

COURSE OUTLINE

Engineering 131 Electronics and Electrical Circuits

I. Catalog Statement

Engineering 131 is intended for students wishing to major in engineering at the university level. It provides an introduction to the basic concepts and theory of electricity and magnetism with an emphasis on passive electrical elements such as resistors, capacitors and inductors (RCL) and their applications in alternating current (AC) or direct current (DC) circuits. Students also learn how to build, test and analyze simple RCL circuits in the laboratory, and use simulation software and test equipment such as power supply, multimeter, signal/function generator, oscilloscope, and spectrum analyzer. Related mathematics and physics concepts are developed alongside these concepts of electrical engineering.

Total Lecture Units: 2.0

Total Laboratory Units: 1.0

Total Course Units: 3.0

Total Lecture Hours: 32.0

Total Laboratory Hours: 48.0

Total Faculty Contact Hours: 80

Prerequisite: None.

Recommended preparation: Mathematics 102 or Mathematics 110

II. Course Entry Expectations

Skill Level Ranges: Reading 6; Writing 5; Listening/Speaking 5; Math 6.

Prior to enrolling in the course, the student should be able to:

1. solve algebraic equations;
2. solve linear and non-linear inequalities;
3. graph the following types of functions and relations: polynomial, rational, exponential, logarithm, conic section, and trigonometric;
4. solve exponential and logarithmic equations;
5. solve linear and non-linear systems of equations;
6. solve applications using vectors.

III. Course Exit Standards

Upon successful completion of the required coursework, the student will be able to:

1. apply and articulate various concepts in applied math and physics to comprehend the fundamentals of passive circuit elements such as resistors, capacitors, inductors and simple RLC circuits;
2. design, build, analyze and test passive electrical AC/DC circuits with resistors, capacitors and inductors;
3. use laboratory test equipment such as power supply, multimeter, signal/function generator, oscilloscope, and spectrum analyzer to test electrical circuits.

IV. Course Content**Total Faculty Contact Hours = 80**

A. Basic Concepts of Electrical Engineering	Lecture 6 hours Lab 9 hours
1. Process of engineering	
2. Systems and units	
3. Instantaneous and constant variables	
4. Charge, current, and voltage	
5. Power and energy	
6. Time varying signals	
7. Coulomb force and electric fields	
8. Reference point	
9. Potential difference	
B. Introduction to circuits	Lecture 6 hours Lab 9 hours
1. Circuit elements	
2. Charge, current, voltage, and resistance	
3. I-V curve	
4. Ohm's law	
5. Test equipment	
6. Conductors, insulators, semiconductors	
7. Material polarization and dielectric constant	
C. Magnetism	Lecture 4 hours Lab 6 hours
1. Magnetic flux and flux density (B)	
2. Magnetic poles and dipoles	
3. Magnetic permeability	
4. Magnetic materials	
5. Magnetomotive force	
6. Magnetic field intensity (H)	
7. B-H curves	
8. Ampere's law	
9. Lenz's law	
10. Faraday's law	
11. Induction and electromotive action	

D. Passive Circuit Analysis, Testing and Building (AC/DC)

Lecture 16 hours

Lab 24 hours

1. Impedance
2. Reactance
3. Capacitance
 - a. Types of capacitors
 - b. Capacitor codes
4. Inductance
5. Magnetic coils
6. Transformers and the conservation of energy
7. Kirchhoff's laws
8. RCL circuits
 - a. I-V curves and frequency response
 - b. Parallel and series reactance
 - c. Peak voltage
 - d. Phase angle
 - e. Impedance
 - f. Period, frequency, angular velocity
 - g. Peak, average and rms values
9. Impedance matching
10. Maximum power transfer
11. Non-ideal resistors, capacitors and inductors
12. AC analysis using C-numbers for RC, LC and RL circuits
13. Building the RLC circuits in the lab environment
 - a. Analysis using complex numbers and phasors

V. **Methods of Instruction**

The following instructional methodologies may be used in the course:

1. lecture and demonstration;
2. instructor analysis of student work;
3. laboratory practice;
4. individual instructor-to-student assistance in the class.

VI. **Out of Class Assignments**

The following out of class assignments may be used in the course:

1. individual and/or group project (e.g. design circuits and devices);
2. portfolios (e.g. laboratory and design notebooks);
3. calculations and homework sets (e.g. problem sets).

VII. **Methods of Evaluation**

The following methods of evaluation may be used in the course:

1. midterm examinations and quizzes;
2. homework problem sets;

3. instructor evaluation of student portfolio work;
4. final examination.

VIII. Textbook

Schultz, M. *Grob's Basic Electronics*. Tenth Edition. United States: McGraw-Hill Higher Education, 2010.

14th Grade Textbook Reading Level. ISBN-13: 978-0-07-741009-4.

IV. Student Learning Outcomes

1. Students will apply fundamental concepts in mathematics and physics to circuit analysis and design.
2. Students will build, analyze and test basic circuits using resistors, capacitors and inductors.
3. Students will demonstrate proficiency in an electronics lab environment, using lab devices such as power supply, multimeter, frequency/function generator, oscilloscope, and spectrum analyzer.