Syllabus for MTH U345: Ordinary Differential Equations

Fall 2007

This course studies the theory, solution methods (both qualitative and quantitative) and applications of ordinary differential equations.

Instructor: Marc Levine, 435 LA, ext. 3899, m.levine@neu.edu

Office hours: MWTh 10:30-11:30 a.m., or by appointment.

Text: Blanchard, Devaney & Hall, *Differential Equations*, Brooks/Cole, 3rd. ed.

Homework assignments: Exercise assignments will be due on Mondays and Wednesdays, or as announced in class. On occasion, homeworks will be collected and "spot checked". See the end of this sheet for the homework problems.

Computer lab assignments: Computer labs will also be due periodically, and will be collected and graded. The labs are an *essential* component of the course: some important concepts will be introduced and explored, both visually and numerically. The labs also provide an opportunity to apply the analytical skills that are being developed in class.

Quizzes: There will be weekly 15 minute quizzes on Wednesdays, unless otherwise announced. The first quiz will be on September 12.

Exams: In addition to the final exam on December **, there will be two in-class exams, to be held on

Wednesday, Oct. 10 and Wednesday, Nov. 14

Grading: The course grade will be determined as follows:

- Homework/Quizzes 15%
- Labs 15%
- Midterm exams 15% each, 30% in total
- Final Exam 40%

Class web page: We will have a class web-page, at

http://www.math.neu.edu/%7Elevine/U345.F07/home.html

Various policies:

- You can receive extra help (a) from me, either during my office hours or by appointment (b) from the Tutoring Center, 540B NI, MTW 10:00 a.m.-9:00 p.m., Th 10:00 a.m.-6:00p.m., F 10:00 a.m.-1:00 p.m., or the Peer Tutoring Center, 242SL.
- Without prior notice, there will be **no makeups** of quizzes or exams. Computer labs and homework papers will **not** be accepted late. On the other hand, I will be dropping the lowest quiz grade, so one missed quiz will not count as a zero.
- The following are acceptable reasons for rescheduling a midterm or final exam: serious, documented medical incapacity, university sanctioned events such as team sports for which the athletic department issues a statement requiring your particpation, or documented legal requirements such as jury duty or military service. For a final exam, there is also the possibility of rescheduling if there is a conflict with another final, or if you have three final exams on the same day. Documentation must be from an appropriate authority other than a parent and must be presented to me at least two days before the scheduled quiz or test.
- You are responsible for **all** information conveyed in class (even if you are absent) or posted on the class web-page.
- If you have a concern about the class that cannot be resolved by speaking with me, please see the Undergraduate Director of the Math Department, Prof. Martsinkovsky, 471 LA, x 5510, alexmart@neu.edu.
- All students will legitimate conflicts that have been approved in advance by the instuctor must take the final exam at the scheduled time. Do not make travel plans that conflict with the final exam.
- It is University policy that no grade, including an Incomplete, can be changed after one year, exceptions must be authorized by the Academic Standing Committee.
- An Incomplete grade is given only when a student who has at least a *C* grade is unable to finsh a relatively small part of the course *due to circumstances clearly beyond her or his control*. Example: you cannot take the final exam because you are in the hospital. Non-example: You realize around Thanksgiving that there is no way you can get a B in the course, even if you ace the final.
- I reserve the right to make changes in the syllabus at any time. This includes homework assignments, exam dates, material covered, and grading policy. It is your responsibility to be aware of these changes as they are announced in class.

Homework problems

Chap. 1. First-order differential equations			
1.	section 1.1	Modeling via dif. eqs.	#1,2, 11, 12, 19, 20
2.	section 1.2	separation of variables	# 1, 5, 11 ,13, 20, 25, 29, 30, 33, 35
3.	section 1.6	existence and uniqueness	#1, 2, 5, 6, 13, 14
4.	section 1.6	equilibria and phase line	#3, 4, 11, 12, 15, 16, 23, 24, 29, 30
5.	section 1.7	bifurcations	# 2, 3, 4, 7, 9, 15, 17
6.	section 1.8	linear dif. eqs.	#3, 4, 9, 12, 13, 14, 24
7.	section 1.9	integrating factors	#3, 4, 9, 12, 13, 14, 24
Chap. 2. First-order systems			
8.	section 2.1	modeling via systems	#1-6, 20, 21, 22
9.	section 2.2	geometry of systems	#7, 9, 10, 11, 13, 16
10.	section 2.3	analytic methods	#1, 2, 5, 6, 7, 8, 9, 13, 14, 15
Chap. 3. Linear systems			
11.	section 3.1	linearity properties	#5, 6, 7, 10, 11, 19, 27, 28
12.	section 3.2	straightline solutions	#3, 5, 6, 11, 12, 13, 16, 23
13.	section 3.3	phase plane for real eigenvalues	#3, 4, 9, 10, 13, 19, 20
14.	section 3.4	complex eigenvalues	#5, 6, 7, 11, 12, 13, 16, 23
15.	section 3.5	repeated and zero eigenvalues	#1, 2, 5, 6, 11, 17, 18
16.	section 3.6	2nd-order linear eqs.	#7, 8, 15, 16, 17, 23, 24, 25
17.	section 3.7	trace-determinant plane	#3, 4, 7
18.	section 3.8	linear 3D systems	#5, 6, 7, 11, 12
Chap. 4. Forcing and resonance			
19.	section 4.1	forced harmonic osc.	#1, 2, 5, 6, 9, 10, 13
20.	section 4.2	sinusoidal forcing	#1, 2, 5, 11, 12, 20
21.	section 4.3	resonance	#1, 2, 3, 9, 10, 13, 21
22.	section 4.4	Tacoma Narrows	#1, 2, 3, 4
Chap. 5. Nonlinear systems			
23.	section 5.1	equilib. points	#1, 2, 3, 7, 8, 18, 20, 21
24.	section 5.2	qualitative analysis	#1, 2, 5, 6, 9
25.	section 5.3	Hamiltonian systems	#1, 2, 10, 11, 13
26.	section 5.4	dissipative systems	#1, 2, 13, 14, 19, 22
27.	section 5.5	3D nonlinear systems	#1, 3, 4, 6
28.	section 5.6	periodic forcing an chaos	#1, 2, 3, 5, 6, 7
Chap. 6. Laplace transforms			
29.	section 6.1-6.4		

Computer Labs

Lab 1.	Slope fields and solution curves
Lab 2.	Numerical methods of Euler
Lab 3.	the Runge-Kutta method
Lab 4.	Using MATLAB for differential equations-1
Lab 5.	Using MATLAB for differential equations-2