MATHEMATICS 2250
Ordinary Differential Equations and Linear Algebra
Fall semester 2005

Time: MTWF 7:30–8:20am EMCB 101 or MTWF 10:45-11:35am LS 101

Instructor: Professor Grant B. Gustafson[1], JWB 113, 581-6879.

Tuesday Lecturers: Lyubima Simeonova and Nessy Tania. Call 581-6851 (main office).

Office Hours: JWB 113, MWF 8:55-10:30am Other times will appear on my door card and on the internet due date page.

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

Email and web site: ggustaf@math.utah.edu http://www.math.utah.edu/~gustafso/ simeonov@math.utah.edu tania@math.utah.edu.

Tuesday Lab: Please attend one or more times as advertised below,e.g., if your class is at 10:45, then you may attend 7:30 or later lab sessions. It is usual to attend two Tuesday sessions for 20 minutes each to obtain help on dailies, maple labs and sample midterm exams.

Tuesday 7:30-8:20 a.m.	EMCB 101
Tuesday 10:45-11:35 a.m.	LS 101
Tuesday 5:00-5:50 p.m.	LCB 219

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.

Texts:

Differential Equations and Linear Algebra, by C.H. Edwards Jr. and David E. Penney, Second Edition (the required text). New problems and text material appear in the second edition. The old blue first edition could be used, provided you can adjust to page number changes and missing text material.

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 documents for 2250 at web site http://www.math.utah.edu/~gustafso/. All are pdf or text documents that can be printed from Netscape or MS explorer web browsers. Author: G.B. Gustafson. The resource most often used is the *due dates page*, which updates tentative collection dates for dailies and exam dates. Located here are sample solutions, maple notes and manuscripts.

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 courses 111-112-113 of 1997-98 fulfill the requirement.

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[1]Pronunciation: In the phrase $\boxed{Gust\ of\ Wind}$ change $\boxed{Wind}$ to $\boxed{Sun}$

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. The entire course can be done without `maple`, but all computer code examples are supplied in `maple` only. 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 course work for 2250. The co-requisite 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 MC 155A (building LCB). See also the tutoring web address cited above. Free tutoring is available in the LCB tutoring center 8:00 a.m. to 8:00 p.m. daily except until 6:00pm on Friday, closed weekends and semester holidays.

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 and `www` documents will make up the course material.

Grading:

Final grades will be based on:

> Textbook problems, the major part of the **dailies**, about 118 scores.
>
> Three computer projects form the minor part of the **dailies**. Each project is counted like six (6) textbook problems, for a total of 18 scores, making 136 dailies.
>
> Written midterm examinations (3).
>
> An in-class 2-hour final examination that counts as two additional midterm scores.

Written In-Class Exams:

There are three (3) midterm exams. There is a 2-hour in-class final exam as scheduled by the university. The midterm and final exams are graded by G.B. Gustafson and the Tuesday lecturers (H. Kassa and B. Murphy).

Hand-written Dailies:

There will be 136 dailies due during the semester, including textbook problems and three maple labs. They will be graded by a staff of readers employed by Angie Gardiner.

Textbook problems:

Textbook problems to be submitted for grading are listed on the `gradesheet` for the course. Visit the web site for extra copies. The due dates for problems appear only on the web site and they are dynamically updated to reflect the reality of what was discussed in class. Generally, problems are submitted shortly after they are discussed in class.

All students must complete each textbook problem and submit their work in their own handwriting. Collaboration is permitted and encouraged on textbook problems in teams of not more than 2. You must submit a separate handwritten report with citation to the partner.

There are certain **rules** for writing up the textbook problems and the take-home portion of a midterm exam. 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 ideas therein to your written work, both textbook problems and take-home midterm exam problems.

Take-home exam problems:

A portion of each of the three midterms is a take-home exam in at least four versions, to be completed and submitted by the due date published on the web site. The format rules apply strictly: what you submit is considered to be your very best work. It will be judged accordingly against the submissions of others.

Collaboration on take-home exam problems is not sanctioned. Tutors and lab assistants may answer questions, but they will not work the problems for you or certify correctness of your solution. Duplicate solutions will be considered a deliberate act of plagiarism.

In-class midterm exam problems:

A midterm sample in-class exam is supplied a few days before the in-class exam. Exam problems are modelled after the sample exam.

Books, tables, notes and calculators are not allowed on exam day.

An in-class Midterm exam has different presentation rules, and none of the textbook problem rules apply in this case. Basically, the in-class exam is a first draft.

Computer projects:

There will be three computer projects assigned during the semester, related to the classroom material. Each project counts the same as 6 daily problems from the textbook, for a total of 18 scores on the dailies. 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 course work as well. Drop-in tutoring in the computer lab in building LCB starts the second week of the semester.

Final exam:

Two hours are reserved for this written exam. As published by the university, the final exams are: 7:30 class: Wednesday, Dec 14, 8-10am; 10:45 class: Tuesday Dec 13, 10:30-12:30. Both in the regular classroom.

The final exam is comprehensive. About one hour of the exam covers the last three weeks of the course. The remaining time covers all topics that appeared on the previous three midterm exams.

No notes, calculators, tables, books or aids of any kind are allowed on the final exam. Please bring pencils and eraser. Paper will be supplied.

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.

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 letter grade reporting. This scale is for internal use only.

Grading Details:

Rite of passage: A passing grade in the course requires at least 75 of the 136 dailies (includes computer projects) to be submitted. A grade of E is assigned if less than 75 Dailies are submitted. The scores on the 75 dailies are expected to be passing at C level or higher.

The right of passage is absolute, similar to the European system, which requires a body of work to be presented before written and oral final exams are taken. For example, the Czech *vypočet* is a requirement to show a body of completed work as the entrance requirement to administration of written and oral final exams.

Final grade: It will be determined as follows:
$$\text{Final Grade} = \frac{30}{100}(\text{Dailies Average}) + \frac{70}{100}(\text{Midterm+Final Average}).$$
An example: the Dailies Average for 128 textbook problems and maple labs is 91% and the Exam Average of the three midterms and the final exam is 86%. The final grade is $0.3(91) + 0.7(86) = 87.5\%$, which by the scale above is a B. While 87.5 rounds to 88, a $B+$, the deciding factor is really the exam average of 86, which is squarely a B. The final grade is B. If the dailies average was 93 or higher, then the final grade would be 88.1 or higher for a B+.

A grade of E is assigned if less than 75 Dailies are submitted. Please read the **Rite of passage** paragraph above.

Purpose of the textbook problems. The *purpose* of the problems is to practice doing mathematics, that is, to write out in detail the solutions to problems. A textbook problem is generally an engineering–style "crank" problem, usually devoid of proofs. The process:

- **Understand the problem**. Understanding usually involves reading the *problem notes* and the textbook. Answers are usually not provided. You may get 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. The classroom slides are mirrored at the web site as pdf files, ready to print from an internet browser.

- **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 1990–2005. This format is described in some detail below and also in the internet document *format for submitted work*.

Some Format Suggestions

1. Use engineering paper or plain white paper. Lined notebook paper and graph paper are not acceptable, because they cause inappropriate vertical white space for mathematics.

2. 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.

3. 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.

4. 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).

5. Any of rules 1-4 can be broken.

6. Every report has an answer check. For odd-numbered problems it is usual to see "*the answer matches the textbook*," or briefly, "*BOB*," which stands for *Back of Book*. For even-numbered problems, a full answer check is expected, unless the problem has an answer in the back of the textbook. Problems with wrong answers also deserve an answer check (there are a few).

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.

Maple computer labs are plagiarized by xeroxing an identical copy of a maple lab without citation. You are allowed to work in groups of two or thee, but you must cite the other authors to receive credit. That is, John and Jack can have identical maple printouts provided they cite each other in the first line of the printed copy. Groups of four with identical maple computer labs are considered plagiarism, even if citations are made, unless this unusual collaboration is approved: send email to `ggustaf@math.utah.edu`. The safest plan is to write your own lab using suggestions from others. Such singular efforts do not require citation.

Cooperative efforts on dailies are allowed and encouraged in groups of two or three. Work groups of 4 to 6 people are tolerated, but please communicate by email your intent to work in a large group, so that equal credit is applied to all members. Graders generally read what is written; write one report for each group member, but cite the members so that graders are not confused by small differences.

English language deficiencies will be tolerated but not excused. Graders prefer precise English comments, and fewer comments. If English is your second language, then try to improve your writing skills: (1) shorten comments and (2) use page references to the textbook to avoid writing English.

Presentation is expected to improve throughout the 14 weeks of the course. You are not expected to be an expert in the first week. Correctness of answers will be checked. The problem notes might contain 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! Sometimes, email communication about due dates and exams will be made from the registrar's list. If your campus information data is incorrect, then please visit the campus WWW system to update the information.

Makeups and Late Work. Due to the number of dailies being collected, work is considered late and therefore unacceptable when two (2) days have elapsed since collection in class. The lowest eight (8) dailies are dropped from consideration in order to eliminate makeups. If more than ten (10) textbook problems have zero scores, then please call 581–6879 or email `ggustaf@math.utah.edu` and discuss the situation and options for getting a passing grade in the course.

Missed Deadlines. There is an absolute deadline for each collection. After the stack is sent to the grading assistant, all late work received henceforth earns a zero.

Iterations and Redos. You may be asked to iterate your work from Chapter one in order to straighten out bugs in the presentation or details. Kindly mark your work $\boxed{\textbf{REDO}}$. 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. **Redo requests end** after chapter one has been returned: **no redos** for Chapters 2-10.

Missed 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.

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Fall 2005 Tentative Daily Schedule

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Week 1, Aug 24,26	Sections 1.1,1.2.
Week 2, Aug 29,31,Sep 2	Sections 1.3,1.4,1.5. Begin Maple lab 1a.
Week 3, Sep 7,9	Sections 2.1,2.2,2.3. Begin Maple lab 1b. Holiday Sep 7.
Week 4, Sep 12,14,16	Sections 2.4,2.5,2.6. Maple Lab 1a due Sep 14.
Week 5, Sep 19,21,23	Sections 3.1,3.2,3.3. Maple Lab 1b due Sep 23.
Week 6, Sep 26,28,30	Sections 3.3,3.4. Exam 1 Sep 28. Begin Maple lab 2 Sep 30.
Week 7, Oct 3,5	Sections 3.5,3.6. Holiday Oct 6,7.
Week 8, Oct 10,12,14	Sections 4.1,4.2,4.3,4.4.
Week 9, Oct 17,19,21	Sections 4.5,4.6,4.7.
Week 10, Oct 24,26,28	Sections 5.1,5.2,5.3. Exam 2 Oct 26. Maple lab 2a due Oct 28.
Week 11, Oct 31,Nov 2,4	Sections 5.4,5.5,5.6. Maple lab 2b due Nov 9.
Week 12, Nov 7,9,11	Sections 6.1,6.2,7.1. Begin Maple lab 3a Nov 11.
Week 13, Nov 14,16,18	Sections 7.2,7.3,7.4. Begin Maple lab 3b Nov 18.
Week 14, Nov 21,23	Sections 10.1,10.2. Holiday Nov 24,25.
Week 15, Nov 28,30,Dec 2	Sections 10.3,10,4. Exam 3 Nov 28. Maple lab 3a due Dec 2.
Week 15, Dec 5,7	Final Exam review. Maple lab 3b due Dec 5. Lectures end Dec 7. Reading Day Dec 9.
Week 16, Dec 13,14	Final exam period. Gradesheet check due in 113jwb. Final exam for the 7:30 class is 8-10am on Wed Dec 14. Final exam for the 10:45 class is 10:30-12:30 on Tue Dec 13.

Policy on Exams. The three (3) midterms plus the final represents 70% of the course letter grade. The final exam is doubled before determining the exam average, so that it counts as two midterms. Graded by G.B.Gustafson.

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

Tentative Due Dates 2250 Fall 2005

Chapter 1 (17 boxes)

26 Aug Page 16, 1.2: 2
29 Aug Page 16, 1.2: 6, 8, 10
02 Sep Page 26, 1.3: 10, 16
07 Sep Page 41, 1.4: 6, 10, 16, 18, 24
09 Sep Maple Lab 1a: Intro maple
   1.1, 1.2
12 Sep Page 54, 1.5: 10, 16, 24, 36

Chapter 2 (10 boxes)

14 Sep Page 86, 2.1: 6, 16
16 Sep Page 96, 2.2: 10, 18
19 Sep Page 106, 2.3: 20, 22
21 Sep Maple Lab 1b: Newton Cooling
   1.3, 1.4, 1.5, 1.6

Chapter 3 (6 boxes)

23 Sep Page 152, 3.1: 8, 18, 28
26 Sep : Exam 1
28 Sep Page 162, 3.2: 10, 16, 26

Chapter 2 (12 boxes)

30 Sep Page 119, 2.4: 10, 10, 12, 12
30 Sep Page 129, 2.5: 10, 10, 12, 12
30 Sep Page 139, 2.6: 10, 10, 12, 12

Chapter 3 (14 boxes)

03 Oct Page 170, 3.3: 12, 18
05 Oct Page 182, 3.4: 22, 26, 38, 40
06,07 Oct: Holiday
10 Oct Page 194, 3.5: 18, 28, 34
12 Oct Page 212, 3.6: 6, 18, 30, 38, 60

Chapter 4 (21 boxes)

14 Oct Page 233, 4.1: 18, 24, 32
17 Oct Page 240, 4.2: 6, 16, 24
19 Oct Maple Lab 2a: Matrix Algebra
   2.1, 2.2, 2.3
21 Oct Page 248, 4.3: 20, 24

24 Oct: Exam 2
26 Oct Page 255, 4.4: 8, 22
28 Oct Page 263, 4.5: 10, 22, 26
31 Oct Page 271, 4.6: 4, 18,
02 Nov Page 278, 4.7: 10, 22, 24

Chapter 5 (25 boxes)

04 Nov Page 294, 5.1: 34, 38, 40, 42, 44, 48
04 Nov Page 306, 5.2: 16, 24
07 Nov Page 319, 5.3: 4, 8, 10, 30
09 Nov Maple Lab 2b: Mechanical Oscillations
   2.4, 2.5, 2.6
11 Nov Page 331, 5.4: 18, 34
14 Nov Page 346, 5.5: 2, 10, 22, 52, 60,
16 Nov Page 357, 5.6: 2, 10, 16

Chapter 6 (6 boxes)

18 Nov Page 370, 6.1: 10, 22, 32
18 Nov Page 379, 6.2: 8, 20, 26

Chapter 7 (8 boxes)

21 Nov Page 400, 7.1: 10, 18
23 Nov Page 413, 7.2: 8, 16
28 Nov: Exam 3
30 Nov Page 425, 7.3: 6, 18, 28
30 Nov Page 438, 7.4: 4

Chapter 10 (10 boxes)

02 Dec Page 576, 10.1: 16, 18, 30
05 Dec Page 588, 10.2: 10, 12, 20
05 Dec Page 597, 10.3: 6, 14, 20, 38

Chapter 7 (7 boxes)

07 Dec Maple Lab 3a: Tacoma Narrows
   3.1, 3.2, 3.3
07 Dec Maple Lab 3b: Earthquake
   3.4, 3.5, 3.6
07 Dec Page 606, 10.4: 20
13 Dec: Final exam, 10:45 class, 10:30-12:30
14 Dec: Final exam, 7:30 class, 8:00-10:00

Policy on Dailies: The highest 128 boxes will be counted. The lowest 8 of the 136 boxes will be dropped. Any record with less than 75 daily and lab scores earns a grade of **E**, regardless of midterm and final exam scores. Deadlines set at web site www.math.utah.edu/~gustafso/. Work not in the stack sent to the assistant is late and it earns a grade of zero.

Policy on Exams: The final exam counts like two midterms.