

MATHEMATICS 2250
Ordinary Differential Equations and Linear Algebra
Spring semester 2003

Time: MWF 7:30–8:20am LS 101 or MWF 10:45–11:35am LCB 219

Instructor: Professor Grant B. Gustafson, JWB 113, 581-6879¹

Tutoring: The Math Department Tutoring Center is located in LCB, and it is open for free tutoring from 8 a.m. to 8 p.m. on M-Th, and from 8 a.m. to 2 p.m. on Friday. Some, but not all of the math tutors welcome questions from Math 2250 students. To see the times and specialities of various tutors, consult the web address

www.math.utah.edu/ugrad/tutoring.html.

Tuesday Lab: Held each Tuesday in LS 101 at 7:30am, in LCB 219 at 10:45am, or you may attend at another time as advertised on the www home page of Korevaar (see below). Students may attend as many or as few of these sessions as they wish.

Tuesday 7:30–8:20 a.m. LS 101

Tuesday 10:45–11:35 a.m. LCB 219

Tuesday 5–6 p.m. LCB 219

The Tuesday instructors are **Eiko Koizumi**, 585-6036 JWB 128, koizumi@math.utah.edu, and **Anca Mustata**, 585-7665, LCB 112, amustata@math.utah.edu.

Web Page: All 2250 courses <http://www.math.utah.edu/~korevaar/>

Web Page: This 2250 course <http://www.math.utah.edu/~gustafso/>

Office: JWB 113

Office Hours: MWF 8:45–9:15am and 11:45–12:15 JWB 113. Other times will appear on my door card JWB 113 and on the internet due date page. These two times are just after class ends and may start in the classroom.

Telephone: 581-6879. Please use email whenever possible.

Email: gustafso@math.utah.edu

Texts:

Differential Equations and Linear Algebra, by C.H. Edwards Jr. and David E. Penney

Also recommended:

Differential Equations, Cliff's Notes series. Contains concise examples and readable explanations of topics found in the Edwards-Penney text.

Student Solution Manual, for the Edwards and Penney text *Differential Equations and Linear Algebra*

WWW notes for 2250, by GB Gustafson, at www.math.utah.edu/~gustafso.

Prerequisites:

¹Pronunciation: In the phrase Gust of Wind change *Wind* to *Sun*.

Math 1210 and 1220 or the equivalent. This is first-year Calculus, with a very brief introduction to linear differential equations. The old Math courses 111-112-113 of 1997-98 fulfill the requirement. In addition, background is required in planar curves, velocity and acceleration vectors from Physics 2210 or Math 2210, or their equivalent courses.

A passive knowledge of `maple` is assumed. Truthfully, the entire course can be done without `maple`. A good replacement for persons without computer training is a graphing calculator and Microsoft's `Excel` or the MathWork's `matlab`. To cooperate with the engineering programs on campus, some `maple` contact is required in the coursework for 2250. The corequisite is Physics 2210 (old 301), with actual use of physics minimal.

Persons without the passive knowledge of `maple` and `unix` may attend one of the *tutorials* on the subject offered during the first two weeks of the term. The instructor for these tutorials is Angie Gardiner, 585-9478, `gardiner@math.utah.edu`. The dates and times are printed on Angie's door in building LCB. See also the tutoring web address cited above. Free tutoring is available in the LCB tutoring center 8:00 to 8:00 daily except until 4pm on Friday, closed weekends and Jan 20, Feb 17, Mar 17-21.

Course content:

This course is an introduction to linear algebra and differential equations in engineering and science. Chapters 1-7 and 10 in the Edwards-Penney text plus class notes will make up the course material.

Grading:

Final grades will be based on:

- Take-Home Exams, about 120 problems.

- The take-home exams include three computer projects, each counted as six (6) problems.

- Written midterm examinations (4).

- There is no in-class final examination.

Written In-Class Exams:

There are four (4) midterm exams. Some portion (10-20 minutes) of each midterm is in-class, while the remainder of the exam is done outside of class and attached to the in-class exam. The outside work is always due at in-class exam time.

Written Take-Home Exams:

The usual homework assignments and in-class quizzes will be replaced by about 120 take-home examination problems and three computer labs, each lab equal to six take-home exam problems. Some of these exams will be graded by a staff of readers employed by Angie Gardiner. The rest of the exams are graded by G.B. Gustafson.

Take-Home Exams:

About three days will be allowed to complete a take-home exam problem. All students must complete each exam problem. Collaboration is permitted and encouraged in teams of not more than 2. For a team of 2, the report is *submitted jointly* and both authors receive the same grade.

There are certain rules for writing up these exam problems. See below for more detail. Please

note that an in-class Midterm exam has different rules, and none of the above rules apply in this case. Basically, the in-class exam is a first draft. A full accounting of the *format rules* contributed by students of 2250 appears on the internet course page as *format for submitted work*. Kindly apply the useful ideas therein to your written work.

Computer projects:

There will be three computer projects assigned during the semester, related to the classroom material. Each project counts the same as 6 take-home exam problems. They will be written by hand and use the software package `maple`. There is a Math Department Computer Lab in building LCB at which registered students automatically own accounts, and there are other labs around campus where `maple` is also available, for example at the College of Engineering. There will be *free* tutoring support for these projects (Tuesdays) and for your other coursework as well. Drop-in tutoring in the computer lab in LCB starts January 13.

Midterm exams. A midterm exam is supplied one week before the in-class 15-minute exam. The exam problem is modeled after those already solved. Solve the problems on the midterm and bring your final report to the exam. Submit the two parts of the exam (outside + in-class = 5 problems) at the end of the exam.

Bring also on exam day your handwritten and computer-produced notes. Any additional handwritten notes, computer-generated notes and take-home exams may be used on exam day. This includes xerox copies of classroom slides. However, **no books are allowed**. Calculators are considered normal equipment. Books and tables are not allowed: transfer what you need to handwritten or computer notes.

Grading Details:

A passing grade in the course requires an average grade for the Take-Homes (includes computer projects) of at least 40%. The final grade will be determined as follows:

$$\text{Final Grade} = \frac{\text{Take Home Average}}{2} + \frac{\text{Midterm Average}}{2}.$$

In short, a grade of *E* is assigned if the **Take Home Average** is less than 40%. An example: the average of 120 take-home exam items is 91% and the average of the four midterms is 88%. The final grade is $(91 + 85)/2 = 89.5\%$, which by the scale below is a *B+*.

Grading Scale:

$$\begin{aligned} A &= 95-100, & A^- &= 92-94, & B^+ &= 88-91, & B &= 84-87, \\ B^- &= 80-83, & C^+ &= 75-79, & C &= 65-74, & C^- &= 60-64 \end{aligned}$$

This scale is determined from 40% passing use GPA increments. It is used for grading and for final grade reporting. This scale is for internal use only by Professor Gustafson.

Withdrawal:

It is the Math Department policy, and mine as well, to grant any withdrawal request until the University deadline. This promise also means that such a withdrawal requires no explanation. Withdrawals are always initiated by the registered student. All paperwork is the duty of the student. My job is the signature.

ADA statement:

The American with Disabilities Act requires that reasonable accommodations be provided for students with physical, sensory, cognitive, systemic, learning, and psychiatric disabilities. Please contact me at the beginning of the semester to discuss accommodation (113 JWB or 581-6879), which is to say, accommodation shall be made.

Purpose of the Take-Homes. The *purpose* of the projects is to practice doing mathematics, that is, to write out in detail the solutions to problems. A project consists of engineering-style “crank” problems, usually devoid of proofs. The process:

- **Understand the problem.** Understanding usually involves reading the *problem notes* and the textbook. Answers are provided and perhaps (but not always) an outline of the solution, to increase the probability that the project gets completed on schedule. Problems are discussed in class in great detail, often with the aid of transparencies (and xerox copies of same). Slides cover a similar problem or sometimes the exact problem considered in the project.
- **Background reading.** To solve a problem, a second opinion of the theory and method is essential. It might be that you can flesh it out of your book’s examples, the college algebra text, the calculus text or some engineering mathematics book. No matter, go to a source that works for you. This is *reading* and not a tutorial.
- **Scratch Paper Write-up.** The initial creation of a solution is the essence of the learning process. Everyone learns by repetition, and here is where you do it. Use a pencil and a big eraser, lots of paper, and flesh out a first draft at full speed. This is not the paper you turn in.
- **Final Copy.** The final copy of the solution uses the scratch paper draft as raw material to *present* the details of the solution. As such, it is more than a collection of formulas on paper. There is no strict requirement, except that *neatness* and *completeness* are a must.²
- **Final Copy Format.** The most successful format to date was invented by several engineering mathematics students over the years 1990–2003. This format is described in some detail below and also in the internet document *format for submitted work*. Engineering paper works nicely as does plain white paper. Lined notebook paper is less ideal because of the way it tends to force vertical spacing in large increments.

Some Format Suggestions

1. Reports are hand-written. They start with a problem statement followed by the book’s answer or by a final answer summary. Supporting material appears at the end, like a tax return.
2. Mathematical notation is on the left, text on the right, about a 60% to 40% ratio. One equal sign per line. Justify equations left or align on the equal signs.
3. Text is left-justified on the right side. It includes explanations, references by keyword or page number, statements and definitions, references to delayed details (long calculations, graphics, answer checks).

²About **plagiarism**: you may copy portions of the student solution manual and the answer provided in the back of the textbook. If this is *all* that appears in your written solution, then you are defacto guilty of plagiarism. Kindly add some of your own details, extra words of explanation, references to the textbook.

4. Every report has an answer check. It is usual to see “*the answer matches the textbook.*”
5. Any of these rules can be broken.

Plagiarism is defined as

the unauthorized use of language and thoughts of another and the representation of them as one’s own.

Textbook problems have **answers** and **solutions** published by Edwards and Penney. They *own* the work. You are authorized to cite *answers* without reference, in the course of doing a problem. To copy their *solution* from the solution manual and represent it as your own work is plagiarism. A blatant violation is the submission of a solution no different than what is found in the solution manual, or a problem statement followed by no work or explanation, just the author’s answer. Such circumstances are rewarded with zero credit; forfeited are opportunities to redo the problem for credit. This includes computer labs. *Please cite those who help you*, because there is no penalty possible from allowed cooperative efforts.

Presentation is expected to improve throughout the 14 weeks of the course. You are not expected to be an expert in the first week. Correct answers are assumed, because the problem notes contain the answers plus a solution outline. In class, further details are communicated. Your job is to *improve* on the initial start into the solution. Add the particulars, make comments, chase down the details from algebra and calculus. The difficulty is generally college algebra, with calculus running a close second. Writing up the solution identifies the stumbling blocks and forces a review of background material.

References are required on the first occurrence. After that, omit the citation. It is appropriate, however, to refer to the previous assignment on which the citations originated. A statement like “References parallel Exercises 1-5” is enough.

Due dates. All due dates are updated dynamically, at www.math.utah.edu/~gustafso/. Consult this resource often. To repeat: the dates will often not be given in class!

Makeups and Late Work. Due to the number of takehome exams being collected, work is considered late and therefore unacceptable when two (2) days have elapsed since collection in class. The lowest ten (10) take-homes are dropped from consideration in order to eliminate makeups. If more than five textbook sections have zero scores, then please call 581-6879 and discuss the situation and options for getting a passing grade in the course.

Deadlines. There is an absolute deadline for each chapter, which is approximately one week after the material has been covered in class. For example, while grading chapter 3, section 2, I will not grade chapters 1 or 2.

Iterations. You may be asked to iterate your work in order to straighten out bugs in the presentation or details. Kindly mark your work accordingly. Submit whatever is requested, but no more, in order to keep the paper trail brief. The deadline for a **redo** is 5 days from the date returned. Such requests end after the tenth lecture (end of January).

Midterm Exams. Missing an in-class exam is a disaster and therefore there will be a scheme to makeup one exam. If you miss two exams, then please equip yourself with reasons in writing and

see me in JWB 113, write email or call 581-6879. Likely, the scheme is 50-minute exam 5, to be given in the last week of classes. The content and level of midterm exam 5 parallels a final exam.

Spring 2003 Tentative Daily Schedule

Week 1, Jan 6,8,10	Section 1.1, 1.2, 1.3
Week 2, Jan 13,15,17	Sections 1.4,1.5. Begin maple lab 1.
Week 3, Jan 22,24	Sections 2.1,2.2. Holiday Jan 20.
Week 4, Jan 29,31	Sections 2.3,2.4,2.5,2.6. Holiday Jan 27. Exam 1 Jan 29.
Week 5, Feb 3,5,7	Sections 3.1,3.2,3.3. Maple Lab 1 due Feb 3.
Week 6, Feb 10,12,14	Sections 3.4,3.5,3.6.
Week 7, Feb 17,19,21	Sections 4.1,4.2. Begin Maple lab 2.
Week 8, Feb 24,26,28	Sections 4.3,4.4,4.5. Exam 2 Feb 26.
Week 9, Mar 3,5,7	Sections 5.1,5.2,5.3.
Week 10, Mar 10,12,14	Sections 5.4,5.5,5.6. Univ closed Mar 15-23.
Week 11, Mar 24,26,28	Sections 6.1,6.2,7.1. Exam 3 Mar 26. Maple Lab 2 due Mar 28.
Week 12, Mar 31, Apr 2,4	Sections 7.2,7.3,7.4. Begin Maple lab 3 Mar 31.
Week 13, Apr 7,9,11	Sections 10.1,10.2,10.3.
Week 14, Apr 14,16,18	Section 10.4,10.5. Maple Lab 3 due Apr 16. Exam 4 Apr 18.
Week 15, Apr 21,23	Section 10.5, Last in-class exam, Grade report. Class ends Apr 23.