MTH 306 **Introduction to Differential Equations** **Spring 2012**

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Course Description: Analytic solutions, qualitative behavior of solutions to differential equations. First-order and higher-order ordinary differential equations, including nonlinear equations. Covers analytic, geometric, and numerical perspectives as well as an interplay between methods and model problems. Discusses necessary matrix theory and explores differential equation models of phenomena from various disciplines. Uses a mathematical software system designed to aid in the numerical and qualitative study of solutions, and in the geometric interpretation of solutions.

Prerequisites: MTH 141, MTH 142 with grade of "C" or above.

Lectures: Tue/Thu 2:00-3:20 in Talbert 107

Recitations: There are 3 recitation sections, and a computing lab
Y1: Tue 4:00-4:50 in Cooke 127
Y2: Thu 4:00-4:50 in Talbert 113
Y3: Tue 5:00-5:50 in Bell 138
Lab: Baldy 8B (in basement)
- Some weeks you meet in the computing lab instead of your regular recitation room. See the schedule on the last page to determine where to go each week.
- On weeks when you have lab, you are encouraged to bring your own laptop if you have one.
- Due to space limitations you must attend the section in which you are registered.
- Recitations will not meet the first week of class.

Course Materials

Book: Differential Equations and Boundary Value Problems: Computing and Modeling by C. Henry Edwards and David E. Penney: UB Custom Edition, second edition ($94.50 at UB bookstore); or (ii) regular 4th edition (ISBN 0131561073, $118.54 on amazon.com)

UBLearns: The course page on UBLearns contains some course materials like assigned homework, exam solutions, Maple programs.

Maple: Software for mathematics applications that we will use to solve equations and graph solutions. Maple is on all CIT public computers on campus. A version of Maple for your own computer is available by download at `http://ubit.buffalo.edu/software/win/maple`

Lab Computers: In the computer lab Baldy 8B you can either use your own computer (with Maple already installed) or use the computers in the lab. The computers in the lab use the SENS (Science and Engineering Node Services) usernames and passwords, the same as for the "unix.eng" and "unix.nsm" clusters. You may (or may not) have such a username already. If you do not already have such a username, please apply for a SENS username by using the web page
`http://www.sens.buffalo.edu/accounts/`
The requested username should be active within one working day.

Where to go for help: (i) TA or Professor office hours, (ii) Math Help Center (free walk-in tutoring M-F 9-12, 1-3 in Math 110, starting the second week of classes), (iii) paid tutors (list available in math dept main office, (iv) Student Solutions Manual for Differential Equations and Boundary Value Problems: Computing and Modeling, 4th Edition ISBN 0131561103 (costs about $30 on amazon.com).

Topics to be covered from the text

Chapter 1 - First Order Differential Equations (Sec 1.1-1.6)
Chapter 2 - Mathematical Models and Numerical Methods (Sec 2.2-2.4)
Chapter 3 - Linear Equations of Higher Order (Sec 3.1-3.6)
Chapter 4 - Introduction to Systems of Differential Equations (Sec 4.1, 4.3)
Chapter 5 - Linear Systems of Differential Equations (Sec 5.1, 5.2, 5.4)
Chapter 6 - Nonlinear Systems and Phenomena (Sec 6.1, 6.2, 6.4)
Chapter 7 - Laplace Transform Methods (Sec 7.1-7.6)
Chapter 8 - Power Series Methods (Sec 8.1-8.3)

Coursework

Exams: 3 Exams (see schedule for dates). Exam #3 is scheduled during finals week.

Homework: In each lecture, homework problems will be assigned to reinforce the topics covered in class. Homework will not be collected, but you are expected to do the assignment at the time it is assigned. Often, the following lecture assumes that you understand the material from the previous lecture, so procrastinating a week to catch up on the homework is a bad way to learn. As added incentive to keep up with the homework, the quiz problem will be taken directly from the homework (see Quizzes below).

Quizzes: In all non-lab recitations, there will be a 10-15 minute quiz on the homework from the previous week. There will be 10 quizzes. There are no makeup quizzes but the worst quiz score will be dropped to determine your quiz grade. The quiz problem will be taken directly from an assigned homework problem, or be a straightforward modification/simplification of an assigned homework problem. The material for the quiz, unless announced otherwise is all assigned homework from previous classes, excluding class the day of the quiz.

Lab Projects: During lab sessions you will work on a computer project that involves some analysis and calculations using the software Maple. You will work with a partner, and must have a different partner for each project. Only one hardcopy of your lab project is submitted for each group.

Course Grades

Your final grade will be determined by averaging your grades for exams and lab projects with the following weightings (+/- grades will be used).

Exam #1-3 @ 25% each = 75%
Quiz and Lab Assignments = 25%

For averaging grades, a **5-point grading scale** is used in the course:

A+ = 4.66-5.00	A = 4.33-4.66	A- = 4.00-4.33
B+ = 3.66-4.00	B = 3.33-3.66	B- = 3.00-3.33
C+ = 2.66-3.00	C = 2.33-2.66	C- = 2.00-2.33
D+ = 1.66-2.00	D = 1.33-1.66	D- = 1.00-1.33

Other info

Academic Honesty: Students are expected to follow the university policy on academic honesty. Cheating on exams or copying of assignments is explicitly forbidden. You must have your student ID for exams.

Make-up Exams: If, due to severe circumstances beyond your control (car accident, illness, death in the family, etc), you will not be able to take an exam, please call me immediately (before the exam) and let me know your situation. If you have a really good reason and can present adequate documentation we can make arrangements for a make-up exam to be taken at the end of the semester.

Incompletes: Incompletes will be given only under extraordinary circumstances (like surgery during the last week of class).

Important Dates:
Mon Jan 23 - Last day to drop the course - no record appears on transcript
Fri Mar 30 - Last day to resign from the course - an 'R' appears on transcript.

Students with disabilities:
If you have a diagnosed disability (physical, learning, or psychological) which will make it difficult for you to carry out the course work as outlined, or requires accommodations such as recruiting note takers, readers, or extended time on exams and/or assignments, please advise me during the first two weeks of the course so that we may review possible arrangements for reasonable accommodations.

Tentative Lecture Schedule

date	lecture	tue recitation	thu recitation
Tue1/17	1.1 differential equations and mathematical models 1.2 integrals as general and particular solutions	no rec	
Thu1/19	intro to Maple 1.3 slope fields and solution curves ***Mon 1/23 last day to drop***		no rec
Tue 1/24	1.4 separable equations and application 1.5 linear first-order equations, part 1	rec	
Thu1/26	1.5 linear first-order equations, part 2 1.6 substitution methods and exact equations		rec
Tue1/31	2.2 equilibrium solutions and stability 2.3 acceleration-velocity models, part 1	rec	
Thu 2/2	2.3 acceleration-velocity models, part 2 2.4 numerical approximation: Euler's method		rec
Tue 2/7	review for exam	rec	
Thu 2/9	exam #1		lab
Tue 2/14	3.1 introduction: second-order linear equations 3.2 general solutions of linear equations	lab	
Thu 2/16	3.3 homogeneous equations with constant coefficients 3.4 mechanical vibrations, part 1		rec
Tue 2/21	3.4 mechanical vibrations, part 2 3.5 nonhomogeneous equations and undetermined coefficients	rec	
Thu 2/26	3.6 forced oscillations and resonance		rec
Tue 2/28	4.1 first-order systems and applications	rec	
Thu 3/1	4.3 numerical methods for systems		rec
Tue 3/6	5.1 matrices and linear systems	rec	
Thu 3/8	5.2 eigenvalue method for homogeneous systems, part 1		rec
Tue 3/13	spring break	no rec	
Thu 3/15	spring break		no rec
Tue 3/20	5.2 eigenvalue method for homogeneous systems, part 2 5.4 multiple eigenvalue solutions	rec	
Thu 3/22	review for exam		rec
Tue 3/27	exam #2	lab	
Thu 3/29	6.1 stability and the phase plane 6.2 linear and almost linear systems ***Fri 3/30 last day to resign***		lab
Tue 4/3	6.4 nonlinear mechanical systems	rec	
Thu 4/5	7.1 Laplace transforms and inverse transforms 7.2 transformation of initial value problems		rec
Tue 4/10	7.3 translation and partial fractions 7.4 derivatives, integrals, and products of transforms	lab	
Thu 4/12	7.5 periodic and piecewise continuous input functions 7.6 impulses and delta functions		lab
Tue 4/17	8.1 introduction and review of power series	rec	
Thu 4/19	8.2 series solutions near ordinary points		rec
Tue 4/24	8.3 series solutions near regular singular points	rec	
Thu 4/26	review for exam		rec
finals wk	exam #3		

"rec" = regular classroom for recitation; "lab" = Baldy 8B for recitation and bring laptop if you have one

revised 1/11/12