

Course Content and Outcome Guide for EET 221

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Course Number: EET 221

Course Title: Semiconductor Devices/Circuits

Credit Hours: 5

Lecture hours: 40

Lecture/Lab hours: 0

Lab hours: 30

Special Fee: \$8

Course Description

Introduction to semiconductor devices. Characteristics and biasing of diodes and transistors. Design and analysis of circuits using diodes, bipolar transistors, and field effect transistors. Application of transistors as amplifiers and switches. A 3-hour per week laboratory includes the application of computer tools in circuit design, evaluation, and analysis. Prerequisite: EET 113

Addendum to Course Description

In addition to introducing the basic theoretical principles of operation of diodes and transistors, the operational characteristics of the devices will be studied, and measured using curve tracers, simulation, and computer data acquisition methods. This term emphasizes diode and transistor biasing circuits, and basic transistor amplifier circuits.

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Intended Outcomes for the course

1. The student will have a qualitative understanding of P and N type semiconductors, PN junctions, NPN and PNP transistor operation, and field effect transistor operation.
2. The student will become familiar with the basic electrical characteristics of diodes and transistors, including the diode equation, and device characteristic curves.
3. The student will be able to bias diodes and transistors, and will be able to analyze and design basic diode and transistor circuits.
4. The student will be able to test diodes and transistors in a circuit and using a curve tracer.
5. The student will be able to calculate and measure the input and output impedances of transistor amplifier circuits.
6. The student will be able to calculate and measure the amplification of a transistor amplifier circuits, including common emitter, common base, and common collector types.
7. The student will be able to simulate basic diode and transistor circuits using a computer simulation program.

8. The student will be able to use computer data acquisition to acquire circuit data, and to process the data in a spreadsheet.
9. The student will be able to use a word processor, spreadsheet, and other software to produce a formal lab report on an experiment.

Course Activities and Design

Outcome Assessment Strategies

Assessment methods are to be determined by the instructor. Typically, in class exams and quizzes, and homework assignments will be used. Lab work is typically assessed by a lab notebook, formal lab reports, performance of experiments, and possibly a lab exam

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Course Content (Themes, Concepts, Issues and Skills)

1. Semiconductor materials, PN, NPN, and PNP junctions. Simplified description of the operation of diodes and transistors. Diode and transistor characteristic curves. The diode equation. Testing diodes and transistors.
2. Diode applications as rectifiers, zeners, limiters, clippers, and logic. Light emitting diodes, variable capacitance diodes.
3. Bipolar junction transistors. Common base, common emitter, and common collector characteristics and biasing circuits. Bias design for BJT's. Bias stabilization using collector and emitter feedback, and voltage dividers. Transistor specifications. The transistor as a switch.
4. Bipolar junction transistor amplifiers. AC and DC amplifier gain, input and output impedance, and effect of source and load resistance. Brief treatment of h parameters.
5. Load line analysis of transistor amplifiers.
6. Field effect transistors (FET's). Junction FET characteristics and biasing. Fixed bias, self bias, and voltage divider bias. Graphical and algebraic bias solutions. Junction FET specifications.
7. Metal oxide semi-conductor FET's (MOS-FET's). Enhancement and depletion type MOS-FET characteristics and biasing. Fixed bias, self bias, voltage divider bias and feedback bias. Graphical and algebraic bias solutions. MOS-FET specifications.