

COURSE OUTLINE

**Electronics and Computer Technology 110  
Electricity and Electronics Principles**

**I. Catalog Statement**

ECT 110 teaches the principles and applications of electricity and electronics. Topics include basic laboratory equipment, various electronics components, and designing/troubleshooting electronic circuit. This course provides students with the knowledge and skills of electricity and electronics and will enhance their success in both their present career and/or advanced education in this field.

Units – 4.0

Lecture hours – 3.0

Lab hours – 3.0

(Faculty Laboratory Hours 3.0 + Student Laboratory Hours 0.0 = 3.0 Total Laboratory Hours)

Prerequisite: None

**II. Course Entry Expectations**

Skills Level Range: Reading 5; Writing 5; Listening/Speaking 5; Math 3.

**III. Course Exit Standards**

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

1. describe basic laboratory equipment and components;
2. determine the value of resistors from their color code, measure DC (Direct Current) and AC (Alternating Current) voltage;
3. identify conductors and insulators, and test common types of switches;
4. measure current in a circuit, verify ohms law, investigate errors in measurement;
5. design a series and parallel circuit that will meet specified resistance requirements;
6. develop a general rule for calculating the voltage across each resistor in an unloaded and loaded resistive voltage divider;
7. develop methods of troubleshooting circuits using voltage, current, capacitor and resistance measurements;
8. identify the operating controls of an oscilloscope;
9. identify the controls and features of an audio frequency generator;
10. describe the effect of AC and DC electrical motors and inductance;

11. identify and measure affect transformers and magnetic relays and contactors.

#### **IV. Course Content**

**Total Contact Hours = 96**

A. Basic Concepts.	3 hours
1. Base units for specifying and calculating energy and work	
2. Energy conversion and conversion efficiency	
3. Characteristics of the major particles of an atom	
4. Nature of electric charge	
5. Industrial applications of static electricity	
B. Electrical Quantities and Units.	5 hours
1. Units of charge, current, voltage, resistance, and power	
2. Electrical current in solids, liquids, and gases	
3. Difference and relationship between power and energy	
4. Express and use the relationship between power, energy, and time	
5. Convert quantities from base units to submultiple or multiple units and vice versa	
6. Relationship between energy, charge, and voltage	
7. Ways of producing voltage	
C. Basic Circuits, Laws, and Measurements.	5 hours
1. Relationship between schematic diagrams and physical circuits	
2. Use of Ohm's law to calculate the current, voltage, and resistance in simple electric circuits	
3. Calculating the power of a circuit	
4. Calculating the cost of operating an electric device	
5. Measuring the current, voltage, and resistance in electric circuits	
6. Relationship between scales and ranges on multiscale, multirange meters	
D. Circuit Components	4 hours
1. Components and their schematic symbols	
2. Wire size for electric conductors	
3. Operating principles of electric components	
4. Ratings of components	
5. Terminology for circuit components and faults	
6. Resistor codes and tolerance	
E. Multiple-load Circuits	4 Hours
1. Identify and classify multiple-load circuits	
2. Series, parallel, and series-parallel circuits	
3. Measure correctly the current, voltage, and/or resistance in any part of a multiple load circuit	
4. Calculate power, current, voltage, and/or resistance for the total circuit or any load in a multiple-load circuit	
5. Kirchhoff's law	

- a. Use in conjunction with Ohm's law to solve circuit problems.
- 6. Convert from resistance to conductance
- 7. Relationship between maximum power transfer and efficiency
- F. Complex-Circuit Analysis 3 hours
  - 1. Simultaneous equations
  - 2. Loop equations using Kirchhoff's voltage law.
  - 3. Electrical quantities of either single-source or multiple source complex circuits.
  - 4. Superposition theorem to solve multiple-source complex circuits.
  - 5. Advantages of viewing a circuit as a two-terminal network.
  - 6. Application of Thevenin's theorem and Norton's theorem to reduce complex circuits.
- G. Magnetism and Electromagnetism 4 hours
  - 1. Magnetic fields, flux, and forces.
  - 2. Determining the direction of the magnetic flux created by a current-carrying conductor.
  - 3. Predict the direction of the force between current-carrying conductors.
  - 4. Magnetic and non-Magnetic materials
    - a. Differences
    - b. Permanent and temporary magnets
  - 5. Terminology for magnetism and magnetic circuits.
  - 6. Magnetic quantities and units
  - 7. Principle of operation for motors, generators, transformers, solenoids, and relays
- H. Alternating Current and Voltage 4 hours
  - 1. Differences between forms of alternating and direct current
  - 2. Relationship between time and frequency
  - 3. Expressing the magnitude of alternating current
  - 4. Sine wave generation
  - 5. Differences between, and relationship of, mechanical and electrical degrees
  - 6. Production of three-phase alternating current
  - 7. Characteristics and applications of delta-and wye-connected AC systems
  - 8. Advantages of three-phase over single-phase systems.
- I. Power in AC Circuits 3 hours
  - 1. Phase relationships in AC circuits
  - 2. Phasor diagrams to represent circuit currents and voltages
  - 3. Right-triangle relationships to electric circuits to determine phase angles and voltages
  - 4. Trigonometric functions to determine resistive and reactive currents and voltages
  - 5. Relationship between true power and apparent power

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| <ul style="list-style-type: none"> <li>6. Power factor of an electric distribution system</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 5 hours  |
| <ul style="list-style-type: none"> <li>J. Capacitance                             <ul style="list-style-type: none"> <li>1. Construction of capacitors and the purpose of each part</li> <li>2. Capacitor behavior in AC and DC circuits</li> <li>3. Capacitance causes current to lead voltage by 90</li> <li>4. Determine the values of reactance, voltage, and current in capacitive circuits</li> <li>5. Capacitors specifications</li> <li>6. Capacitor testing for opens and shorts</li> <li>7. Capacitor charging time</li> <li>8. Relationship between capacitance and voltage drops in a series capacitor circuit</li> </ul> </li> </ul>                                                                                                                                                                                                                      | 5 hours  |
| <ul style="list-style-type: none"> <li>K. Inductance                             <ul style="list-style-type: none"> <li>1. Concepts</li> <li>2. Terminology associated with inductance and inductors.</li> <li>3. Common types of inductors</li> <li>4. Specifications</li> <li>5. Lag voltage</li> <li>6. Relationship between inductance, frequency, and reactance</li> <li>7. Circuit values when inductors are connected in series or in parallel.</li> <li>8. Inductor resistance</li> <li>9. Inductance relationship to AC than to DC current</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                             | 4 hours  |
| <ul style="list-style-type: none"> <li>L. Transformers                             <ul style="list-style-type: none"> <li>1. Symbology</li> <li>2. Terminology</li> <li>3. Operation                                     <ul style="list-style-type: none"> <li>a. Voltage levels changes</li> <li>b. Matching impedances</li> <li>c. Electrical isolation.</li> </ul> </li> <li>4. Transformer core losses                                     <ul style="list-style-type: none"> <li>a. Causes</li> <li>b. Minimizing losses</li> <li>c. Calculating</li> </ul> </li> <li>5. Transformer selection and ratings</li> <li>6. Connecting three-phase transformer windings in either a delta or a wye configuration</li> <li>7. Connecting transformer windings in series and/or parallel to obtain the desired voltage and current capabilities.</li> </ul> </li> </ul> | 4 hours  |
| <ul style="list-style-type: none"> <li>M. Laboratory assignments related to lecture topics</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 48 Hours |

**V. Methods of Presentation**

The following instructional methodologies may be used in the course:

1. Lecture/discussion;
2. Multimedia presentations;
3. Demonstration;
4. Simulated field work.

**VI. Assignments and Methods of Evaluation**

1. Midterm examination.
2. Final examination.
3. Manipulation Skills Evaluation.

**VII. Textbook**

Zbar, P., Basic Electricity, Current Edition.  
New York City: McGraw-Hill, 2008  
10<sup>th</sup> Grade Textbook Reading level, ISBN# 978-0070728615

**VIII. Student Learning Outcomes**

1. The students will be able to identify the basic concepts of electricity, quantities, and units.
2. The student will be able to describe basic circuit laws, measurement, and circuit components.
3. The students will be able to describe the use of various electrical measuring instruments used in the electronics/electricity industry.