

MICHIGAN STATE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 280: Analytical Methods for Electrical Engineering

Fall Semester, 2005

ECE 280 WEB SITE – <https://www.angel.msu.edu>

INSTRUCTORS' CONTACT INFORMATION

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Appt. by email: Send 2 suggested times that you could meet on Mon. or Fri. – 24 hrs. notice, please.
Email response will confirm.

COURSE PREREQUISITES / COREQUISITES

(MTH 234) and (ECE 201 or concurrently)

STUDY MATERIALS

- Lecture notes:** Posted on course web site.
- In-class notes:** We will discuss many examples, numerical solutions.
- Textbooks:** [required] D.M. Etter and D. Kuncicky, *Introduction to Matlab 6-6.5* (updated 2nd edition), Pearson Education Pub. (Prentice-Hall), 2004.
[optional] A. Kaw, *Introduction to Matrix Algebra*, U. South Florida, 2002. (ebook, download free: www.eng.usf.edu/~kaw)
- DSP software package:** MATLAB. Available on college network.
- Supplementary references:** Posted on course web site as available.

COURSE DESCRIPTION AND POLICIES

Topic Coverage and Emphasis

- What is covered in the course?
 - ECE 280 covers four fundamental sets of analytical techniques that are used throughout the ECE curriculum. The use of these techniques is motivated and illustrated through simple engineering examples. Additionally, the MATLAB computing package is introduced and used extensively so that the software can be used as an important tool in future courses. The schedule of coverage of the material appears in the **Course Schedule** attached to this syllabus.
 - Material discussed in class and related problems will be emphasized on exams.

Homework (HW)

- When and how are HW assignments made?

HW assignments will be posted on the class web site approximately every two weeks. New assignments will always be announced in class and announced on the class web site.
- How is HW graded?
 - Unless it becomes apparent (through test scores, student interactions, etc.) that another strategy is needed, HW will *not* be collected. Why?
 - * The pervasive availability of solutions and the increased tendency for some students to copy one another's solutions (as opposed to working together, which is *encouraged* for those who find it helpful) has made it difficult to fairly grade HW.
 - * HW scores rarely change students' grades, because those who work hard on HW (hence, get good HW scores), are generally those who do well on exams. (The converse is also true.)
 - You may keep a "HW Notebook" and hand it in near the end of the semester if you choose (date will be announced). This is *optional* – choosing not to hand in such a notebook will *not* reduce your course grade. Effort exhibited in this book, as well as interactions with students concerning HW problems, will be considered in assigning course grades for those who are on the "borderline" between grades.
 - The number of exams has been increased to five to provide ample data with which to assess performance.
 - Examinations will include problems that strongly resemble the HW problems and examples worked in the lecture notes and in class, *including* MATLAB exercises.
- Is it important to do the HW assignments?
 - You will not succeed in this course unless you diligently work the assigned problems. These problems force you to struggle with the concepts, and to learn the important analytical tricks necessary to solve exam problems. It is important to *try the problems and exercises as soon as possible after the relevant class*. Doing so will strongly reinforce the new concepts.
 - Examinations will include problems that strongly resemble the HW problems and examples worked in the lecture notes and in class, *including* MATLAB exercises.
- Are solutions to HW problems provided?

HW will be discussed in and outside of class to the extent that students have questions, and to the extent that certain problems might be particularly illustrative of some points. Solutions will be posted on the class web site.

- Do I need to use a computer to solve HW problems?

Problems labeled “MATLAB” involve the use of the MATLAB software package for their solutions. These problems will be part of a regular HW assignment.

- How can I get help with MATLAB? Help using computers?

Students are expected to take some initiative, just as you would in an engineering job setting, in seeking out and learning to use the appropriate computing resources (e.g., software, plotters, printers) for completion of assignments. MATLAB will be introduced and discussed frequently in class, but continual “hand-holding” (e.g., “I can’t get MATLAB to plot.” “How do you read this file into MATLAB?”) will not be available. It is strongly recommended that you attend one of the DECS MATLAB Workshops for valuable training. For information, see

<http://www.egr.msu.edu/decs/facilities/software/matlab.php>

and especially note item 17.

- Do I have to use MATLAB, or may I use another software package?

MATLAB is required in ECE 280 because you need the training for future courses. Most employers of signal-processing, communications, control, etc., engineers expect job applicants to be proficient users of MATLAB. MATLAB will be employed in class demonstrations. The package is available on all Windows and Unix-based computers in the college and probably elsewhere on campus. A student (PC) version of the software is available for reasonable prices, but it should not be necessary to purchase it.

Examinations

- How many exams will there be, and when are they scheduled?

There will be four “Midterm” Exams, and a Final Exam. Dates for the five exams are shown on the course schedule. Midterms 1, 2, 3, and 4, cover Parts 1, 2, 3, and 4 of the course, respectively. The Final represents a comprehensive review of Parts 1, 2, and 3 of the course. The Final is *optional* for students receiving a “2.5” or better (see below for explanation of “QPA” scores) on Midterm 1, and Midterm 2, and Midterm 3. Although the material might have to be adjusted, the exam dates will not change, so you can plan accordingly.

- Are sample exams available?

Yes, these will be posted on the web site. Working “sample exams” is useful to get an impression of the “exam style,” and also to see some of the topics that might be emphasized. However, simply working old exams is generally a very poor way to study for an exam.

- What if I miss an exam?

A student may take a “makeup” exam only if a legitimate case of illness or personal emergency arises which is documented by a physician or other appropriate official. A student who finds it necessary to miss a midterm should contact one of the professors *before* the exam, if at all possible, to explain the circumstances. The Final Exam will serve as the “Makeup Exam” for students with an *excused* absence from Midterm 1, 2, or 3. (Merely “skipping” a midterm does not guarantee that the Final will be considered a “Makeup.”) Students who miss more than one midterm are usually required to drop the course because such absences are indicative of a chronic health or other personal problem which makes it impossible to stay current with the material.

- How do I decide whether to take the “optional” Final Exam?

– If you have a “quality point score” of 2.5 or greater (see below) on Midterms 1 and 2 and 3, you may elect to omit the Final Exam. *No assistance with this decision will be available! By the end of ECE 280 (if not sooner), you should be able to average a few numbers and make your own decision!*

- If you have a “quality point score” *less than* 2.5 on Midterm 1 or Midterm 2 or Midterm 3, you *must* take the Final Exam. Failure to do so will result in a score of 0% on the Final.
- If you missed Midterm 1, 2, or 3, and you have been given permission to take the Makeup Exam, you must take the Final Exam because this will serve as the Makeup. Failure to do so will result in a 0% on the missed midterm, and a 0% on the Final Exam. In this case, your grade will be based on the four exams you will have taken (three midterms and the final).
- If you missed Midterm 1, 2, or 3, and you have been *denied* permission to take the Makeup Exam, you must take the Final Exam because you will have a 0% score on the missed Midterm and therefore do not qualify to opt out of the Final.

Grading

- Are “Incompletes” possible?
 - INCOMPLETE grades will be given only in unusual cases of illness or other personal emergency which causes the student to miss a significant amount of the course. The instructors must agree that the missed work can be completed in a reasonable amount of time in their opinion. This grade will *not* be given for any other reason.
 - A student who misses more than one examination will usually be required to repeat the course.
 - A student who misses the Midterm 4 or the Final Exam (both given during the university-scheduled final exam period) without satisfactory explanation will receive a failing grade in the course. This is university policy.
- How is the final course grade determined? How will I know where I stand in the course after Midterm 1, Midterm 2, etc.?

Grades will be determined as follows:

4 Midterm Exams*	100 points each
Final Exam	100 points
TOTAL possible points	500 [†]

[†]400 if the student legitimately opts out of the Final Exam

On each Midterm (as well as on the Final) you will receive a “report card” or “quality point” (QPA) grade: 4.0, 3.5, 3.0, . . . , 0.0 [sometimes a finer quantization used], as well as a usual point (percentage) score. At the end of the semester, the professors will determine a grade for each person based on a curve of the total 500 points. A second grade will also be based on your individual “QPA” scores. Let

$$\begin{aligned}
 G &= \text{course grade determined in conventional way using percentage scores} \\
 Q_{\text{mt1}} &= \text{“QPA” grade on Midterm 1} \\
 Q_{\text{mt2}} &= \text{“QPA” grade on Midterm 2} \\
 Q_{\text{mt3}} &= \text{“QPA” grade on Midterm 3} \\
 Q_{\text{mt4}} &= \text{“QPA” grade on Midterm 4} \\
 Q_{\text{fin}} &= \text{“QPA” grade on the Final Exam}
 \end{aligned}$$

Then your final course grade will be¹

$$\max \left\{ G, \left\lceil \frac{100 Q_{\text{mt1}} + 100 Q_{\text{mt2}} + 100 Q_{\text{mt3}} + 100 Q_{\text{mt4}} + 100 Q_{\text{fin}}}{500} \right\rceil \right\}.$$

where, $\lceil \cdot \rceil$ indicates rounding to the nearest half integer. See Fig. 1 for an example grade computation.

¹If the student legitimately opts out of the Final Exam, a similar computation will be made discounting the Final Exam score, Q_{fin} , and dividing by 400.

Figure 1: EXAMPLE COURSE GRADE COMPUTATION

André-Marie “Andy” Amperè receives the following “percentage” scores on the exams: MT1 40 (1.5), MT2 43 (1.5), MT3 78 (3.5), MT4 71 (3.25), Final 99 (4.0). The test scores in parentheses correspond to the “QPA” scores in each case.

Method 1 (“Subjective”). At the end of the semester, Andy’s “percentage” scores are averaged to give a course percentage of

$$\frac{40 + 43 + 78 + 71 + 99}{500} \times 100\% = 66.2\% \rightarrow 2.5$$

The class average for this aggregate measure is 68%. The instructors decide that Andy’s result is a 2.5 for the course after considering the overall class performance.

Method 2 (“Objective”). Then Andy’s “QPA” scores are averaged

$$\frac{(1.5 \times 100) + (1.5 \times 100) + (3.5 \times 100) + (3.25 \times 100) + (4.0 \times 100)}{500} = 2.75 \text{ round to } \rightarrow 3.0$$

The Verdict. Andy receives a 3.0 in ECE 280.

Advice?

- How can I do well in this course?
 - Come to class regularly. If you need to miss class, find out what you missed (especially whether there were any important announcements), but **please don’t ask** “Did we do anything important in class last week?”!
 - Work hard on the HW (seek help when needed). Make sure you understand the theory behind each HW problem (*never* memorize a solution - this is a waste of time!). Exam problems test theoretical concepts usually with easier problems than those in the HW.
 - Preview the material to be covered in class.
 - Stay organized and check the course web page regularly. (Even though no “surprises” will appear on the web, there are updates, handouts, etc. that you might miss if you don’t check.)
- How can I fail this course?

There are many effective ways, but the following techniques are universally successful:

- Enroll in the class without the appropriate background.
- Skip class frequently. Think of Friday and Monday as the first and last days of the weekend.
- Don’t work the HW assignments, or, if you do, think of HW problems as isolated pieces of information to be memorized.
- Don’t keep up with the class schedule. Do all your studying the nights before the exams.

UPDATED 09/08/05

Dates (Instructor)	Topics	Assignments
Weeks of: Aug. 29, Sep. 5, 12, 19 (Rothwell)	PART 1: Fundamental Topics in Vector Calculus and Coordinate Systems	
Weeks of: Sep. 26, Oct. 3, 10, 17 (Deller)	PART 2: Fundamental Topics in Linear Algebra; Introduction to MATLAB	Read: EKH* Chs. 1,2,4; Kaw [‡] Chs. 1,2,3,4,5,9,10
Weeks of: Oct. 24, 31, Nov. 7, 14 (Deller)	PART 3: Fundamental Topics in Probability, Statistics and Random Variables; MATLAB functions	Read: EKH Ch. 3
Weeks of: Nov. 21, 28, Dec. 5 (Rothwell)	PART 4: Complex Numbers and Variables; Symbolic math using MATLAB	Read: EKH Ch. 5

*Etter, Kuncicky & Hull, *Introduction to Matlab 6-6.5* (or later version)

[‡]Kaw, *Introduction to Matrix Algebra*

**Examination and Other Important Dates
(updated 09/08/05)**

Monday, Sep. 5	<i>No class - Labor Day</i>
Monday, Sep. 26	Midterm 1 (regular class period)
<u>Monday, Oct. 24</u>	Midterm 2 (regular class period)
<u>Friday, Nov. 18</u>	Midterm 3 (regular class period)
Friday, Nov. 25	<i>No class - Thanksgiving Holiday</i>
Tuesday, Dec. 13	Midterm 4 and Final Exam (7:45–9:45 a.m. [<u>a.m.</u> , that's <i>morning</i> , folks])