Syllabus
Math 320 - Linear Algebra and Differential Equations
Fall 2007

Lecturer: Dr. Jeff Viaclovsky
Office Hours: Tue 2:30–3:30, Thurs 2:30–3:30.
Office: 803 Van Vleck
Phone: 263-1161
Email: jeffv@math.wisc.edu
TA: Bing Wang **Email:** bwang@math.wisc.edu
TA: Melanie Ruiz **Email:** ruiz@math.wisc.edu

Course Web Site: http://www.math.wisc.edu/∼jeffv/courses/320_F07.html

Text: Edwards and Penney, *Differential Equations and Linear Algebra*, 2nd ed., Prentice Hall.

Lecture: TR 1:00–2:15PM, Ingraham 19

Discussion Sections:
331 (Bing Wang) M 11:00–11:50 AM in Van Vleck B123
332 (Bing Wang) W 11:00–11:50 AM in Van Vleck B123
333 (Bing Wang) M 12:05–12:55 PM in Van Vleck B219
334 (Bing Wang) W 12:05–12:55 PM in Van Vleck B341
335 (Melanie Ruiz) M 14:25–15:15 AM in Van Vleck B219
336 (Melanie Ruiz) W 14:25–15:15 AM in Van Vleck B219

Exam schedule:
Exam 1: 1:00–2:15 PM Thursday, October 4
Exam 2: 1:00–2:15 PM Thursday, November 8
Final Exam: 5:05–7:05 PM on Monday, December 17 (room TBA)
Acceptable excuses for missing an exam include only official university excuses, with a note from an appropriate univeristy official. The location of the final will be announced on the Registrar's homepage in early December. The final exam is cumulative.

Prerequisite: The prerequisite for Math 320 is Math 222, and we will use ideas from Math 222 in a fundamental way in many parts of Math 320. Credit may not be received for both Math 320 and Math 340.

Course Content and Goals: Differential equations are equations describing a function in terms of its derivatives. They are the basic tool that scientists and engineers use to model physical reality. Given an unknown functional relationship one wishes to model, one chooses an appropriate differential equation that the function should satisfy, and one wants to recover the function; doing so is called *solving* the differential equation. The importance of this process to science and engineering cannot be over-emphasized. The crucial questions regarding differential equations that we seek to answer in this course are:

1. When does a differential equation have a solution? When is that solution unique?
2. Can one construct the (unique) solution of a differential equation in terms of elementary functions? If not, can one approximate its solution numerically and/or understand it qualitatively?
3. How does one choose the differential equation(s) used to model a physical system? What are the strengths and limitations of such models? Specifically, what is the significance of linearity in our models and applications?

Linear algebra is the part of mathematics that grows out of solving systems of linear equations. It blossoms into a general theory of linear objects, namely vector spaces, and concerns itself with transformations that preserve this linear structure, which can all be described by matrices. In this class, we will see that solutions of certain differential equations in fact form a vector space, and techniques from linear algebra will allow us to solve systems of linear differential equations.

These two subjects are frequently studied separately, with little note made of their connection. We will study them together and in so doing will see that

1. The viewpoint of linear algebra is immensely helpful in uncovering the order underlying the topic of differential equations; it helps us understand the why and not just the how of our calculations;

2. Conversely, seeing immediately the applications of linear algebra to differential equations helps to motivate many of the ideas of linear algebra, which can seem overly abstract by themselves.

3. Linear algebra is crucial to the computer approximations which are often the only way to solve the most challenging differential equations.

Thus you should emerge from this course with a better understanding of both differential equations and linear algebra, and a sense of how they motivate and enrich each other.

Grades: Course grades will be based on a possible total of 500 points, determined as follows:

Homework + Discussion	150 points
Exam 1	100 points
Exam 2	100 points
Final Exam	150 points

The Homework + Discussion score is broken down as follows: approximately 120 points for homework, and 30 points for participation. Students who attend nearly all the sections and come prepared with questions will receive the full 30 points. Those who miss many sections or are conspicuously not participating (e.g. sleeping, surfing the internet, etc.) will lose points.

Homework: The homework exercises are the most critical component of your learning in this course. The best way to cement your understanding of this subject is to work through a wide variety of problems, so it is vital that you do the homework. Moreover, the questions on the exam will be very similar to the kinds of exercises given in the homework.

Homework assignments are posted on the course web site, which will be updated often. Homework is due in the folder outside your TA's office by 5 pm each Friday. Late homework is not accepted. It is essential that you begin the homework early – do not expect to do it all the two days before it's due!

Learning often happens best when we are forced to explain our work or thinking to someone else. Sometimes just verbalizing your mathematical thoughts can deepen your understanding. Thus, I encourage group working on the homework (groups of two or three tend to be most effective). However, you must still each write the problems up on your own. And of course there will be no group consultations during exams.

Please prepare your written homework according to the following rules (failure to do so may result in your getting no credit for the assignment):

1. Write your name clearly at the top of the first page.

2. Put the problems in order, indicating clearly any you have skipped.

3. STAPLE your homework. Paper-clips, folded corners, etc. are not accepted. No matter how sturdy the corner-fold seems, while the grader is flipping through your homework during grading, it will come undone.

4. Write clearly.

5. If you naturally do the problems out of order or with very messy script, then seriously consider rewriting them neatly on a new sheet of paper after you are done and turning that in.

Also, note that a correct solution to a homework problem consists of more than just writing the correct answer. Homework solutions should also include a *convincing argument* that your solution is the correct answer. Write enough steps and work that your thought processes are clear.

Midterm exams: The questions on the exam will be very similar to the kinds of exercises given in the homework. Both midterms will be given on Thursdays, and may include any material up to and including the Tuesday before the exam. Students will have their exams returned within a few days.

Other Policies and Suggestions:

Calculators: Calculators are not allowed (or necessary) on exams or quizzes. You are welcome to use them on homework.

Preparing for class: You should expect to spend at least five hours per week outside of class studying. "Studying" does not mean just doing assigned exercises. The number of problems we assign is probably not enough for most students. It is your responsibility to find and work additional exercises as needed. The five hours (minimum) of studying includes reading the texts (before and after the material is covered in lecture), writing up problems to turn in for feedback, working additional problems as needed, formulating coherent questions for your TA, and reviewing.

The lectures are intended to supplement and highlight the reading and exercises, and you will be expected to learn and understand the lecture material as well as the reading and assigned exercises. **Because of time constraints, it isn't possible to do examples of every kind of HW problem in class, nor is it possible to discuss everything you need to know in class.**

Here are some recommendations for how to get the most out of class. You should quickly read the material in the text before it is covered in lecture so that you'll know what to listen for. After the lecture, the big ideas will stand out for you, and some of the most difficult ideas will have been clarified so that when you sit down to re-read the text carefully, you will be able to focus on the details. Then, when you do the exercises, that is where you will actually start to learn the material. The goal of working the exercises is not to just get them done and hand something in. The goal is to learn something. *Please give yourself enough time to learn something from the problems.* If a problem is difficult, think about what makes it difficult. If you had to get help (from a person or a book) to finish a problem, don't just move on to the next one. Find more problems similar to that one and do them until you no longer need help.

Preparing for Discussion section: Your weekly discussion section gives you a chance to discuss anything related to the course. You can go over problems, ask questions on examples or ideas discussed in lecture, review, etc. You will get the most out of your discussion section if you have already spent considerable time working on the problems or thinking about the ideas from lecture.

Missing a lecture: If you miss a lecture, you should contact a Note Buddy or other classmate as soon as possible to find out what you missed and to get a copy of the notes. Please do not expect me or the TA to give you notes or repeat a lecture for you during office hours.

Getting Help: Your lecturer and your TA will hold regular office hours throughout the semester. Whenever you have a question (even a homework question!) or need assistance in the course, you should see one of us right away. You should also always feel free to send email privately to me or the TA when you have a question about the course or the material. If the question cannot be answered over email, you might be instructed to come to office hours or to set up an appointment. There are also other places on campus to go for help. Other resources include

MathLab Free drop-in tutoring in room B227 Van Vleck, beginning in the second week of classes. <http://www.math.wisc.edu/~mathlab>

GUTS Free small group, drop-in, and individual tutoring at various locations on campus. <http://guts.studentorg.wisc.edu>

Private Tutors Cost varies. See the receptionist on the second floor of Van Vleck (or check the web) for a list of tutors. <http://www.math.wisc.edu/~paulson/tutor.html>

Note Buddies:

Name	Email	Phone

1. _____

2. _____