Course Acronym:	ECHT
Course Number:	122
Descriptive Title:	Semiconductor Circuits II
Division:	Industry and Technology
Department:	Electronics and Computer Hardware Technology
Course Disciplines:	Electronic Technology, Electronics
Catalog Description:	This course gives the student an advanced background in solid-state devices such as transistors, Field Effect Transistors (FETs) and Silicon Controlled Rectifiers (SCRs). Practical laboratory experience similar to circuitry, used in the electronics industry, is included.
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Electronics and Computer Hardware Technology 11, Electronics and Computer Hardware Technology 110 and Electronics and Computer Hardware Technology 120 or equivalent
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	4
Outside Study Hours:	4
Total Course Hours:	108
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Prior to July 1992
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	

Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Advanced In-Circuit Measurements** The student will make advanced "in-circuit" measurements using Bench and Portable Digital Multimeter (DMM), Oscilloscope, and Voltage Ohm (VOM), Milliamp Meter on Solid-State-Systems **SLO #2 Field Effect Amplifier** Given a schematic diagram of a basic Field Effect Amplifier, the students will be able to assemble, test and measure the circuit for its operational parameters. **SLO #3 Experimental Data and Analysis Reporting** The students will be able to incorporate experimental data and analysis reporting protocols, using either "paper" or "paperless" environments, similar to data reporting and analysis used by many Electronics Manufacturers and Service Organizations
Course Objectives:	1. Identify various types of transistors, and other related semiconductor devices by their schematic symbol. 2. Test and identify diodes, Bipolar Junction Transistors (BJTs), and related devices. 3. Design, build, test and troubleshoot diode circuits. 4. Demonstrate transistor operation and describe its characteristics and various parameters such as basic operating polarities and the effects of current gain (i.e.) Beta hfe on a transistor amplifier. 5. Build and test the five biasing schemes for transistors. 6. Construct and test an FM radio and troubleshoot the operation of the antenna system, mixer, and local oscillator. 7. Conduct Radio Frequency (RF) alignment on a typical superhetrodyne (AM receiver) using a RF generator, frequency counter, Alternating Current (AC) voltmeter, and oscilloscope. 8. Build, test, troubleshoot, and document test results on an FM receiver capable of receiving a minimum of 15 stations. 9. Build, test, and troubleshoot the operation of class B power amplifiers.
Major Topics:	**I. OVERVIEW OF SEMICONDUCTOR CIRCUITS (1 hour, lecture)** A. Principles of amplification B. Function of power supplies

C. Power (motor) control
D. Audio and radio frequencies
E. Building the AM radio
F. Employment opportunities
G. Soldering

II. DIODES AND THEIR APPLICATION (10 hours, lecture)

A. Half Wave rectifier
B. Full Wave rectifier
C. Voltage multipliers
D. Clippers and clampers
E. Zener regulation and clipping
F. Varactor diodes

III. DIODES AND THEIR APPLICATION (24 hours, lab)

A. Half Wave rectifier
B. Full Wave rectifier
C. Voltage multipliers
D. Clippers and clampers
E. Zener regulation and clipping
F. Varactor diodes

IV. BIPOLAR TRANSISTORS (12 hours, lecture)

A. Transistor switch
B. Ohmmeter tests
C. Transistor action, Beta
D. Voltage gain and configurations: common emitter, common collector, common base
E. Darlington connection
F. Class A, AB, B amplifiers: efficiency and distortion
G. Complimentary and quasi-complimentary amplifiers and use in radio project

V. BIPOLAR TRANSISTORS (24 hours, lab)

A. Transistor switch
B. Ohmmeter tests inversi
C. Transistor action, Beta
D. Voltage gain and configurations: common emitter, common collector, common (grounded) base
E. Darlington connection
F. Complimentary amplifiers

VI. FIELD-EFFECT TRANSISTOR (FET) DEVICES (12 hours, lecture)

A. Junction Field Effect Transistors (JFETs)
B. Metal Oxide Effect Transistors (MOSFETS), dual and single gate
C. Power Vertical Channel Metal-Oxide Semiconductor (VMOS)
D. Ohmmeter tests

	E. Voltage gain and phase inversion F. Configuration **VII. FET DEVICES (24 hours, lab)** A. FETs B. MOSFETS, dual and single gate C. VMOS D. Ohmmeter tests E. Voltage gain and phase inversion F. Configuration **VIII. OPERATIONAL AMPLIFIERS (1 hour, lecture)** A. Inverting mode gain B. Non-inverting gain
Total Lecture Hours:	36
Total Laboratory Hours:	72
Total Hours:	108
Primary Method of Evaluation:	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Given the schematic and specifications for a simple transistor circuit, construct the circuit on a protoboard and compare measurements to the predicted values. Report measurements on a one-page lab report and submit it to the instructor.
Critical Thinking Assignment 1:	Build a complete 9V FM radio, given a kit of parts. Exercise proper soldering techniques, and avoid open and short circuits. Using the schematic as a wiring guide, build and test the Audio Frequency (AF), Radio Frequency (RF), oscillator and detector circuits utilizing the Digital Multimeter (DMM), Volt-Ohm-Millimeter (VOM), oscilloscope, and RF generators. Consult the instructor for evaluation.
Critical Thinking Assignment 2:	Design a power supply from standard components to deliver: 12V DC at 250mA, with a ripple less than 1% of the DC output. Consult the instructor for evaluation.
Other Evaluation Methods:	Performance Exams Other Exams Quizzes Written Homework Laboratory Reports Class Performance Homework Problems Multiple Choice Completion Matching Items True/False
Instructional Methods:	Demonstration Discussion Laboratory Lecture

	Multimedia Presentations Simulation
If other:	Internet Presentation/Resources
Work Outside of Class:	Study Answer questions Skill practice Required reading Problem solving activity
If Other:	
Up-To-Date Representative Texts:	Albert Malvino, David Bates, Patrick Hoppe, Electronic Principles, 9th Edition, McGraw-Hill Education, 2021.
Alternative Texts:	Kevin McGowan. Semiconductors: From Book to Breadboard. 1st ed. Cengage, 2012. (Discipline Standard) Thomas L. Floyd, Electronic Devices, 10th edition, Pearson, 2018. (Discipline Standard) James M. Fiore. Semiconductor Devices: Theory and Application**.** Dissidents. 2018. (Discipline Standard)
Required Supplementary Readings:	
Other Required Materials:	Scientific calculator Class notebook Elenco FM-88K Radio Kit
Requisite:	
Category:	
Requisite course(s): List both prerequisites and corequisites in this box.	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	Electronics and Computer Hardware Technology-11 Electronics and Computer Hardware Technology-110

Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Test diodes and BJTs with a Digital Multimeter (DMM).** ECHT 11 - Demonstrate the use of various types of test equipment, including Digital Multimeter (DMM), signal generators, power supplies and oscilloscope to make various circuit measurements. **Conduct troubleshooting procedures to find a simple fault caused by a short or open circuit in circuit.** ECHT 11 -Apply fundamental circuit theories, Alternating Current (AC) and Direct Current (DC) to compute component values and voltages, resistances, currents and power in various circuit configurations. ECHT 11 - Differentiate color codes and component symbols to build a circuit. ECHT 11 - Connect meters to circuits, select proper meter ranges and obtain accurate measurements. ECHT 11 - Demonstrate the use of various types of test equipment, including Digital Multimeter (DMM), signal generators, power supplies and oscilloscope to make various circuit measurements. **It is recommended that students have basic knowledge and use of the MultiSim software to simulate and supplement both the understanding and analysis of DC and AC circuits.** ECHT 110 - Ability to measure AC and DC currents and voltages, using portable and/or bench electronic equipment. ECHT 110 - Demonstrate the use of MultiSim software to build electronic circuits and simulate their operation and troubleshooting circuit problems. ECHT 110 - Ability to use different network theorems such as Kirchhoff's laws, Thevenin's Theorem, Superposition Theorem to analyze circuit functions and simplifications of different electronic circuits. ECHT 110 - Demonstrate the measurements of voltages and frequencies using either analog or digital oscilloscopes. **It is recommended that students have the ability to design, build, test, and troubleshoot basic diode and transistor circuits.** ECHT 120 - Apply different network theorems to conduct practical circuit analysis and calculations to be used in troubleshooting and predicting different circuit operations. ECHT 120 - Identify and differentiate classes of bipolar transistor amplifiers (BJTs). ECHT 120 - Test and identify diodes, BJTs, and related solid-state devices using Volt-Ohm-Milliammeter (VOM) and other electronic bench equipment.

	ECHT 120 - Build, test, and troubleshoot electronic circuits from schematic diagrams using basic electronic bench equipment and tools, including the use of oscilloscopes.
Requisite Skill:	or equivalent
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	If a student has completed the equivalent courses at another college, the student will have skills needed to enroll in this course It is recommended that students have basic electronics knowledge and understand AC/DC, diode and transistor circuits to enhance their success in this course. This includes testing diodes and BJTs with a Digital Multimeter (DMM), troubleshooting faults caused by a short or open circuit, and have basic knowledge in using the MultiSim software for simulation.
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	M. Freschi/W. Mitchell
Date:	09/23/2015
Original Board Approval Date:	05/01/1974
Last Reviewed and/or Revised by:	Supriya Bhargave
Date:	12/01/2023
Last Board Approval Date:	06/17/2024
Effective Term:	FALL 2025