MATHEMATICS 2250
Ordinary Differential Equations and Linear Algebra
Spring semester 2002

Time: MWF 7:30–8:20am JWB 335 or 6:00-7:15pm JFB B1

Instructor: Professor Grant B. Gustafson, JWB 113, 581-6879

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

Tuesday Lab: Held each Tuesday in JWB 335 at 7:30am, in JFB B1 at 7:15pm, 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.

In addition to the special 2250 sessions, the Math Department Tutoring Center is located in Mines 210, and 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`.

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 9:30-10:30am, JWB 113

Telephone: 581-6879, An answering machine is ON when I am out of the office. The machine takes only short messages, about 30 seconds. A modem line takes over at 4 rings. 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:

Schaum's Outline (McGraw-Hill), Richard Bronson's *Differential Equations*, especially for examples, solutions and numerical methods.

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*

Prerequisites:

Math 1210 and 1220 or the equivalent. This is first-year Calculus, with a very brief introduction to linear differential equations. The old Math 111-112-113 of 1997-98 fulfills the requirement. In addition, background is required in vectors, curves, velocity (tangent), 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. The dates and times are printed on Angie's door, JWB 112. See also the tutoring web address cited above.

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.
>
> Three computer projects, each counted as six (6) problems.
>
> The Term Project, at least 25 problems.
>
> In-class 50-minute written midterm examination.
>
> Optional oral and written final exam, by written agreement.
>
> If the oral–written final exam is elected, then the Term Project and the midterm exam scores are replaced by the final exam scores. *Register* for the optional final before the midterm exam date. Each final exam will be created on an individual basis. Due to the oral component, the exam must be scheduled.

Written In-Class Exams:

An oral–written final exam is optional; you may use the sum of the term project score and the midterm exam score to replace the oral–written final exam.

The only in-class exam is the midterm exam.

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.

There is a term project to be completed before the last week of classes. Less than 3 percent of this project involves computers. Collections of first drafts for the project problems will occur periodically, but the final version is the one submitted at the end of the course. The term project consists of 25 or more problems, similar to the ones required in the daily work, selected to be representative of the entire subject area.

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 some grade. This does not apply to the term project.

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

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 (Phyics South 205) 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.

Term project. The *Term Project* consists of 25 or more problems over the various topics in the course. This project is to be done in your own handwriting following the rules for detail and format suggested below. Submit the project in pieces according to the em gradesheet deadlines and the final version by April 26. This date is absolute: extensions of time will not be considered. Please plan ahead and work on the project each week.

Midterm exam. A sample midterm is supplied in the last weeks of the semester. You are to work out the problems on the sample midterm and bring to the exam your handwritten and computer-produced notes. Any additional handwritten notes, computer–generated notes and take-home exams may be used on midterm 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:

Grade I. Equals 50% of the Take-Home average (includes computer projects) plus 25% of the Midterm grade plus 25% of the Term project grade.

Grade II. Equals 50% of the Midterm grade plus 50% of the Term Project grade.

Final Grade. If the take-home average is less than 40%, then the final grade is E. Otherwise, the final grade is the higher of Grade I and Grade II.

A sample calculation:

$$\begin{aligned}\text{Average} &= \frac{94}{2} + \frac{1}{2}\frac{73+92}{2} \\ &= \frac{94}{2} + \frac{1}{2}\frac{73+92}{2} \\ &= 47 + 41.25 \\ &= 88.25 \\ &= \text{B+}\end{aligned}$$

Above, the take-home average is 94, the midterm 73 and the term project 92. Each number represents the percentage out of 100 percent for that item. Since the take-home average of 94

exceeds the midterm plus term project average of 82.5, the number 88.25 is used to compute the final grade.

Grading Scale:

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A  = 95-100, A- = 92-94, B+ = 88-91, B  = 84-87,
B- = 80-83,  C+ = 75-79, C  = 65-74, C- = 60-64
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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.

- **Final Copy Format**. The most successful format to date was invented by several engineering mathematics students over the years 1990–2002. This format is described in some

detail below. 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).
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 batant 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, which typically are cooperative projects; please cite those who help you.

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.

Makeups and Late Work. Due to the number of 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 days 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.

Spring 2002 Tentative Daily Schedule

Week 1, Jan 4	Section 1.1
Week 2, Jan 7-11	Sections 1.2,1.3,1.4. Begin maple lab 1.
Week 3, Jan 14-18	Sections 1.5,2.1,2.2.
Week 4, Jan 21-25	Sections 2.3,2.4,2.6,3.1.
Week 5, Jan 28-31, Feb 1	Sections 3.2,3.3,3.4. Maple lab 1 due.
Week 6, Feb 27, Mar 1	Sections 3.5,3.6.
Week 7, Mar 4-8	Sections more 3.6,4.1,4.2. Begin Maple lab 2.
Week 8, Mar 11-15	Sections 4.3,4.4,4.5. Last withdrawal date!
Week 9, Mar 18-22	Sections 5.1,5.2,5.3. Maple lab 2 due.
Week 10, Mar 25-29	Sections 5.4,5.5,5.6. Begin Maple lab 3.
Week 11, Apr 1-5	Sections 6.1,6.2,7.1.
Week 12, Apr 8-12	Sections 7.2,7.3,7.4. Maple lab 3 due.
Week 13, Apr 15-19	Sections 10.1,10.2. Midterm exam, in-class.
Week 14, Apr 22-26	Sections 10.3,10.4. Exam results. Semester project Ch 1-7 due Apr 26.
Week 15, Apr 29-30, May 1-2	Section 10.5. Semester project ch 10 due Apr 30. Grade report.