

**College of San Mateo**  
**Official Course Outline**

1. **COURSE ID:** ELEC 112    **TITLE:** Advanced Electronics Fundamentals

**Units:** 3.0 units    **Hours/Semester:** 32.0-36.0 Lecture hours; 48.0-54.0 Lab hours; and 64.0-72.0 Homework hours

**Method of Grading:** Letter Grade Only

**Prerequisite:** ELEC 111, and ELEC 231 and Completion of or concurrent enrollment in ELEC 232.

**Recommended Preparation:**

MATH 110

2. **COURSE DESIGNATION:**

**Degree Credit**

**Transfer credit:** CSU

3. **COURSE DESCRIPTIONS:**

**Catalog Description:**

Introduction to more advanced electrical/electronics circuits. Includes power supply circuits, filtering circuits, amplifiers and oscillators circuits using BJT, FET, and Op-amp devices; also an examination of digital circuits. Emphasizes laboratory techniques and the use of electronic test equipment. A materials fee in the amount shown in the Schedule of Classes is payable upon registration.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**

Upon successful completion of this course, a student will meet the following outcomes:

1. Review ELEC 111 topics and basic electrical units and their applications.
2. Develop a working knowledge of diodes used as rectifiers and how they are used in power supplies in Half and full wave configurations.
3. Develop a working knowledge of transistors (BJT, FET and MOSFET) as amplifiers, oscillators and switches.
4. Develop a working knowledge of SCRs and Triacs for power switching.
5. Explore analog Op-Amps applications; Buffers, Summing and Differential amplifiers and oscillators.
6. Develop a working knowledge of Digital devices such as basic logic gates, flip flops and counters.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**

Upon successful completion of this course, a student will be able to:

1. Review ELEC 111 topics and basic electrical units and their applications.
2. Develop a working knowledge of diodes used as rectifiers and how they are used in power supplies in Half and full wave configurations.
3. Develop a working knowledge of transistors (BJT, FET and MOSFET) as amplifiers, oscillators and switches.
4. Develop a working knowledge of SCRs and Triacs for power switching.
5. Explore analog Op-Amps applications; Buffers, Summing and Differential amplifiers and oscillators.
6. Develop a working knowledge of Digital devices such as basic logic gates, flip flops and counters.

6. **COURSE CONTENT:**

**Lecture Content:**

1. Review Scientific, Engineering notation and decimal number system to be used in lectures and lab.
2. Explain the operation and construction of small signal diodes, light emitting diodes and how they are used. (Chapter 35)
3. Present material on half wave rectification and filtration with capacitors. Explain regulation with Zener diodes. (Chapter 36)
4. Explain full wave rectification and integrated circuit regulation with 7800 series voltage regulators. (Chapter 36)
5. Introduce bipolar and field effect transistors. Examine their construction and operation as switches, amplifiers and oscillators. (Chapter 37 and 38)
6. Explore operational amplifiers; examine their operation as buffers, inverters, comparators, differential amplifiers. Discuss common mode rejection and phase shift oscillation. (Chapter 40)
7. Investigate the 555 timer circuit and its versatility. Review time constants and explore pulse width modulation as used in motor control. (Chapter 40)

8. Examine Silicon Controlled Rectifiers (SCR) and Triacs. Investigate the operation of each with DC and AC voltages and currents. (Chapter 39)
9. Introduce digital devices; explain the difference between analog and digital signals and voltage levels. Explore the different types of logic gates and their operation. Investigate combinational logic circuits and use the Boolean algebra to construct equivalent circuits. (Chapter 41)

**Lab Content:**

1. **Week 1 Lab 1:** Review of ELEC 111 topics such as resistive circuits, polarity, graphing and proper notation used to write conclusions and answer questions in the labs.
2. **Week 2 Lab 2:** Small Signal Diodes will be examined. The construction and operation will be observed through lab exercises to educate the student on how a diode is used in a circuit in forward biased and reversed biased configurations.
3. **Week 3 Lab 3:** Half Wave Rectification will be explored using the small signal diodes from week 2. The effects of filtration using capacitors and regulation with Zener diodes will also be examined in lab.
4. **Week 4 Lab 4:** Full Wave Rectification with center tapped transformer and a rectifier bridge will be examined. Also using inductor filtration and integrated circuit regulation will be explored in this lab.
5. **Week 5 Test week: Complete and make up labs**
6. **Week 6 Lab 5:** Bipolar Junction Transistors as a switch will be examined as well as how a BJT can control a larger current with a very small current at the base of the device. The operational regions of a BJT will be observed and measured.
7. **Week 7 Lab 6:** Bipolar Junction Transistors as an amplifier. In this lab the student will construct an amplifier circuit. The student will predict and measure voltages, currents and signal gains.
8. **Week 8 Lab 7:** Construction of a Transistor oscillator. This lab will examine a circuit using resistive capacitive networks or inductive capacitive networks to demonstrate the Barkhausen criteria of oscillators
9. **Week 9 Lab 8:** Introduction to operational amplifiers (LM741); student will construct inverting and non-inverting op amp circuits. Students will take voltage and gain measurements.
10. **Week 10 Lab 9:** Students will construct operational amplifiers (LM741) in buffer and differential amplifier circuits. Student will observe common mode rejection.
11. **Week 11 Lab 10:** Student will construct an operational amplifier (LM741) into a phase shift oscillator. Student will observe phase shift in each resistive capacitive networks and verify that the Barkhausen Criteria is in effect.
12. **Week 12 Lab 11:** Introduction to the 555 timer circuit. Student will construct a 555 timer circuit and experiment with changing time constants to affect the pulse width modulation waveform. Student will also learn to use a digital oscilloscope to capture the PWM waveform.
13. **Week 13 Lab 12: Introduction to Silicon Controlled Rectifiers (SCR) and Triacs.** Student will construct circuits to examine latching and conduction angle SCR and Triac circuit will both DC and AC voltages and currents.
14. **Week 14 Test week: Complete and make up labs**
15. **Week 15 Lab 13:** Introduction to Digital Devices, students will investigate how Not gates (inverters) logic works. Students will construct circuits to explore Not gate operation. Students will learn to use logic trainer to construct circuits on.
16. **Week 16 Lab 15:** Students will use combinational digital devices to construct circuits and examine how the NAND gate can mimic other digital devices.
17. **Week 17 Lab 16:** Students will construct circuits to examine Boolean Algebra equations and create equivalent circuits.

**7. REPRESENTATIVE METHODS OF INSTRUCTION:**

Typical methods of instruction may include:

- A. Lecture
- B. Lab
- C. Experiments
- D. Observation and Demonstration
- E. Other (Specify): a. Lectures b. Handouts c. Homework assignments from the textbook d. Videos e. Computer based training activities f. Lab activities

**8. REPRESENTATIVE ASSIGNMENTS**

Representative assignments in this course may include, but are not limited to the following:

**Writing Assignments:**

Students are required to complete worksheets and lab questions.

**Reading Assignments:**

Students are required to complete all assigned reading from text and lab books.

**9. REPRESENTATIVE METHODS OF EVALUATION**

Representative methods of evaluation may include:

- A. a. Quizzes b. Examinations c. Homework assignments d. CBT results e. Lab activities

**10. REPRESENTATIVE TEXT(S):**

Possible textbooks include:

- A. Petruzelia. *Essentials of Electronics*, 2nd ed. McGraw-Hill, 2001

Other:

- A. CSM. ELEC 111 Fundamentals of Electronics: Laboratory Manual and Supplemental Handouts

**Origination Date:** November 2021

**Curriculum Committee Approval Date:** February 2022

**Effective Term:** Fall 2022

**Course Originator:** Steven Gonzales