SOUTHEAST COMMUNITY COLLEGE
ADVANCED TECHNOLOGIES & SKILLED TRADES DIVISION
Electronic Systems Technology Program
Revision Date: June 26, 2025

I. CATALOG DESCRIPTION

Course Number:	ELEC2150
Course Title	Fundamentals of Electronic Circuits III
Prerequisite(s):	ELEC1240 or ELEC1217
Catalog Description:	Fundamentals of Electronic Circuits III covers diodes, transistors, SCR's, and TRIAC's and other integrated semiconductor devices. Analysis, basic circuit design, and common troubleshooting practice for these components will be discussed. Experience in testing/troubleshooting audio amplifiers and discrete/operational amplifiers will also be covered. This course focuses on industrial control devices such as variable Frequency drives and servo motors/drives. Industrial processes, including motion control, PID tuning, and vision systems are introduced and demonstrated in vocational lab.
Credit Hours:	6
Class Hours:	45
Lab Hours:	135
Total Contact Hours:	180

II. COURSE OBJECTIVES: *Course will:*

A. Describe basic theory and operation of semiconductor devices.
B. Explain several transistor amplifier circuit designs.
C. Introduce electronic theorems and methods useful in semiconductor circuit analysis.
D. Explain useful troubleshooting techniques in transistor amplifier circuits.
E. Analyze and measure key parameters of multistage and operational amplifiers and terminology.
F. Build and troubleshooting multistage amplifier circuits.
H. Talk about the different classes of Power Amplifiers.
I. Identify characteristics and operation of oscillators and active filters.
J. Describe the applications and tuning of Process Control systems.
K. Explain the set up and operation of electronic motor controllers.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

A. Student Learning Outcomes: *Student will be able to:*
1. Describe the basics of semiconductor operation theory.
2. Explain the principles of operation behind amplifier design.
3. Demonstrate proper computation and analysis of semiconductor-based circuits.
4. Demonstrate troubleshooting capabilities for semiconductor-based circuits.
5. Calculate decibels and correlate calculation to measurements.
6. Operate test equipment to measure key parameters of multistage and operational amplifiers.
7. Construct and troubleshoot multistage amplifiers.

8. Construct and explain basic filter and oscillator designs and their operational use.
9. Construct basic power amplifier designs, and explain the underlying principles of operation.
10. Tune a process control application.
11. Graph and analyze data from a process control system.
12. Setup and test the operation of a Variable Frequency motor drive and Servo Systems

B. General Education Learning Outcomes (GELOs)

1. GELO #3: Critical Thinking & Problem-Solving Outcome 1: Collect, identify, interpret and analyze data.

IV. CONTENT/TOPICAL OUTLINE

A. Fundamentals of semiconductor Theory

1. Biasing
2. Regions of operation
3. Doping
4. Leakage current
5. Temperature effects on performance

B. Diode Theory

1. Characteristics
2. Testing
3. Applications
4. Special Purpose

C. Bipolar Junction Transistors (BJT)

1. General principles of operation
2. Regions of operation
3. AC characterization
4. Basic amplifier design and analysis using BJT devices
   a. Common emitter
   b. Common Base
   c. Common Collector

D. Field Effect Transistors

1. JFET principles of operation
2. JFET AC characterization
3. JFET Amplifiers
   a. Common source
   b. Common gate
   c. Common drain
4. General MOSFET principles of operation
5. Enhancement type MOSFET theory
6. Depletion type MOSFET theory
7. MOSFET applications

E. Discrete multi-stage amplifiers

1. Discrete Multi-stage Amplifiers

2. Effects of cascading amplifier stages
- **a.** Current gain (absolute and dB)
- **b.** Voltage gain (absolute and dB)
- **c.** Input impedance
- **d.** Output impedance
- **e.** Balanced and unbalanced media

3. Types of discrete amplifiers
- **a.** Differential pair
- **b.** Constant current sources
- **c.** Direct coupled amplifiers

4. Discrete amplifier characteristics
- **a.** Negative feedback
- **b.** Frequency response

F. Power amplifiers
- **1.** Class of operation
- **2.** Complementary output circuit analysis
  - **a.** Driver circuitry
  - **b.** Biasing
  - **c.** Device power ratings
  - **d.** Heat sinks
  - **e.** Protection circuits
- **3.** Amplifier troubleshooting
- **4.** Power amplifier applications

G. Operational Amplifier Circuits
- **1.** Introduction to operational amplifiers
  - **a.** Inverting/non-inverting amplifier configurations
  - **b.** Input/output impedance
  - **c.** Gain
  - **d.** Other circuit considerations
- **2.** Comparator/detector circuits
  - **a.** Zero crossing
  - **b.** Level
  - **c.** Window
- **3.** Sum and difference amplifiers
- **4.** Active filters
- **5.** Instrumentation amplifiers
- **6.** Oscillators

H. Process Control
1. Introduction tuning of a PID process control system using the Zigler Nickols method.
   a. Manual Control
   b. Automatic control
      1. On/off control systems
      2. PID control systems
      3. Fuzzy control systems

I. Variable Speed Drives and Servo Drives

1. Introduction to the installation and setup of motor drives.
    a. Variable frequency drives
        1. Describe the theory of operation of variable frequency drives.
        2. Discuss the components that are used in variable frequency drives.
        3. Discuss the uses of variable frequency drives.
        4. Discuss the detrimental effects that variable frequency drive has on motors, and the things that are done to combat these effects.
        5. Learn the setup procedures to perform a basic installation.
        6. Learn about SCR, TIARC, and IGBT and how there are used in Variable Frequency Drives

J. INTRODUCTION TO VISION SYSTEMS

1. Goal Statement: The student will learn the basic uses and theory of operation of industrial Vision Systems.
    a. Automated Visual inspection
        1. Describe the theory of operation of a CCD.
        2. Discuss picture resolution and its effects on picture quality.
        3. Discuss lensing and lighting.

V. INSTRUCTIONAL MATERIALS

A. Required Text(s): Floyd, Thomas, *Electronic Devices-Electron Flow Version,* (Refer to CID and/or instructor for current edition)

B. Other Resources: Handout materials and class notes

C. Supplies: Calculator, and Proto board

VI. METHODS OF PRESENTATION/INSTRUCTION

A. Methods of presentation typically include a combination of the following:

1. Terminology enhanced lecture

2. Classroom discussion

3. Interactive group activities

4. Audio visual materials

VII. METHODS OF EVALUATION

A. Methods of evaluation, although determined by the individual instructor, traditionally includes a combination of the following:

1. Class participation

2. Daily assignments

3. Written exams and/or quizzes

4. Performance and observational assessment

VIII. SPECIFIC COURSE REQUIREMENTS

A. Minimum grade of 60% is required.

B. Credit by Examination: Credit for the course CANNOT be earned through Credit by Examination.