Math 320 –Section 001 – Spring 2012
Linear Algebra and Differential Equations

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Office: 809 Van Vleck
Office Hours:
- MW 10:45 AM-11:45 AM

Class schedule:
- MWF 9:55-10:45 AM
VAN VLECK B102

Personal Website: http://www.math.wisc.edu/∼hernande/

Text: Edwards and Penney, Differential Equations and Linear Algebra, third ed., Prentice Hall.

Discussion sessions :

301	T 8:50-9:40AM	B119 Van Vleck Hall	Erkao Bao
302	R 8:50-9:40AM	B119 Van Vleck Hall	Erkao Bao
303	T 11:00-11:50AM	115 Ingraham Hall	Erkao Bao
304	R 11:00-11:50AM	115 Ingraham Hall	Erkao Bao
305	T 9:55-10:45AM	B329 Van Vleck Hall	Hesamaddin Dashti
306	R 9:55-10:45AM	B329 Van Vleck Hall	Hesamaddin Dashti

Exam Schedule :

Exam 1:	Feb.24	Time: 9:55 - 10:45 AM	ROOM: Van Vleck B102	20% of the Final Grade
Exam 2:	March 28	Time: 9:55 - 10:45 AM	ROOM: Van Vleck B102	25% of the Final Grade
Exam 3:	May 13	Time: 7:45 - 9:45 AM	ROOM: **TBA**	30% of the Final Grade

Dates for the exams are fixed. Make plans now to be certain these dates are in your calendar. Note that travel is *not* a sufficient excuse to have an exam scheduled on a different day.

Prerrequisites: 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 description: 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.

Quizzes During Section Meetings: There will be an estimate of 6 quizzes, to be scheduled during section meetings on dates to be determined by the TA. Quizzes will be graded and will count for 5% of the overall grade. The lowest quiz score will be dropped. There will be no make-up quizzes.

Weekly Problem Sets: Homework will normally be due on Wednesday and is **due at the beginning of class**. Homework will be available on-line at http://www.math.wisc.edu/∼hernande/ approximately one week prior to the due date. Roughly 15 problems will be assigned each week (most of the time from the book, but not always).

Please write your name and section number clearly on each homework set, stapled please! The TA is not responsible for loose sheets of paper that are not stapled together.

Grading of Homework: The TAs will grade a subset of the homework problems given out each week (with some points also given for completeness). The homework scores will count for 15% of the grade. The lowest homework score will be dropped.

Late Policy: Homework turned in after the beginning of class will be considered late and will be graded at 80% credit. Late homework will be accepted until 5 PM on the due date (no credit thereafter). NO EXCEPTIONS! The policy is intended to keep everyone as current as possible.

Late homework should given directly to the TA. Late homework placed anywhere else will not be accepted.

Calculators: Calculators and/or computer software may be used to help with homework problems but are not permitted during exams.

Course outline: The course covers material in Chapters 1-9 of the text. The topics are listed below with corresponding chapter.

Chapter 1: First-Order ODEs (continuing from 221/222 with some review).
Chapter 2: Mathematical Models and Numerical Methods.
Chapter 3: Linear Systems and Matrices.
Chapter 4: Vectors Spaces.
Chapter 5: Higher-Order Linear ODEs.
Chapter 6: Eigenvalues and Eigenvectors
Chapter 7: Linear Systems of ODEs.
Chapter 8: Matrix Exponential Methods (sections 8.1-8.2).
Chapter 9: Nonlinear Systems (sections 9.1-9.2, sections 9.3-9.4 if time permits).

Expectations: You are expected to spend six hours working on math outside of class. You are expected to read the appropriate text before coming to class. In order to fully understand the material and do well in the course, it is vital that you stay on top of your reading and homework assignments. 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 six 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.

In Class: You are required to come to class. Important announcements will be given in class. Should you miss a class, please be sure to get notes and other important information from a classmate. Class participation will count 5 % of the final grade.

No cell phones, ipods, computers or other gadgets may be used in class. Texting is strictly prohibited. Please raise your hand to ask and answer questions and be quiet and respectful when others are talking.

Grading :

Exam 1: 20 %
Exam 2: 25 %
Exam 3: 30 %
Homework: 15%
Quizzes: 5%
Class participation: 5%

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. This lab does not tutor 320, but might be useful for those who need help with the background material http://www.math.wisc.edu/∼matlab/

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/tutors

Note: Any student with a documented disability should contact me as soon as possible so that we can discuss arrangements to fit your needs.

Please feel free to ask me any questions. I look forward to working with you!