

## 18.034, Spring Semester 2006

### General Information

**Class meetings:** Monday, Wednesday, and Friday 1:00–2:00 in 12-142.

**Text:** *Differential Equations, a Modeling Perspective*, by Robert L. Borrelli and Courtney S. Coleman, 2nd edition, Wiley, 2004.

**Lecturer:** David Vogan, 2-281 (x3-4991, [dav@math.mit.edu](mailto:dav@math.mit.edu)). Office hours are Monday 11–12 and Wednesday 2–3, or by appointment.

**Recitation meetings:** Monday and Wednesday 10:00–11:00 in 12-142.

**Recitation instructor:** David Vogan

**Homework** assigned during lectures. Due in recitation each Monday. Late work is not accepted.

**Exams:** One-hour exams during the lecture hour on Friday, March 10, and Friday, April 21. The exams will be closed book, and calculators will not be allowed.

**Grading:** In-class exams will be worth 25% each, the final exam 30%, and problem sets 20%.

### Syllabus

Doing the reading *before* class offers you the priceless (©MasterCard) possibility of catching the lecturer in an error.

Wed 2/8	Recitation	
Wed 2/8	Lecture 1	Modeling and terminology (Ch. 1)
Fri 2/10	Lecture 2	Linear differential equations (2.1, 2.2)
Mon 2/13	Recitation	
Mon 2/13	Lecture 3	Uniqueness of solutions (2.3, A1)
Wed 2/15	Recitation	
Wed 2/15	Lecture 4	Existence of solutions (Picard iterates) (Ch. 2, A2)
Fri 2/17	Lecture 5	Extension of solutions (Ch. 2, A3)
Tues 2/21	Recitation	
Tues 2/21	Lecture 6	Slope fields, separable equations (2.4, 2.5)
Wed 2/22	Recitation	
Wed 2/22	Lecture 7	Qualitative analysis (2.8)
Fri 2/24	Lecture 8	Approximate numerical solutions (page 122)
Mon 2/27	Recitation	
Mon 2/27	Lecture 9	Homogeneous second order linear ODEs (3.1, 3.2)
Wed 3/1	Recitation	
Wed 3/1	Lecture 10	Direction fields, complex numbers (3.3)
Fri 3/3	Lecture 11	Inhomogeneous second order linear ODEs (3.5, 3.6)
Mon 3/6	Recitation	
Mon 3/6	Lecture 12	Theory of second order linear and nonlinear ODEs (3.7, 3.8)
Wed 3/8	Recitation	
Wed 3/8	Lecture 13	Beats, resonance, frequency response (4.1, 4.3)
Fri 3/10	Lecture 14	<b>EXAM 1</b> on Lectures 1–13
Mon 3/13	Recitation	
Mon 3/13	Lecture 15	Trigonometric Fourier series (10.1, 10.2)
Wed 3/15	Recitation	
Wed 3/15	Lecture 16	Half-range and exponential Fourier series (10.3)
Fri 3/17	Lecture 17	Dirac's delta function (page 328)

Mon 3/20	Recitation	
Mon 3/20	Lecture 18	Laplace transform and IVPs (5.1)
Wed 3/22	Recitation	
Wed 3/22	Lecture 19	Properties of Laplace transform (5.2, 5.3)
Fri 3/24	Lecture 20	Convolution (5.4)
Mon 4/3	Recitation	
Mon 4/3	Lecture 21	Compartment models, linear algebra (6.1, page 421)
Wed 4/5	Recitation	
Wed 4/5	Lecture 22	Eigenvalues, eigenvectors, eigenspaces (6.2)
Fri 4/7	Lecture 23	Homogeneous linear systems: real eigenvalues (6.3)
Mon 4/10	Recitation	
Mon 4/10	Lecture 24	Homogeneous linear systems: complex eigenvalues (6.4)
Wed 4/12	Recitation	
Wed 4/12	Lecture 25	Inhomogeneous linear systems, matrix exponentials (6.6)
Fri 4/14	Lecture 26	Theory of general linear systems (6.8)
Mon 4/17	Patriot's Day	Holiday
Wed 4/19	Recitation	
Wed 4/19	Lecture 27	Lie groups, review
Fri 4/21	Lecture 28	<b>EXAM 2</b> covering lectures 1–25
Mon 4/24	Recitation	
Mon 4/24	Lecture 29	Fundamental theorem (7.1)
Wed 4/26	Recitation	
Wed 4/26	Lecture 30	Autonomous systems, interacting species models (7.2, 7.3)
Fri 4/28	Lecture 31	Stability of autonomous systems (8.1, 8.2)
Mon 5/1	Recitation	
Mon 5/1	Lecture 32	Conservative systems, Lyapunov functions (8.3, page 508)
Wed 5/3	Recitation	
Wed 5/3	Lecture 33	Limit cycles, planar autonomous systems (9.1, 9.2)
Fri 5/5	Lecture 34	Power series solutions (11.1)
Mon 5/8	Recitation	
Mon 5/8	Lecture 35	Solutions near ordinary points (11.2)
Wed 5/10	Recitation	
Wed 5/10	Lecture 36	Regular singular points (11.3)
Fri 5/12	Lecture 37	Solutions near regular singular points (11.4)
Mon 5/15	Recitation	
Mon 5/15	Lecture 38	Special functions
Wed 5/17	Recitation	
Wed 5/17	Lecture 39	Review

FINAL EXAM week of 5/22–5/26 to be scheduled by Registrar.