introduction to ordinary and partial differential equations, and how they are used to model problems arising in engineering and science. It is the second semester of the year long sequence 2270-2280, which is an in-depth introduction to linear mathematics. The linear algebra which you learned in Math 2270 will provide a surprising amount of the framework for our discussions in Math 2280, although this will not be apparent at first. The semester begins with first order differential equations: their origins, geometric meaning (slope fields), analytic and numerical solutions, in Chapters 1-2. The logistic equation and various velocity and acceleration models are studied closely. The next topic area, in Chapter 3, is linear differential equations of higher order, with the principal application being mechanical vibrations (friction, forced oscillations, resonance). This is about the time your linear algebra knowledge will start being helpful.

Next we show how models of more complicated dynamical systems lead to first and second order systems of differential equations (Chapter 4), and study Euler’s method for numerical solutions to help understand existence and uniqueness of solutions. We use eigenvalues and eigenvectors, matrix exponentials and general vector space theory, to explicitly solve these problems in Chapter 5. The concepts of phase plane, stability, periodic orbits and dynamical-system chaos are introduced with various ecological and mechanical models, in Chapter 6. The study of ordinary differential equations concludes with an introduction to the Laplace transform, in Chapter 7.

The final portion of Math 2280 is an introduction to the classical partial differential equations: the heat, wave and Laplace equations, and to the use of Fourier series and separation of variable ideas to solve these equations in special cases. This material is covered in Chapter 9 of the text.

Course Objectives: The goal of this course is to teach you ordinary differential equations! Or, at least, the basics of ordinary differential equations (its a huge and difficult subject, and the focus of
much active research today!) By the end of the semester you should have a firm understanding of
the basic concepts of differential equations; what a differential equation is, how to solve linear differ-
ential equations, how to solve systems of linear differential equations, some basic numeric methods,
Laplace transforms, and Fourier series methods. By the final exam you should understand what all
these concepts mean, and know how to use them to solve problems.

**Homework:** Practice is important for the mastery of mathematical concepts. To facilitate this
practice, homework will be assigned weekly. The assignments will be announced in class and posted
online each Monday and due later that week. A subset of these problems, usually two or three, will
be graded each week by a grader. There will also be suggested additional problems. These additional
problems are optional, and will not be graded, but are a good resource in case you want to work
more problems to get a stronger understanding of the material.

I will be posting solutions to each homework assignment. These solutions will include solutions to
the recommended problems. I will usually not accept late homework, but I will definitely not accept
late homework after the solutions have been posted. In calculating your final grade, I will drop your
lowest two homework scores, so if extenuating circumstances come up and you can’t get a couple of
the homework assignments done, you'll be able to drop them.

**Computer Projects:** There will be several computer projects assigned during the semester, related
to the classroom material. They will be written in the software package MAPLE. In addition, you will
be asked to use this computer software to check various homework calculations from throughout the
course. There is a Math Department Computer Lab in the T. Benny Rushing Mathematics Center
at which you all automatically have accounts. There are other labs around campus where MAPLE
is also available, for example at the College of Engineering and Marriott Library. There will be an
optional computer lab session scheduled the first few weeks of the semester to introduce students to
MAPLE. MAPLE projects are separate from your weekly homework assignments. **You may not drop
any of your MAPLE project scores.**

**Exams:** There will be two midterm exams and one final exam for this class. Each exam is closed-
book. The final exam is comprehensive (with special emphasis placed on the material covered after
the second midterm). With the exception of a few extremely extraordinary circumstances, make-up
exams will only be given for university-excused absences and must be arranged in advance. You
may be required to show your student ID during each test. The exam dates are given below. Plan
accordingly.

<table>
<thead>
<tr>
<th>Exam</th>
<th>Date</th>
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<tbody>
<tr>
<td>Exam 1</td>
<td>Friday, February 15</td>
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<tr>
<td>Exam 2</td>
<td>Monday, March 25</td>
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<tr>
<td>Final Exam</td>
<td>Monday, April 29, 1:00 - 3:00 PM</td>
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Grading Policy: Students’ scores will be determined from the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Computer projects</td>
<td>10%</td>
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<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm exams (2)</td>
<td>40% (20% each)</td>
</tr>
<tr>
<td>Final exam</td>
<td>30%</td>
</tr>
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ADA Statement: The Americans with Disabilities Act requires that reasonable accommodations be provided for students with physical, cognitive, systemic learning, and psychiatric disabilities. If you will need accommodations in this class, prior notice needs to be given to the instructor and to the Center for Disability Services (162 UNION, 801-581-5020). If you require special accommodations under the ADA please inform me through official channels early in the semester.

Important Dates: January 16 is the last day students may drop the class, and March 1 is the last day to withdraw from this class.

Tutoring: Free tutoring is offered at the T. Benny Rushing Mathematics Center, which is located between the JWB and LCB buildings. The tutoring center will be open the second week of classes.

DISCLAIMER

This syllabus has been created as a preview of the course and I have tried to make it as accurate as possible. However, I reserve the right to make reasonable changes to the following policies as I deem appropriate. Any such changes will be announced in class.