ELEC A290: ELECTRONIC TROUBLESHOOTING

Item	Value
Curriculum Committee Approval Date	10/30/2024
Top Code	093400 - Electronics and Electric Technology
Units	3 Total Units
Hours	90 Total Hours (Lecture Hours 36; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	Yes
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)

Course Description

In this course students will develop the fundamental problem solving skills necessary to troubleshoot simple and complex electronic circuits. Students will learn how to identify problems, localize problems to subsystems, and sequentially test a circuit to quickly identify faulty components or subsystems. Students will gain hands-on experience with diagnostic tools such as multimeters, oscilloscopes, spectrum analyzers, and current clamps. Finally, students will learn to solve these issues by weighing the cost of repair or replacement. ADVISORY: ELEC A111 and ELEC A112. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Perform self-directed repairs of electronics systems using industrials manuals and test equipment.
2. Document the repair process and components replaced.
3. Demonstrate critical safety skills that apply technical processes.
4. Demonstrate calibration processes to industrial specifications and standards.

Course Objectives

- 1. Demonstrate the ability to utilize state-of -the-art test equipment to troubleshoot analog circuits including power supplies, amplifiers, oscillators.
- 2. Demonstrate the ability to utilize state-of-the-art test equipment to troubleshoot digital counter circuits.
- 3. Follow current flow patterns in complex circuits and troubleshoot to the component level using logic tree diagnosis methods.
- 4. Demonstrate the ability to breadboard analog circuits containing the standard passive and active components.
- 5. Demonstrate the ability to breadboard digital circuits containing the standard passive and active components.
- 6. Demonstrate a knowledge of the characteristics of each electronic component discussed in the course.

Lecture Content

Lecture Topics1.0 Review of basic concepts Ohms law Bi-polar biasing active, cutoff, saturated Beta Fault diagnosis Static testing 2.0 Transformer power supply Half, Full wave Filtering/ripple Loading 3.0 Transformer power supply/regulated Pass transistor/zener diode Fault diagnosis 3.1 Switching power supply Introduction/types of 4.0 DC-DC converter Block diagram Application/function 5.0 DC to AC conversion Op-amp oscillator R/C phase shift network 6.0 Class A amplifier Common emitter Beta dependent biasing Voltage gain = ac collector resistance/ ac emitter resistance 7.0 Class B amplifier Driver transistor Push pull (single supply) 8.0 Class B amplifier /reduced crossover distortion Op-amp driver op-amp characteristics Push pull (split supply) 9.0 Sound activated lamp Condenser microphone characteristics Dual op-amp configuration null offset control Bipolar transistor as a switch 10.0 XR2240 programmable delay timer Selectable function and characteristics Design features and metho ds Biasing 11.0 555 timer oscillator Basic design for a stable operation Design for dual timer frequency modulation 12.0 Programmable delay timer with warble alarm Combined XR2240 delay timer and 555 timer oscillator circuit Build and operate a programmable delay timer with alarm Fault diagnosis related to circuit fabrication and operation 13.0 Seven segment display counter 555 one hertz timer, 7490 decade counter, 7448 display driver Design 555 as clock with differential signal conditioning ckt. for edge triggering Configure decade counter for divide by 10 BCD format Design decoder driver to LED display 13.1 Function and fault diagnosis of typical ckt. failure14.0 Relays DPDT latch current, Hold current, dropout current self latching ckt. vibrator Silicon controlled rectifier configuration and biasing 15.0 Hands on system analysis and fault diagnosis Using available industry standard device circuit trace, take test point measurements, operate to factory specifications Using factory service manuals follow circuit function and logic flow. Using factory service manuals follow fault diagnosis

Lab Content

Laboratory assignmentsCourse includes weekly projects, appropriately chosen from the following list, to reinforce the previous lecture(s). Bipolar transistor saturation/cutoff Power supply Oscillators bipolar amplifiers class A, B sound activated switches programmable timers digital counters relays silicon controlled rectifier application and use of industry methods and practices as related to troubleshooting Required reading and homeworkStudents will be expected to read all pertinent chapters of the required textbook, as well as all handouts. Homework will be to analyze scenarios set forth in lecture and review in the following class meeting.

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

Instructional methodologies will include, but not necessarily be restricted to: 1. Detailed multi-media lectures of each topic covered, Which include basic AC and DC principles, analog bipolar circuits, analog op-amp circuits, digital counting circuits. 2. Student feedback during each lecture. 3. Detailed illustrative discussion of textbook examples. 4. Concentration on alternate common sense ohms law approach to

troubleshooting. 5. Instructor introduction to practical applicational analysis of each laboratory session. 6. Laboratory exercises pertaining to all subjects discussed, during which students either work singly or in pairs.

Reading Assignments

weekly hours: 1.5

Writing Assignments

In all laboratory assignments students will be required to give verbal answers in a clear and understandable manner consistent with industry methods and practices. Students will be expected to show a proficiency in the use of digital multimeters, programmable dual trace oscilloscopes, signal generators, and power supplies. weekly hours: 1.5

Out-of-class Assignments

weekly hours: 1.5

Demonstration of Critical Thinking

Written examinationsThree written exams (scantron and essay type) plus a written final exam will be utilized to test the students mastery of the material.Laboratory examinationsOne laboratory midterm exam will be given to test the student s ability to read a schematic and identify components and fault diagnose a functioning circuit.DiscussionsStudents will answer the instructor s reinforcement questions during each of the lecture periods.Practical evaluationsEach week the students will build and take data from specified circuits. Student performance will be monitored and supplemented as necessary.

Required Writing, Problem Solving, Skills Demonstration

In all laboratory assignments students will be required to give verbal answers in a clear and understandable manner consistent with industry methods and practices. Students will be expected to show a proficiency in the use of digital multimeters, programmable dual trace oscilloscopes, signal generators, and power supplies.

Eligible Disciplines

Electronics: Any bachelor’s degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required Tomal, Daniel, et al.. Electronic Troubleshooting, ed. New York: Glencoe/McGraw Hill, 2003 Rationale: -

Other Resources

1. Handouts: Programmable Timer, Sutter CPM 9000 Home Rehab.