ECE 311 – Engineering Electronics

Credits: 4, **Contact Hours:** Two 75 minute lecture sessions per week, one 160 minute laboratory session per week.

Coordinator: T. Wong, Professor of ECE

Textbook: A. Sedra and K. Smith, *Microelectronic Circuits*, Oxford University Press, 7th Edition, 2015.
ECE 311 Laboratory Manual

2019 Catalog Data: ECE 311: Engineering Electronics, Credit 4

Physics of semiconductor devices. Diode operation and circuit applications. Regulated power supplies. Field-effect and bipolar transistors operating principles. Biasing techniques and stabilization. Linear equivalent circuit analysis of field-effect and bipolar transistor amplifiers. Laboratory experiments reinforce concepts. Lecture: 2 Lab 1 Satisfies Communications (C)

Prerequisites or co-requisites by topic: ECE 213 Circuit Analysis II

Enrollment: Required course for CPE and EE majors

Specific outcomes of instruction:
Course contents and laboratory work will provide students with the experience of

1. Apply circuit models of voltage, current and transconductance amplifiers to analyze practical amplifiers
2. Model OP Amp operation as an electronic element and to apply the model to the analysis of typical op amp functional circuit blocks, taking into consideration imperfections in practical op amps.
3. Feedback and its effects on amplifiers, including bandwidth variation, utilizing op amp circuits
4. Apply diode device models to the analysis of diode circuits, including Zener regulating circuits.
5. Apply MOSFET device models (DC and small signal AC) to analyze the performance of MOSFET amplifying circuits.
6. Apply BJT device models (DC and small signal AC) to analyze the performance of BJT amplifying circuits.
7. Conduct laboratory experiments to confirm the analysis done in the class.
8. Prepare an informative and organized lab report that describes the methodologies employed, the results obtained, and the conclusions make in a laboratory experiment.

Relationship of ECE 311 specific outcomes of instruction to student outcomes:

	Student Outcomes	**Course Goals**
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	1,2,3,4,5,6,7
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	4,5,6
3	An ability to communicate effectively with a range of audiences	8
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	7
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	7,8
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Topics:

- Introduction to Electronic Amplifiers (1 week)
- Operational Amplifier Applications (1 week)
- Operational Amplifier Imperfections (0.5 week)
- Review on Diode Fundamentals (0.5 week)
- Diode Models and Small Signal Analysis (1 week)
- Zener Diodes and Power Supplies (1 week)
- Properties of Intrinsic and Extrinsic Semiconductors (1 week)
- PN junction at Equilibrium and Under Bias (1week)
- MOSFET Operation (1 week)
- DC Q-Point Analysis & Design (1 week)
- Equivalent Circuit and AC Analysis (1 week)
- MOSFET Small Signal Models & Small Signal Equivalent Circuits (1 week)
- BJT Theory and DC Consideration (1 week)
- Equivalent Circuit & Small Signal Analysis (1 weeks)
- BJT Design Considerations (1 week)

Computer usage:

Students can use PSpice to check homework results and are required to use it in the laboratory.

Laboratory topics:

- Operational amplifiers (2 weeks)
- Diodes with applications (2 weeks)
- MOSFETs (1 week)
- BJTs (2 weeks)
- PSpice (1 week)

Prepared by: T. Wong **Date:** February 28, 2020