Course Acronym:	ECHT
Course Number:	120
Descriptive Title:	Semiconductor Circuits
Division:	Industry and Technology
Department:	Electronics and Computer Hardware Technology
Course Disciplines:	Electronic Technology, Electronics
Catalog Description:	This course provides the student with a background in modern solid-state devices for electronic technician work or troubleshooting. Emphasis is placed on testing devices, combined with study of typical applications. The course of study includes student construction of an Amplitude Modulation (AM) radio and computer simulation.
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Electronics and Computer Hardware Technology 11 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 In-Circuit Measurements** The student will make basic 'in-circuit' measurements using Bench and Portable Digital Multimeter (DMM), Oscilloscope, and Voltage Ohm (VOM) meter, Milliamp Meter on Solid-State Systems. **SLO #2 Experimental Data and Analysis Reporting** The student will be able to use various circuit analysis calculations to predict basic circuit operation. **SLO #3 Advanced In-Circuit Measurements** The student will make advanced "in-circuit" measurements using Bench and Portable Digital Multimeter (DMM), Oscilloscope, and Voltage Ohm (VOM) meter, Milliamp Meter on Solid-State-Systems.
Course Objectives:	1. Identify various transistors, and other related semiconductors 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. 5. Build and test the five biasing schemes for transistors. 6. Construct and test an AM radio and troubleshoot the operation of the antenna system, mixer, and local oscillator. 7. Conduct Radio Frequency (RF) alignment on a typical superheterodyne (AM receiver) using a RF generator, frequency counter, Alternating Current (AC) voltmeter, and oscilloscope. 8. Build, test, troubleshoot, and document test results on an AM 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 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 (grounded) base
E. Darlington connection
F. Class A, AB, B amplifiers: efficiency and distortion
G. Complimentary and quasi-complimentary amplifiers, use in radio project

V. BIPOLAR TRANSISTORS (24 hours, lab)

A. Transistor switch
B. Ohmmeter tests
C. Transistor action
D.
    a. Common emitter
    b. Common collector
    c. Common base
E. Voltage gain and configurations
F. Darlington connection
G. 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. JFETs
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 mode 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 to the instructor.
Critical Thinking Assignment 1:	Build a complete 9-volt AM 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, AF and RF generators. Consult the instructor for evaluation.
Critical Thinking Assignment 2:	Design a power supply from standard components to deliver: 12 volts Direct Current (DC) at 250 milliamperes 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 Internet Presentation/Resources Laboratory Lecture Multimedia Presentations Simulation
If other:	Internet Presentation/Resources
Work Outside of Class:	Study Answer questions

	Skill practice Required reading
If Other:	
Up-To-Date Representative Texts:	Albert Malvino, David Bates and Patrick Hoppe, Electronic Principles, McGraw Hill, 2020
Alternative Texts:	
Required Supplementary Readings:	
Other Required Materials:	Scientific calculator Class Notebook AM Radio Kit, like Elemco AM-550CK
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
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Understand the fundamental electrical principles of Ohm's Law, the sine wave, AC versus DC, Root Mean Square (RMS) values of waveforms and techniques for measuring these voltages.** 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.
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 an equivalent course at another college, the student will have skills needed to enroll in this course. If students have basic electronics knowledge, they will be will be prepared to enroll in this course. It is recommended that students have knowledge in electronics to enhance their success in this course.
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Walter Kahan
Date:	09/23/2015
Original Board Approval Date:	09/01/1977
Last Reviewed and/or Revised by:	Supriya Bhargave
Date:	10/18/2023
Last Board Approval Date:	01/17/2024
Effective Term:	FALL 2024