Syllabus for Calculus IV (with Laplace transforms)

University of Kentucky

Time and place:

Section 002: MWF 9:00-9:50 a.m., CB339
Section 003: MWF 11:00-11:50 a.m., CB339

Course instructor and contact information:

Instructor: Dr. Alan Demlow, Assistant Professor of Mathematics
Office: POT 775, phone 257-6797
E-mail: demlow@ms.uky.edu

Office hours: Office hours will be held in POT 775, Tuesdays 9:45-10:45 and Fridays 1-2 or by appointment. You are also welcome to drop by my office any time the door is open.

Course website: The course website will be linked to from http://www.ms.uky.edu/~demlow/.

Textbook: *Elementary Differential Equations and Boundary Value Problems* (8th Edition), by William E. Boyce and Richard C. DiPrima

Course overview: Ordinary differential equations (ODE) have long been a fundamental part of the mathematical vocabulary used to describe natural phenomena. ODE have been studied using a wide range of tools and techniques. These include:

1. Classical attempts to find exact solution formulas;
2. Numerical methods which yield precise but approximate quantitative information about solutions;
3. Qualitative methods which provide a less precise, but very rich, geometric understanding of ODE.

Most of this course will emphasize exact solution techniques, and we may briefly consider qualitative methods as time allows. Material to be covered includes most of Chapter 1 (Introduction), Chapter 2 (First-order differential equations), Chapter 3 (Second-order linear equations), and Chapter 6 (The Laplace transform), along with selected sections from Chapter 5 (Series Solutions) or Chapter 7 (Systems of first-order linear equations) as time and the interests of the instructor allow.

Homework: Homework will be assigned in lecture each Friday and will be due the following Friday by 2 p.m. (slide it under the door of my office if I'm not there). I will select a few of the assigned problems to grade each week, but you are required to complete all assigned problems. You are encouraged to work with others while solving homework problems, but you must write up your own solutions. Late homework will not be accepted. However, your two lowest homework scores will be dropped. Homework will be worth 100 points, or 1/6 of your final grade.

Exams: There will be three one-hour in-class preliminary exams during the course of the semester (worth 100 points, or 1/6 of your final grade, each) and a final exam (worth 200 points, or 1/3 of your final grade). The exam schedule with an approximate breakdown (subject to change!) of material covered on each is:

Prelim 1:	Sept. 22	Chapter 1, Sections 2.1 through 2.7
Prelim 2:	Oct. 20	2.8, 3.1-3.6
Prelim 3:	Nov. 20	3.7-3.8, 7.1-7.5
Final Exam:	Dec. 11, 8.a.m. (11 a.m. section)	All previous material plus 9.1-9.5
	Dec 13, 8 a.m. (9 a.m. section)	

Grading: Your final grade will be determined by your composite homework score for the semester (1/6), your 3 prelims (totaling 1/2 of your grade, or 1/6 for each exam), and your final exam (1/3). I will use a standard grading scale (90-100% A-/A, 80-89% B-/B/B+, etc.). If the overall class average on any individual component of the grade is too low to ensure a fair distribution of grades, that component will be curved to raise the class average.

Software: There are many software options available for solving ODEs. Some packages are able to give exact solutions to many classes of problems symbolically (Maple and Mathematica), while others are able to display approximate numerical solutions graphically or in table form (Matlab, many graphing calculators, and the ODE Toolkit provided with your text). As you do your homework during the course of the semester, you are encouraged to explore these software options and use them to check your pencil-and-paper answers, and some homework may require you to use one of them. However, no electronic aids (computers or graphing calculators) will be allowed on exams.

Attendance: You are responsible for all lecture material and announcements made in class. Attendance will not be recorded, however.

Academic integrity: All violations of academic integrity will be taken seriously and dealt with according to university regulations.

Suggested schedule for sections of MA214 (Calculus IV) w/Laplace transforms

Class	Sections in Boyce and DiPrima, 8th ed.
1	1.1,1.2,1.3: Introduction
2	1.1,1.2,1.3: introduction
3	2.1: Linear equations, method of integrating factors
4	2.2: Separable equations
5	Homework questions, etc.
6	2.3: Modeling with first order equations
7	2.4: differences between linear and nonlinear equations
8	Homework questions, etc.
9	2.5: Autonomous equations and population dynamics
10	2.6: Exact equations and integrating factors
11	Homework questions, etc.
12	Review
13	PRELIM 1
14	3.1: Homogeneous equations with constant coefficients
15	3.2: Fundamental solutions of linear equations
16	Homework questions, etc.
17	3.3: Linear independence and the Wronskian
18	3.4: Complex roots of the characteristic equation
19	Homework questions, etc.
20	3.5: Repeated roots: Reduction of order
21	3.6: Nonhomogeneous equations: Method of undetermined coefficients
22	Homework questions, etc.
23	3.7: Variation of parameters
24	Review
25	PRELIM 2
26	3.8: Mechanical and electrical vibrations
27	3.9: Forced vibrations
28	Homework questions, etc.
29	6.1 Definition of the Laplace transform
30	6.2 Solution of the initial value problem
31	Homework questions, etc.
32	6.3 Step functions
33	6.4 Differential equations with discontinuous forcing functions
34	Homework questions, etc.
35	6.5 Impulse functions
36	Review
37	PRELIM 3
38	7.2 Review of matrices
39	7.3 Linear algebraic equations, etc.
40	7.4 Basic theory of systems of first order linear equations
41	7.5 Homogeneous linear systems with constant coefficients
42	Homework questions, etc.
43	Final review
44	Final review

Notes: Here we assume one recitation per week on a fixed day, so the overall schedule depends on where holidays fall, etc. Also, one could replace the sections from Chapter 7 with sections from Chapter 5 (Series Solutions), as desired.