Department of Electrical and Computer Engineering

University of Massachusetts Amherst

ECE 323: Electronics I

Fall 2015 Syllabus

Catalog Description:

- Lectures plus four three-hour labs and discussion sections as scheduled.
- Principles of the design of simple analog and digital electronic circuits employing nonlinear devices such as diodes, field effect transistors (FETs) and bipolar transistors
- The design projects make use of PSPICE and include diode characteristics, transistor biasing, small signal analysis and modeling, amplifier design, CMOS gate characteristics. The design, simulation, and build cycle is emphasized. 4 credits.

Prerequisites:

In order to take ECE 323, students must have received a grade of C or better in ECE 212. Students must be familiar with PSPICE because it is used extensively in laboratory analysis and is required for the reports.

Web Site: All course material (announcements, handouts, assignments and solutions, grade records) will be available through MOODLE:

http://moodle.umass.edu

Lectures: Prof. Joseph Bardin, Marcus 215H, jbardin@ecs.umass.edu

Office hours, Wednesday, 3-4pm, Friday 3:30-4:30pm, and by apt.

Recitations: Prof. Robert Jackson, Marcus 215G, jackson@ecs.umass.edu

Office hours, Tuesday/Thursday, 3-4pm and by apt.

Teaching Assistants: (i) Natesh Ganesh, nganesh@engin.umass.edu
(ii) Hua Bai, huab@umass.edu
(iii) Sachin Bhat, sachinbalach@umass.edu

TA Office hours will be located in Marston 221. Times will be posted to the course Moodle page shortly.

Undergraduate Teaching Assistant: TBD

Lectures: MWF 9:05 - 9:55 am Goessmann Laboratory, RM 20

Laboratories: For all lab sections, see the Course Schedule to determine lab weeks.

Lab Section 1/4: Tu 2:30 - 5:30 pm Marston 221
Lab Section 2: W 2:30 - 5:30 pm Marston 221
Lab Section 3: Th 2:30 - 5:30 pm Marston 221

Discussion Sections: Discussion will be held per Course Schedule

Disc. Section 1: M 1:25 - 2:15 pm Elab 323
Disc. Section 2: M 2:30 - 3:20 pm Elab 323

Textbook (Required):
Sedra, A.S., and K.C. Smith, *Microelectronic Circuits*. Oxford University Press, 6 th edition, 2010.
Or
Sedra, A.S., and K.C. Smith, *Microelectronic Circuits*. Oxford University Press, 7 th edition, 2015.

Additional References:
Lecture notes will be posted to the Moodle website for the convenience of students in the course. It should be noted that these notes are NOT a substitute for attending class.

Simulation Software: Orcad Lite Version 16.6 will be supported for ECE 323. It can be downloaded via the following website:
http://www.orcad.com/resources/orcad-downloads#pspice

Late Policy:

No late homework assignments will be accepted. While late prelab reports will be accepted, the maximum score a late prelab can receive is 15/25.

Grading policy:

Four design projects 25% of total grade (See comments below)
Exam I 20% of total grade
Exam II 20% of total grade
Final (Cumulative) 25% of total grade
Homework 10% of total grade

Comments:

(1) Each project will be graded primarily on the preparatory design/simulation ("prelab report"). **The prelab reports are due before 2:30pm on the Tuesday of lab weeks, regardless of lab section. See course schedule or Moodle for more details. The prelab report should be the work of a single student alone.** Students who turn in a design that duplicates the design submitted by another student will cause all the students involved to get zero credit.
(2) An example prelab report is available on the course Moodle site.
(3) The prelab report grade will not be recorded (a grade of zero) unless that student completes the laboratory portion of the project. All laboratory results will be certified as complete by the laboratory instructor or T.A.
(4) **In order to pass the course**, a student must have a passing grade on each of the four design projects.
(5) **In order to pass the course**, a student must have at least a passing score on the average of the midterms and the final exam.

Course Objectives and Program Outcomes
There are five main Course Objectives for students taking ECE 323:
1. Mathematically model nonlinear electronic devices.
2. Analyze circuits using nonlinear devices for digital and analog applications.
3. Understand some of the fundamental circuit elements used in digital and analog circuits.
4. Design basic electronic circuits to meet a set of specifications.
5. Appreciate the value of comparing hand calculations, simulations, and measurements.

For undergraduate majors taking this course, these five objectives are related in part to ten broad capabilities (Program Outcomes) that we expect for all our BS graduates in the EE and CSE programs. These are related as shown in the table below.

Program Outcomes	**Course Objectives**				
	1	2	3	4	5
1. Well grounded in the fundamental concepts of math, physics, chemistry, computer science, and engineering science	Y	Y	N	N	P
2. Able to identify, formulate and solve problems in ECE	Y	Y	Y	Y	Y
3. Able to design and conduct experiments, and to analyze and interpret measured data	N	Y	N	N	Y
4. Capable of designing analog and digital systems, components, and processes to meet desired needs	N	N	Y	Y	Y
5. Proficient in using modern engineering techniques and computing tools for effective engineering practice	Y	Y	N	Y	Y
6. Experienced in engineering teamwork, and in solving technically diverse and multidisciplinary problems	N	N	N	P	N
7. Able to communicate effectively orally and in writing, and through symbolic and graphical expression	N	N	N	Y	Y
8. Aware of professional and ethical responsibilities as engineers	N	N	N	N	N
9. Aware of the impact of ECE technology and decisions on society	N	N	N	N	N
10. Motivated about the importance of lifelong learning, scholarship and professional development	N	N	Y	N	N

Tentative Schedule

Date	Topic	S&S 6ed Reading	S&S 7ed Reading	Notes
9/9	Introduction, basic diode	4.1, 4.2	4.1, 4.2	
9/11	Diode 0.7V model	4.3.1-4.3.6	4.3.1-4.3.6	
9/14	Rectifier, Peak Detector	4.5	4.5	
9/16	NPN IV	6.2, 6.3	6.2, 6.3	
9/18	NPN DC I	6.2, 6.3	6.2, 6.3	
9/21	NPN DC II	6.2, 6.3	6.2, 6.3	
9/22	**Project 1 Prelab due**			
9/23	PNP	6.2, 6.3	6.2, 6.3	
9/25	NMOS DC	5.2, 5.3	5.2, 5.3	
9/28	NMOS DC II	5.2, 5.3	5.2, 5.3	
9/30	PMOS DC	5.2, 5.3	5.2, 5.3	
10/2	Amps: Goals/specs	1.4, 1.5.1, 1.5.5, 6.4	1.4, 1.5.1, 1.5.5, 7.1	
10/5	Small signal mod. (BJT)	6.4, 6.5	7.1, 7.2.2	
10/6	**Project 2 Prelab due**			
10/7	CE Amp analysis	6.6-6.8	7.3-7.5	
10/9	CB/EF Amps	6.6-6.8	7.3-7.5	
10/13	MOS SSM	5.5	7.1, 7.2.1	Monday schedule
10/14	MOS/CMOS Amps I	5.6-5.8	7.3-7.5	
10/16	MOS/CMOS Amps II	5.6-5.8	7.3-7.5	
10/19	Exam Review	-	-	-
10/20	**Midterm Exam I**			
10/21	Freq resp/Laplace I	9.4.1, 9.4.2	10.4.1, 10.4.2	Refer to course notes for
10/23	Freq resp/Laplace II	9.4.1, 9.4.2	10.4.1, 10.4.2	additional information
10/26	SSM w/caps	9.2	10.2	
10/28	Freq resp of CE/CS	9.3	10.3	
10/30	Freq resp of EF	9.6.1, 9.7	10.5.1, 10.6	
11/2	Opamp model revisited	2.1, 2.7	2.1, 2.7	
11/3	Project 3 prelab due			
11/4	Sec. Order Sys Freq dom.	-	-	See lecture notes
11/6	Sec. Order Sys Time dom	-	-	See lecture notes
11/9	Intuitive view of stability	-	-	See lecture notes
11/13	Logic/CMOS Specs I	13.1	14.2, 14.3	
11/16	Logic/CMOS Specs II	13.2	14.2, 14.3	
11/18	Exam review			
11/19	**Midterm Exam II**			
11/20	CMOS delay I	13.3	14.4, 14.5.1	
11/23	CMOS delay II	13.3	14.4, 14.5.1	
11/25	CMOS power	13.1.1.6, 13.1.1.8, 13.3.4	14.6	
11/30	Pass transistors	14.2	15.4	
12/1	**Project 4 prelab due**			
12/2	Flip flops I	15.1	16.1	
12/4	Flip flops II	15.1	16.1	
12/7	DACs	-	-	See lecture notes
12/9	ADCs	-	-	See lecture notes
12/11	Summary, review			
12/18	**Final Exam**			

ECE ACADEMIC HONESTY POLICY

An Honor Code Policy has been adopted for all ECE students at UMass Amherst, the result of a joint initiative between students in Eta Kappa Nu (the ECE student honor society) and the Faculty of the ECE Department. The purpose of this policy is to emphasize engineering ethics as an important part of your education and career, and to enhance the value of your ECE degree from UMass. Simply put, the policy requires that each ECE student demonstrate high ethical standards by attesting to personal honesty and integrity for each examination taken and laboratory report completed. The policy fits within the framework of the existing Academic Honesty Policy of the University, and is similar to that used by other universities. On the last page of your ECE 323 midterm and final exams, you will be expected to write out and sign your name to the Honor Code Pledge: **"On my honor, I have not given nor received aid on this exam."** This statement reflects your personal commitment to honesty and ethical practice in the taking of an exam. If you have not written and signed this, you will be contacted by the instructor. Cheating will not be tolerated. A student found cheating on an exam will receive an automatic grade of F on the exam, and likely will fail the course as well.