

Tufts University

Department of Mathematics

Fall 2011

Mathematics 38

Sections: 01 (Block B) Hasselblatt, 02 (Block C) Höft, 03 (Block F) Barthelmé.

Text: Reprint of M. M. Guterman, Z. H. Nitecki, *Differential Equations – A First Course*, 3rd ed., Saunders (1992).

Prerequisites: Mathematics 11–13 or 17–18.

Course web page: <http://www.tufts.edu/as/math/38/>

Important dates: Three midterm exams **Mondays 12:00 noon to 1:20 pm: October 3 and 31 and December 5**. Final examination: **Friday, December 16**, from **8:30 am to 10:30 am**. *Please notify your instructor of any time conflicts with other examinations during the first week of classes.* Students who take two mathematics courses with any exams at the same time have to take these back to back and must notify *both* instructors during the first week of classes. *The exams are cumulative.* **Deadlines:** consult <http://uss.tufts.edu/stuserv/AcadCal/default.asp>.

Accommodation due to a documented disability: *at the beginning of the semester* please call the Student Services Desk at 617-627-2000 to arrange an appointment with Sandra Baer, Program Director of Disability Services.

Homework: Homework is due at the beginning of the next class. You are encouraged to collaborate, but you must hand in solutions written in your own hand. You receive one point if your homework contains (1) a bona fide attempt at *every* exercise (copying the statement does not suffice) and (2) the correct solution to at least 60% of the exercises (answers only are not enough). *Do not claim credit for any parts of solutions copied from the blackboard during class! This is plagiarism.* Your homework credit is $H = u_{26}(n) \cdot (n - 20)/4$, where n is the number of homework points and u is as on p. 449 of the text.

Grades: Your course average is computed from your lowest midterm score L , the other midterm scores T and T' , the final exam score F , and your homework credit H as the larger of these two numbers: $.1L + .2T + .2T' + .5F + H$ or $(L + T + T' + F)/4 + H$. This average will be converted into a letter grade according to the conversion chart given on the Mathematics Department website at <http://math.tufts.edu/?pid=10>. If you must miss a midterm exam for a reason accepted by the Mathematics Department, then there is no T' , and we instead use the larger of $.2L + .3T + .5F + H$ or $(L + T + F)/3 + H$.

Missing examinations: *Don't, if you can at all help it! Full information can be found on the mathematics department web pages:* <http://math.tufts.edu/?pid=10>. If your ability to take an examination is in doubt for any reason, please consult Gail Kaufmann <Gail.Kaufmann@Tufts.edu>, 617-627-2162 and your instructor as early as possible. Doing so in advance can help avoid one of 2 possible costly mistakes: Missing an examination when the reason for doing so is not sufficient, or taking an examination under circumstances in which you really should not. These can not be undone after the fact.

Cheating: Don't! You must sign your exam book before handing it in. *With your signature you are pledging that you have neither given nor received assistance on the exam.* If you question the grading on a particular problem, write a note explaining the issue (on the cover of the exam if it will fit there), and resubmit the exam booklet with the note *at the end of the class when the graded booklets were returned*. *Submitting an examination for regrading after altering original answers, submitting a fraudulent excuse for course work missed, cheating on an examination or bringing unauthorized materials into the room during an examination are all Level III offenses* for which one can expect an F in the course and suspension for a year or expulsion, and a permanent transcript notation. There is no appeal of grading consequences.

Learning objectives: Of our learning objectives found on the main department web page, this course addresses mainly 1 a, b, e.

The Course: We solve and analyze a wide variety of ordinary differential equations, and it is largely to this end that calculus was invented. They are a fundamental tool common the quantitative sciences and engineering because the simplest expression of the laws of nature often involves the *rate of change* of quantities. They are used by astronomers when calculating the trajectory of a planet, by physicists when computing the trajectory of a charged particle in an electromagnetic field, by population biologists when studying the dynamics of predator-prey populations, by chemical engineers when studying the variations of chemical concentrations in reactors, by electrical engineers when studying how a circuit of resistors, capacitors and inductors behaves after a switch is thrown, and by mechanical engineers when studying the flexure of a bridge under a varying load.

The course develops a complete method for solving constant-coefficient systems of differential equations and introduces qualitative methods for the study of nonlinear systems. The former entails much linear algebra, which is in itself most useful; a course on Linear Algebra is an excellent follow-up to this one. The qualitative analysis of nonlinear systems prepares participants for a fuller study of Nonlinear Dynamical Systems and Chaos, and a course on this subject is another recommended sequel.

Mathematics 38 Lecture and Test Schedule

	B, F	C	Sec.	Homework
1	9/6	9/6	1.1, 1.2	p. 8: 1, 3, 7, 17, 18*, 19*, 20* & p. 16: 3, 5, 15, 17, 24
2	9/8	9/7	1.3	p. 25: 1, 3, 7, 8, 12, 19, 23, 25 & p. 37: 1, 5
3	9/9	9/9	1.6	p. 8: 4 & p. 56: 1, 3, 7, 11, 17, 19, 21
4	9/13	9/13	1.8	p. 63: 1 & p. 71: 1, 3, 5, 16, 17, 21 & p. 194: 2
5	9/15	9/14	2.A	p. 8: 5 & p. 194: 1, 3, 5, 11, 16, 17, 19, 21, 31
6	9/16	9/16	2.2	p. 91: 1, 5* & p. 102: 1, 3, 7, 9, 13, 15, 17, 21, 23, 24
7	9/20	9/20	2.3	p. 113: 1-3, 9, 13, 15, 17, 31 & p. 196: 33
8	9/22	9/21	2.4	p. 103: 25 & p. 120: 1, 5, 9, 10, 13-15, 18;
9	9/23	9/23	2.5	p. 8: 6 & p. 129: 3, 5, 9, 11, 15, 18, 19, 22, 23
10	9/27	9/27	2.6	p. 136: 1, 5, 11, 13, 15, 19, 21, 23, 25
11	9/29	9/28	2.8	p. 155: 1, 5, 7, 9, 15, 17 & p. 196: 34
12	9/30	9/30	Review	
October 3 Exam 1: 12:00-1:20. Covers through 2.8				
13	10/4	10/4	2.7	p. 9: 8 & p. 145: 1-3, 5, 11, 14, 15 & p. 463: 12 ^{†*} , 13 ^{†*}
14	10/6	10/5	2.7	p. 145 ^a : 4, 6-9, 5, 13, 16 & p. 91: 1 & p. 172: 4a & p. 463: 11 ^{†*}
15	10/7	10/7	2.9	p. 164: 1-4, 5a, 6, 8, 11
16	10/11	10/11	5.2 & 4p.	421: 8-10, 13-15, 17, 19, 22-23 & p. 441: 1, 5, 9, 15, 18
17	10/13	10/12	5.3	p. 432: 1, 3, 11, 13, 17, 21 & p. 442: 27, 32 & p. 463: 14 [†] , 16 [†] , 17 [†]
18	10/14	10/14	5.5	p. 452: 3, 5, 7, 15, 17, 19, 23, 29
19	10/18	10/18	3.2	p. 203: 1 & p. 219: 1, 2cd, 5, 7, 8, 11, 13, 19, 24ab, 25, 32, 33
20	10/20	10/19	3.3	p. 103: 26 & p. 196: 35 & p. 232: 1, 7, 9, 11, 13
21	10/21	10/21	3.4	p. 121: 19 & p. 241: 1-5, 7, 8, 11-14
22	10/25	10/25	3.5	p. 9: 10 & p. 254: 1*, 4*, 5*, 6*, 9*, 11*, 13
23	10/27	10/26	3.6	p. 265: 1-3, 6, 7, 9, 11, 13
24	10/28	10/28	Review	
October 31 Exam 2: 12:00-1:20. Covers through 3.5				
25	11/1	11/1	3.6	p. 265: 20, 21, 14*, 17*, 18*, 19*
26	11/3	11/2	3.7	p. 275: 1, 4*, 5*, 7, 8, 9, 11, 13
27	11/4	11/4	3.8	p. 103: 27 & p. 196: 36 & p. 284: 1, 3*, 5, 7, 11
28	11/8	11/8	3.9	p. 9: 11 & p. 295: 1, 5*, 7, 9, 13
29	11/10	11/9	3.10	p. 308: 3, 5, 7, 9, 13 & p. 26: 9 & p. 155: 3
30	11/15	11/15	3.11	p. 71: 1 & p. 320: 1, 4, 5, 6, 7, 8, 13 & p. 194: 2 - [Recommended: p. 321: 1-14]
31	11/17	11/16	4.1	p. 71: 3-6, 8, 21 & p. 332: 1, 5, 9 - [Start review homework now!]
32	11/18	11/18	4.2	p. 348: 1-3, 7, 8, 9, 11, 13, 15, 17, 19, 20
33	11/22	11/22	4.3	p. 9: 12 & p. 364: 9 [‡] , 10 [‡] , 14 [‡] , 16 [‡] , 17 [‡] , 24 & p. 173: 5
34	11/29	11/29	4.4	p. 377: 1, 3, 7, 9, 10, 12, 13a
35	12/1	11/30	4.5	p. 8: 2 & p. 63: 1 & p. 385: 1, 2, 4, 5, 7
36	12/2	12/2	Review	
December 5 Exam 3: 12:00-1:20. Covers through 4.4				
37	12/6	12/6	4.6	p. 397: 1, 3, 4, 5, 8
38	12/8	12/7	4.6	p. 397: 9, 10, 11, Show that there is no closed integral curve in Exercise 4.5.5
39	12/9	12/9	Review	p. 17: 21 & p. 56: 5, 18 & p. 72: 15 & p. 113: 4 & p. 121: 16 & p. 129: 17 & p. 145: 7 & p. 155: 19 & p. 222: 34 & p. 233: 12 & p. 242: 15-17 & p. 255: 22 & p. 320: 11 & p. 348: 1, 3 & p. 421: 1, 7 & p. 441: 3, 17, 31 & p. 452: 1, 13 & p. 462: 2, 13 & p. 473: 5, 11. Optional: p. 284: 5 & p. 308: 3 & p. 433: 19 & p. 452: 9

Friday, December 16 Final Exam: 8:30-10:30am Cumulative

* Keep your answer for later assignments.

^a Use complex exponentials as appropriate, but not in the final answer to initial-value problems.

[†] Only find the partial-fractions decomposition.

[‡] Answer the question as posed and draw a full phase portrait.