Wharton County Junior College

Administrative Master Syllabus

Course Information

Course Title	Solid State Devices
Course Prefix, Num. and Title	CETT 1429 - Solid State Devices
Division	Technology and Business
Department	Electronics Engineering Technology
Course Type	WECM Course
Course Catalog Description	A study of diodes, transistor characteristics and other semiconductor devices, including analysis of static and dynamic characteristics, biasing techniques, and thermal considerations. Study of basic power-supply design and application as well as linear and switching circuits. Laboratory realization of lecture topics.
Pre-Requisites	CETT 1403
Co-Requisites	None

Semester Credit Hours

Total Semester Credit Hours (SCH): Lecture Hours: Lab/Other Hours	4:3:3
Equated Pay Hours	4.5
Lab/Other Hours Breakdown: Lab Hours	3
Lab/Other Hours Breakdown: Clinical Hours	0
Lab/Other Hours Breakdown: Practicum Hours	0
Other Hours Breakdown	0

Approval Signatures

Title	Signature	Date
Department Head:	David Kucera, Electronics Engineering Technology Program Director	10-26-2023
Division Chair:	David Kucera, Technology & Business Division Chair	10-26-2023
VPI:	Leigh Ann Collins Digitally signed by Leigh Ann Collins Date: 2024.05.21 10:17:20 -05'00'	

Wharton County Junior College

Additional Course Information

Topical Outline: Each offering of this course must include the following topics (be sure to include information regarding lab, practicum, and clinical or other non-lecture instruction).

The following performance will be expected of any student completing this course with a passing grade. There is no absolute time limit on the performance of these objectives, unless noted, but the grade received by the student will depend, in part, on the relative speed and precision of the student's performance in these tasks. Where subjective evaluations are indicated, the instructor will make these judgments based on his or her knowledge of the skills required to place a graduate with the expectation of successful on-job performance. The student will be expected to show understanding of the following in written examination or laboratory demonstration:

- Identify the anode and cathode of the diode symbol, and of a diode with typical case markings.
- Draw the Voltage-Current characteristics of a silicon junction diode, marking Ir, Vbeo, and indicating the forward voltage drop.
- Demonstrate ability to successfully test a diode to determine anode and cathode using only an ohmmeter
- Correctly explain the safety factors involved in the use of hot-chassis power supplies, and how the isolation transformer reduces the shock hazard.
- Calculate the proper size for a simple filter capacitor when given the load current, the line frequency, and the required ripple voltage for a half-wave or full- wave rectifier.
- Draw a correct diagram for a half-wave and a full-wave CT rectifier.
- Draw a correct diagram for the full-wave bridge rectifier.
- Calculate the correct diode PIV necessary in a half- wave or full-wave rectifier.
- Calculate the approximate reduction in ripple voltage provided by a pi-section filter given the input ripple, input frequency, inductor value, and capacitor value.
- Estimate the output voltage for a choke input filter, given the RMS voltage of the transformer secondary.
- Correctly draw the schematic diagrams for the NPN and PNP bipolar transistor.
- Show laboratory skills sufficient to identify the base of a bipolar transistor, given*good transistor and an ohmmeter.
- Show ability to separate good and bad bipolar transistors using only an ohmmeter.
- Correctly measure the beta of a good bipolar transistor, given an ammeter, a voltmeter, power supply, and resistors.
- Find the power dissipation of a bipolar transistor given the circuit values for a common-emitter circuit. Design and construct a common-emitter circuit which will produce a given voltage at the collector, given on the beta of the transistor and a power supply voltage.
- Show how changes in beta effects changes in Q-point.
- List the meaning of, and the advantages of operation in the saturation and cutoff regions of bipolar transistors.
- Define linear operation of the common-emitter circuit.
- Draw diagrams showing the relationship between bias point and output voltage clipping for the common-emitter amplifier.
- Demonstrate ability to design a common- emitter amplifier with simple or voltage-divider biasing to produce a specified Q-point and voltage gain.
- Demonstrate his or her ability to set voltage gain in the common-emitter amplifier independently of stability criteria, by use of the emitter-bypass capacitor.
- Construct a properly biased common-collector circuit.
- Give a valid comparison of the output impedance/voltage gain of the common-emitter and common- collector circuit configurations.

- Find correct input impedance (resistive), voltage gain, and output voltage limits for the simple common-emitter and common-collector circuits.
- Draw a diagram correctly showing collector biasing for the common-emitter circuit.
- Show how multistage circuits can be produced using common-emitter circuits with capacitor coupling, or alternating common-emitter and common-collector circuits with direct coupling.
- Describe the use of the inter-stage coupling transformer.
- Design a three-stage transistor amplifier with a voltage gain of 100 +/- 10%, using 2N2222 transistors and a power supply voltage of no more than 15 volts, with input impedance of 20K ohms or greater. This is to be done in three steps, with instructor feedback after each design phase, and lab construction of the final design, with measurement of actual performance.
- List the important characteristics of operational amplifiers.
- Identify the inverting configuration, the non-inverting configuration, and the unity gain buffer configuration for operational amplifier circuits.

Course Learning Outcomes:

Learning Outcomes – Upon successful completion of this course, students will:

1. Analyze various solid-state devices and circuits, including BJT/FET, bias and amplification.
2. Construct circuits to test.
3. Troubleshoot various solid-state devices and circuits.

Design a three-stage transistor amplifier with a voltage gain of 100 +/- 10%, using 2N2222 transistors and a power supply voltage of no more than 15 volts, with input impedance of 20K ohms or greater. This is to be done in three steps, with instructor feedback after each design phase, and lab construction of the final design, with measurement of actual performance

Methods of Assessment:

Outcomes 1,2,3 will be assessed by:

- Exams
- Homework
- Labs
- Quizzes

Required text(s), optional text(s) and/or materials to be supplied by the student:

An appropriate electronics text covering Solid State Devices. Example-Electronic Principles by Malvino

Calculator – scientific with Sine, Cosine, Tangent capabilities

Suggested Course Maximum:

30 lecture, 20 Laboratory

List any specific or physical requirements beyond a typical classroom required to teach the course.

Lecture facilities for 30 students. Laboratory facilities for 20 students must include 10 bench positions each with a digital meter, logic probe, 50 MHz oscilloscope and probes, bread boarding facility with power supply and signal generator, and a stock of basic circuit components.

Wharton County Junior College

Course Requirements/Grading System: Describe any course specific requirements such as research papers or reading assignments and the generalized grading format for the course.

Evaluation of Performance:
Course grades will be determined by the percentage of course objectives for which the student can demonstrate mastery and by attendance. Mastery of course objectives will be determined by written examinations, physical soldering exams, an attendance grade as described in the Departmental Policy handout, a daily work grade which will include graded homework, graded laboratory work, and a comprehensive final exam.

Approximate Grade Evaluation Summary:
Major tests 60%
Attendance 10%
Lab reports, homework, and quizzes..... 15%
Final examination 15%

Grade Scale:
90 to 100 ..... A
80 to 89 ..... B
70 to 79 C
60 to 69 ..... D
0 to 59 ..... F

Curriculum Checklist:

☐ **Administrative General Education Course** (from ACGM, but not in WCJC Core) – No additional documents needed.

☐ **Administrative WCJC Core Course**. Attach the Core Curriculum Review Forms

- ☐ Critical Thinking
- ☐ Communication
- ☐ Empirical & Quantitative Skills
- ☐ Teamwork
- ☐ Social Responsibility
- ☐ Personal Responsibility

☒ **WECM Course** -If needed, revise the Program SCANS Matrix and Competencies Checklist