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EE 302H: Introduction to Electrical Engineering

Fall 2018

URL: http://courses.utexas.edu (Canvas)
(Announcements, problem sets, handouts, etc.)

Instructor: Seth Bank
MER 2.606C (Tu/Th/Fri)
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(Please include "EE302" in subject)

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Lectures: MW 1:30PM-3:00PM
EER 1.516

Office hours: MW 3:00PM-4:30PM, EER 3.876
or by appointment at EER or MER

Labs: Th 3:00PM-5:00PM (16037)
Fri 11:00AM-1:00PM (16038)
M 9:00AM-11:00AM (16039)
EER 1.826

TA Office hours: Office hours and location(s) will be posted on course web site.

Semester Exams: three semester exams, 90 minutes each, will be given on the dates/times below. The 2-hour time slot allows some time for seating, directions, collecting exams, etc. Our regular lectures scheduled on 10/03/2018, 10/31/2018, and 11/28/2018 will not meet.

Semester Exam 1: We 10/03/2018, 8:00PM-10:00PM
Semester Exam 2: Tu 10/30/2018, 8:00PM-10:00PM [NOTE DIFFERENT DAY OF WEEK]
Semester Exam 3: We 11/28/2018, 8:00PM-10:00PM

Course Description:
This course provides an introduction to some of the central elements of electric circuits, their application, and related issues. Topics covered will include the following: the scientific method, and general tools and approaches for problem-solving and analysis; fundamental physical phenomena and their connection to electrical systems; analysis and applications of analog resistive circuits, including Kirchhoff's Laws, nodal and mesh analysis, Thévenin and Norton equivalents, and operational amplifiers; and technological, societal, and ethical issues that arise in electrical engineering. **Additional topics specific to EE302H include an introduction to two-port networks, frequency domain analysis, electronic materials, diodes, transistors and their application to CMOS logic, and photonic devices (solar cells, and light-emitting diodes).** Substantial teamwork experience is included in the laboratory component of this course. The course will help students to build and understand the intellectual foundations that underlie much of electrical engineering, and to establish and appreciate connections between electrical engineering and basic sciences, mathematics, and liberal arts.

Prerequisite:
Completion of or concurrent enrollment in Mathematics 408C or equivalent is required.

Required Text and Equipment:
F. T. Ulaby & M. M. Maharbiz, Circuits (National Technology & Science Press, Third Edition, 2016).
National Instruments myDAQ (sold in bundle with Circuits text)
PDF download: https://www.publishing.umich.edu/publications/ee/ (but you still need a myDAQ for lab!)

Supplementary References:
C. K. Alexander and M. N. O. Sadiku, Fundamentals of Electric Circuits, 4th Edition (McGraw Hill, 2009).
P. Horowitz and W. Hill, The Art of Electronics, 3rd Edition (Cambridge University Press, 2015).
J. W. Nilsson and S. A. Riedel, Electric Circuits, 9th Edition (Prentice Hall, 2011).

Grading:

Homework	5%	
Laboratory	12%	
Project	3%	
Semester Exams	50%	[3 exams during semester, best 2 count 25% each]
Final Exam	30%	

Your final course grade will be determined using these course components and weightings. Because only your best 2 semester exams are counted, makeup exams will be given only under extraordinary circumstances and at my sole discretion. Per University policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence. Class attendance is not considered explicitly in computation of your course grade, but is strongly recommended as an important part of your learning process.

Each course component will be graded on a curve, rather than an absolute scale, for translation of numerical to letter grades. This will almost certainly result in your receiving a higher letter grade than if the traditional absolute scale were employed. Final grades will be assigned using +/- grade increments.

Notes on exam grading: For exam problems, reasoning and analysis are typically as or more important than the final answer. You should explain your reasoning clearly and show all work. Be sure to erase or cross out any work you do not want to be considered in grading. If you demonstrate mastery of the key concepts required to solve a problem, you will receive substantial credit even if the final answer is not completely correct. Conversely, a correct final answer without explanation or justification will typically receive very limited credit. *Any requests for exam regrades must be made in writing with an explanation of the issue in question, and within one week of your receiving your original graded exam. If an exam regrade is requested, the entire exam may be regraded and your total score may increase or decrease.*

Drop Policy

All adds and drops should be discussed with your academic advisor. The last day to drop this course without permission from the Dean and the department advisor is the twelfth class day. After this day, drops are not approved unless students can demonstrate "good cause", i.e. health or personal problems that did not exist at the end of the official add and drop period. Academic performance, such as making poor exam grades, is not a valid reason to drop. The Cockrell School of Engineering add/drop policies may be found at:

http://www.engr.utexas.edu/undergraduate/policies

Policy on Collaboration:

Discussion of course material and homework problems is permitted (and encouraged!). However, each student should work through the homework problems (and write up his or her solutions) independently. For additional details please see the section of this syllabus on Policy on Academic Integrity.

Course Policy on Academic Integrity:

Ethics and integrity in both academic and professional affairs should be part of your education at UT Austin. Academic integrity is a serious matter and will be treated as such in EE 302. My hope is that this will be beneficial to your education both technically and in a much broader sense.

While I am confident that the large majority of students will naturally adhere to the university's guidelines and regulations regarding academic integrity, I provide below an explicit statement of course policy in this regard.

Homework:

EE 302 course policy is that discussion of course material, including homework problems, is allowed and indeed encouraged. However, each student should work through assigned homework problems and write up his or her solutions independently. Problem-solving is an extremely useful skill in itself, and in addition is the only really effective way to learn the material!

Specifically, each student is responsible for working out and writing up his or her own solutions to each homework assignment. Discussion of the course material and problems is encouraged, but practices such as allowing a classmate to copy your homework solutions, or a group working out a problem solution together which everyone then copies down and turns in, are forbidden. Use of problem solutions obtained from other students, over the web, etc. is forbidden. Students violating course policy on homework will receive a warning possibly followed by a grading penalty and further disciplinary action, in accordance with university policy.

Examinations:

In general you will be allowed to use a calculator, writing implements and erasers, and blue books during exams. No other materials will be allowed. Students who are caught using unauthorized materials during an exam, copying from a classmate on exams, continuing to work on an exam after time has been called, or violating exam or course rules in some other manner are likely, at a minimum, to receive a score of zero on that exam and may be subject to further disciplinary action, again in accordance with university policy.

For further information:

Additional information concerning UT Austin's policy on academic integrity is posted on the UT Austin web site at: http://deanofstudents.utexas.edu/sjs/acint_student.php

Homework

Homework assignments are intended to give you practice in problem-solving, and to enable you to apply and further explore concepts and techniques introduced in lecture and/or assigned reading. Typically there will be one homework assignment per week, except during weeks for which an exam is scheduled. Homework assignments are due in class, at the beginning of lecture, on the assigned due date. Late assignments will not be accepted except possibly in cases of serious, documented illness. Please see the sections of this syllabus addressing Policy on Collaboration and Policy on Academic Integrity for information on working with your classmates on homework assignments.

Laboratory

The laboratory sessions for this class meet once per week for two hours at the times indicated for your section, in EER 1.826. All students are required to purchase a National Instruments myDAQ for use in the lab. This measurement device will also be used in subsequent courses in the curriculum. The instructor for the laboratory component is your TA. All lab issues, including lab grading, should be discussed with your TA. Participation in all lab sessions is required except for documented illness or religious observance approved in advance. Per University policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day.

Laboratory sessions will start the week of 09/04/2018. The laboratory manual will be available online as a pdf file.

Project

The project for this course is designed to allow you to learn more about the engineering profession. The project consists of a series of assignments that are due on specified dates throughout the semester. Details will be provided in a separate handout and on the class web site.

Accommodation for Religious Observances

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence. If there is uncertainty regarding the precise date of a religious observance due to lunar cycles, etc., you still must inform me at least 14 days prior to the earliest possible date of the observance and provide the probable range of dates for the observance.

Students with Disabilities:

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of Services for Students with Disabilities (SSD). Additional information on this subject is posted on the UT Austin web site at http://www.utexas.edu/diversity/ddce/ssd/

If you feel you may be entitled to accommodation under these policies, please consult with the appropriate offices early in the semester. Evaluation and approval take time, and typical adjustments cannot be applied retroactively.

Sources of Help

Like most engineering courses, EE302 builds knowledge in a rapid step-by-step process throughout the semester. Each step assumes you have mastered the prior material. If you fall behind by even a few days, it can be difficult to catch up. If you do not understand something, ask questions in class, come to office hours, and/or take advantage of the other sources of help that are available. Get help quickly; do not wait! UT also provides resources to help you with nonacademic issues. A search of the UT website is often a good place to start.

The best way to get help from the instructor is during office hours. If you are not able to make it to my scheduled office hours, I am often available at my office on the Pickle Research Campus, MER 1.206M. If you would like to meet outside scheduled office hours, it is generally best to arrange a time and location with me in advance. Email is typically the best way to reach me. Please mention EE302 in the subject of any email.

Any professor teaching EE302 will also be available to help you during their normal office hours.

The EE honor society, HKN, provides free tutoring for Basic Sequence ECE courses including EE302 on Tuesday and Thursday from 7:00 PM to 9:00 PM in the HKN office. They also provide limited assistance with basic math and science courses. HKN has a help desk service where you can "ask anything about anything"; just drop by their office at anytime. Their web site is http://hkn.ece.utexas.edu/services.php .

The UT Sanger Learning Center provides free tutoring in JES. Consult their website for hours of operation and programs. The UT Sanger Learning Center also provides one-on-one tutoring free or for a reasonable hourly charge. Visit their web page at http://www.utexas.edu/ugs/slc .

The ECE Undergraduate Student Advising Office in EER is the best place to start if you have issues related to advising, registration, add/drop, or issues with the UT bureaucracy in general.

The Engineering Student Services and Advising (ESSA) Office in ESS can assist with many issues. Their web page is http://www.engr.utexas.edu/undergraduate/advising.

Emergency Preparedness and Classroom Evacuation Instructions

Every member of the university community must take appropriate and deliberate action when an emergency strikes a building, a portion of the campus, or entire campus community. Emergency preparedness means we are all ready to act for our own safety and the safety of others during a crisis. It takes an effort by all of us to create and sustain an effective emergency preparedness system. Information on emergency preparedness is posted on the class Canvas site. In addition, specific instructions provided to us on classroom evacuations is included just below for your reference.

Classroom Evacuation for Students

All occupants of university buildings are required to evacuate a building when a fire alarm and/ or an official announcement is made indicating a potentially dangerous situation within the building.

Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.

If you require assistance in evacuation, inform your instructor in writing during the first week of class.

For evacuation in your classroom or building:

1. Follow the instructions of faculty and teaching staff.
2. Exit in an orderly fashion and assemble outside.
3. Do not re-enter a building unless given instructions by emergency personnel.

What's different from EE302?

This course is intended to be a deeper, more aggressive version of 302, with the goal of getting you to think deeply like an engineer, earlier on in your career. We'll cover all the 302 material a bit faster, allowing us to introduce a few other key aspects of EE that you wouldn't see in the core curriculum otherwise. Our hope is this will enable you to spot and understand the deeper connections between seemingly disparate areas of EE earlier on in your career. FAQ:

- **Is it necessary to take 302H?** No.
- **Is it helpful to take 302H?** That is our goal! We'll treat the 302 material a bit more deeply, as well as introduce additional important topics.
- **Will we assume you know more coming in?** Yes. Since we will dig deeper, we'll draw more heavily on your high school math and physics background in how we introduce topics.
- **How much more material in 302H?** This is our first experiment, so we will adjust as the semester goes along, but the goal is ~15-20% additional material. *Specific topics are called out below in red.*
- **How about exams?** There will be common exam questions between 302 and 302H, but expect one or more questions to differ and come from the additional material.
- **How about HW?** Expect 1-2 additional questions per homework of an increased level of difficulty.
- **Labs?** They are the same, but we encourage you to take the Freshman Design course once you've built a foundation of lab skills in 302H. This will give you some great open-ended design experience.

- **Other parts of the course?** They are the same (e.g. book).
- **How about grades?** We will determine how grade distributions will differ between 302 and 302H, based on the exam performance on the common questions shared between the two courses. It is anticipated that the understanding of you and your peers in 302H will be greater overall, so competition for grades will likely be somewhat more difficult.

Lecture and Exam Schedule

Date	Topic/Event	Reading (Ulaby & Maharbiz)
08/29/2018	*First lecture*	
08/29	Introduction, overview of EE and systems	Chapter 1
09/05	Signals: current & voltage; circuit (ckt) components	
09/10	Ckt components, electric field, and resistance	
09/12	Ckt topology, Kirchoff's Laws (KCL & KVL)	Chapter 2
09/17	Examples - KCL and KVL	
09/19	Simple equiv ckts Part I: resistors	
09/24	Simple equiv ckts Part II: source transformations	
09/26	Ckt Examples (digital-to-analog converter, etc.)	
10/01	Node voltage analysis	Chapter 3
10/03/2018	*Semester Exam 1*	
10/08	Mesh current analysis	
10/10	Node vs. Mesh, superposition	
10/15	Source superposition, linear systems (e.g. transfer functions)	
10/17	Transistors	Chapter 4
10/22	Transistor logic circuits	
10/24	CMOS NAND and implementing general Boolean functions	
10/29	Thevenin and Norton equivalent circuits	
10/30/2018	*Semester Exam 2*	
11/05	Thevenin/Norton cont'd and max power transfer	
11/07	Max power and Thevenin/Norton ckt examples	
11/12	Operational amplifiers (op-amp), linear sys. (2-port networks)	
11/14	Ideal op-amp model	
11/19	Functional & multiple op-amp ckts	
11/21	*No class!*	
11/26	Multiple op-amp circuits	
11/28/2018	*Semester Exam 3*	
12/03	Diodes and nonlinear ckts	Handouts
12/05	Photonic devices (i.e. fun with diodes!)	
12/10	Photonic devices: solar cells and light-emitting diodes	
Date and Time TBD	*Final Exam*	

NOTE: As the semester progresses, I post any handouts on Canvas prior to lecture. You may download them, but I will also bring print-outs to class for your convenience.

Helpful Prerequisite Knowledge

To master the material in EE 302, it will be important for you to have a strong working knowledge of pre-calculus-level mathematics and high-school-level physics. In addition, you are required to have completed or be concurrently enrolled in M 408C (Differential and Integral Calculus) or its equivalent.

The basic topics you will find helpful to understand, and the ideal level of understanding, are as follows. We will discuss many of the ideas listed under "Physics" below, but prior familiarity with them will still be helpful.

1. **Mathematics**
   a. Excellent proficiency with elementary algebra
   b. Good proficiency with linear, polynomial, exponential, and logarithmic functions
   c. Some proficiency with systems of linear equations and (ideally) matrices

d. Basic knowledge of differential calculus by mid-semester, and integral calculus by late in semester

2. Physics

a. Some familiarity with basic concepts of charge, current, voltage, and resistance
b. Some familiarity with basic concepts of energy and power
c. Some familiarity with proper use of significant figures in calculations
d. Some familiarity with proper use and essential nature of units in calculation of physical quantities
e. Some familiarity with concept of physically "reasonable" quantities