

EE 320 *Electronics I* / EE 320L *Electronics I Laboratory* **Fall 2017**

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Office hours: MWF 2-2:50 PM

Please use e-mail rather than the telephone if you need to contact the instructor. All e-mail will be answered. The instructor and TAs/graders will have at least three office hours per week in which to answer any questions you may have on the lecture material, homework problems, homework grading, laboratories, etc.

Teaching Assistant/Graders: To be announced.

Catalog Description: (3-1) 4 credits. Pre- or co-requisite: EE 221/221L. Presents concepts of electronic devices and circuits including modeling of semiconductor devices, analysis and design of transistor biasing circuits, and analysis and design of linear amplifiers. Use of computer simulation tools and breadboarding as part of the circuit design process is emphasized. Students are introduced to methods for designing circuits that still meet specifications even when there are statistical variations in the component values.

Meeting Times: The lecture portion of this course will meet Monday, Wednesday, and Friday from 12:00-12:50 PM in room MI 222. The laboratory portion meets on pre-announced Tuesdays from 8:00-10:50 AM in rooms EEP 336 and 342. These days are listed below in the Class Schedule.

Use of Electronic Devices in Class: The use of electronic devices during lecture can be very disruptive to your learning, to those around you, and to the instructor. To maximize your learning opportunity during lecture, laptops may be used for notetaking, but only as a tablet. The use of laptops with the cover open and in the vertical position are not permitted. The use of smartphones and other electronic devices during the lecture are not allowed. Repeated noncompliance with this course policy may result in the student being excused from the classroom and eventually the course.

Course Reference Materials: The required materials for this course are

- A. S. Sedra and K. C. Smith, *Microelectronic Circuits*. New York: Oxford University Press, seventh edition, 2015.
- Additionally, the lecture notes K. W. Whites, *EE 320 Electronics I Lecture Notes*, 2017, are available from the course web page.

Grading: 65 % – Two semester exams and the final exam
15 % – Homework (dropping lowest score on one homework set)
20 % – Laboratories (all must be completed for a passing grade in the course)

Homework policy: One homework set will generally be assigned each week, usually on Friday. The homework assignments will be distributed through the EE 320 web page accessible from the URL above. One problem from this set will be randomly selected for you to turn in at the

beginning of class on the due date and will be graded. Please use engineering paper and write your name and student number on your homework. Please begin each problem on a new sheet of paper and do not write on the back side. Late homework will be penalized with a 10% score reduction per calendar day and will only be accepted when you show the instructor that all of the problems for that set have been completed.

Exam Policy: The exams will be closed book, closed notes, and no formula sheets. Using or referring to equations stored in a calculator is not allowed, even if these equations came pre-programmed in the calculator. If you feel an exam problem was graded incorrectly, it must be resubmitted to the instructor within 24 hours from the time the exam was returned. Failure to write an exam will result in a score of zero. No makeup exams will be given. Upon prior notification of the instructor, allowances will be made under extreme circumstances.

Laboratories: Use a laboratory notebook for all of your laboratory work. Work exclusively in ink and cross out mistakes, keeping them legible. Number the front of every page in the upper right corner. The first page of the lab book is to be used as the table of contents. Pre-laboratory work is to be done in your lab book and completed prior to the scheduled laboratory period. The TA must sign off on your pre-laboratory work before you begin your lab experiments. Work in teams of no more than two students per bench. Each student must maintain their own lab book. Your completed lab book must be delivered to the TA no later than 4 PM on the Thursday following your lab. Late lab books will be penalized with a 10% score reduction per calendar day. Every lab must be completed to receive a passing grade in the course.

Honor System: All work written in the exams, homework, and the laboratories must be your own. Failure to abide by this rule will result, at a minimum, in a zero score for the assignment and/or further action following SDSMT regulations. Homework solutions and laboratories can be discussed with your colleagues that are currently enrolled in EE 320/320L, but ***all work you submit must be your own.***

Course Outcomes: Upon completion of this course, students should demonstrate the ability to:

1. Draw characteristic curves for the diode, BJT, and MOSFET, and to identify regions of operation.
2. Complete simple load line analyses for diode and transistor circuits.
3. Design and analyze common rectifier circuits such as half cycle, full cycle and bridge rectifiers and compute the diode currents and peak inverse voltage (PIV) for the circuit with a resistive load.
4. Bias a diode, BJT, or MOSFET device to achieve a desired quiescent operating point.
5. Linearize non-linear devices (diodes and transistors) and apply small signal models where appropriate.
6. Design and analyze common transistor amplifier configurations for BJTs (such as common emitter, common base, and emitter follower) and for FETs (such as common source, common gate, and source follower).
7. Know advantages and disadvantages of common BJT and FET transistor amplifier configurations.
8. Design and analyze simple digital circuits using diodes, BJTs, or MOSFETs.
9. Compute the frequency response of basic transistor amplifier circuits.
10. Use SPICE to analyze circuits that include semiconductor devices such as diodes, BJTs, and FETs.

11. Construct basic diode circuits in the laboratory (such as rectifiers) and make AC and DC voltage and current measurements.
12. Construct basic BJT transistor circuits in the laboratory (such as small signal amplifiers) and make AC and DC voltage and current measurements.
13. Construct basic FET transistor circuits in the laboratory (such as small signal amplifiers) and make AC and DC voltage and current measurements.

Americans with Disabilities Act (ADA) Statement: Students with special needs or requiring special accommodations should contact the campus ADA coordinator, Megan Reder-Schopp, at 394-6988 and/or the instructor at the earliest opportunity.

Freedom in Learning Statement: Students are responsible for learning the content of any course of study in which they are enrolled. Under board of regents and university policy, student academic performance shall be evaluated solely on an academic basis and students should be free to take reasoned exception to the data or views offered in any course of study. Students who believe that an academic evaluation is unrelated to academic standards but is related instead to judgment of their personal opinion or conduct should contact the dean of the college which offers the class to initiate a review of the evaluation.

EE 320/320L Class Schedule Fall 2017

Date	Section	Topic
8/21	4.1	Pre-assessment. Introduction to course. Ideal diode.
8/22	–	<i>No laboratory.</i>
8/23	4.2, Ch. 3	Physical operation of diodes.
8/25	4.3	DC analysis of diode circuits.
8/28	4.3	Small-signal diode model and its application.
8/29	–	<i>No laboratory.</i>
8/30	Notes	Introduction to <i>B2 Spice</i> from Beige Bag Software.
9/1	4.4	Zener diodes.
9/4	–	No class.
9/5	–	<i>No laboratory.</i>
9/6	4.5	Diode rectifier circuits (half, full cycle, and bridge).
9/8	4.5	Peak rectifiers.
9/11	4.6	Limiting and clamping circuits. Voltage doubler. Special diode types.
9/12	–	Laboratory #1. Diodes.
9/13	6.1, 6.2	BJT construction. NPN physical operation.
9/15	6.1, 6.2	PNP BJT physical operation. BJT examples.
9/18	6.3	DC analysis of BJT circuits.
9/19	–	<i>No laboratory.</i>
9/20	7.1	BJT as a signal amplifier.
9/22	7.2	BJT small-signal equivalent circuit models.
9/25	–	Review.
9/26	–	Laboratory #2. Zener Diodes and Diode Rectification.
9/27	–	Exam #1.
9/29	7.2	BJT small-signal amplifier examples.
10/2	7.2	Graphical analysis of a BJT small-signal amplifier.
10/3	–	<i>No laboratory.</i>
10/4	7.4.2, 8.2.3	BJT biasing. Current mirror.
10/6	7.3.3	Common emitter amplifier.
10/9	–	No class.
10/10	–	Laboratory #3. DC Characteristics of Bipolar Junction Transistors.

10/11	7.3.4	Common emitter amplifier with emitter degeneration.
10/13	7.3.5	Common base amplifier. Emitter follower amplifier.
10/16	10.2.2	BJT internal capacitances. High frequency circuit model.
10/17	–	<i>No laboratory.</i>
10/18	10.3.2	Common emitter amplifier frequency response.
10/20	10.3.3	Miller's theorem.
10/23	Notes, 6.3	BJT as an electronic switch.
10/24	–	Laboratory #4. Bipolar Junction Transistor Small-Signal Amplifiers.
10/25	5.1	Enhancement type MOSFET operation, p-channel, and CMOS.
10/27	5.2	MOSFET circuit symbols, current-voltage characteristics.
10/30	–	Review.
10/31	–	<i>No laboratory.</i>
11/1	–	Exam #2.
11/3	5.3	MOSFET circuits at DC.
11/6	7.1, 7.2	MOSFET as an amplifier. Small-signal equivalent circuit models.
11/7	–	<i>No laboratory.</i>
11/8	7.2	MOSFET small-signal amplifier examples.
11/10	–	No class.
11/13	7.4.1, 8.2.1	Biasing MOSFET amplifiers. MOSFET current mirror.
11/14	–	Laboratory #5. DC Characteristics of NMOS and PMOS FETs.
11/15	7.5.1	Common source amplifier.
11/17	7.3.4	Common source amplifier with source degeneration.
11/20	Notes, App. B	CMOS common source amplifier.
11/21	–	<i>No laboratory.</i>
11/22	–	No class.
11/24	–	No class.
11/27	7.3.5, Notes	MOSFET common gate and CMOS common gate amplifier.
11/28	–	Laboratory #6. MOS Field Effect Transistor Amplifiers.
11/29	6.7	MOSFET common drain (source follower) amplifier.
12/1	14.3	CMOS digital logic inverter.
12/4	–	Review. Post-assessment. Course assessment.
12/?	–	Final Exam, Room MI 222. (Date and time not posted by Registrar.)
