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## Course Outline - Electronics Solid State

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**Course Topic:** Electronics Solid State

**Recommended Contact Hours:** 40 hours

**Course Description:**

This course will provide students with the fundamental knowledge of AC single phase and the comparison with Direct Current. The effects of inductance and capacitance in AC circuits is emphasized and reinforced by problem assignments dealing with phase relationships. The need and methods for power factor correction are explained. Practical lab experiments are integrated with theory to help students analyze and confirm predicted circuit behavior. This includes the correct use of the oscilloscope and wattmeter. Refer to current Schedule of Classes for software version(s). Course/lab fees.

**BEE-9 Identify and explain the fundamental concepts of solid state**

1. Describe the properties of conductors, semiconductors, and insulators.
2. Describe the difference between electron flow and hole flow.
3. Explain how P-type and N-type materials are formed, and the difference between them
4. Explain what is meant by barrier voltage, depletion region, and how it is formed
5. Describe how forward, reverse, or no biasing, affects the PN junction of a semiconductor and the resulting current that flows
6. Identify the forward voltage drops across the PN junction of a silicon diode
7. Describe how to forward and reverse bias semiconductor diodes, and what the applied voltages that are required at the anode and cathode for each of these conditions
8. List the most common two ratings of a diode that should not be exceeded
9. Describe the operation of a zener diode, and the voltage drops that form as the current changes when a series resistor or the supply voltage is varied
10. Describe the operation of a light emitting diode, what is the purpose of its current limiting resistor, and how the LED should be connected in a circuit
11. Identify if the condition of a diode is shorted, open, or good, by being given test results with an ohmmeter
12. Given the applied voltage, indicate the voltage drops across each component of a series circuit that has a diode and resistor, when forward and reverse biased

**BEE-10 Explain and demonstrate the use of power supplies**

1. Describe the operation and identify the components of each section of a DC Power supply
2. Given the input voltage of a power supply, determine the secondary of the transformer based on the turns ratio, the pulsating dc output voltage of the rectifier, and the dc output of the filter circuit
3. For each section of a DC power supply, draw the waveforms of the input and outputs at each one





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4. Given the frequency of the applied AC supply voltage, list the frequency of the pulsating DC voltage at the outputs of a half-wave and full-wave rectifier
5. Given the peak voltage of a pulsating DC voltage of half wave and full wave rectifiers, determine the average voltage
6. Describe in detail when the diode is forward-biased and reverse-biased, and when the filter capacitor charges and discharges
7. Describe how changing the values of the filter capacitor, load resistor, and voltage frequency affect the ripple of a dc power supply
8. Describe the difference between voltage regulation and filtering, and explain in detail how the components for each circuit function to perform their operation
9. Given the peak-to-peak value of an AC voltage applied to the rectifier, determine the required minimum PIV value of the rectifier diode in the circuit
10. Describe what happens to the zener diode current and voltage when the load resistor value and the voltage changes
11. Given various symptoms of a defective filtered rectifier circuit, determine the cause of the fault

### **BEE-11 Identify and explain solid state devices**

1. Describe the basic construction and operation of a bipolar junction transistor (BJT)
2. List the three terminals of the bipolar transistor, and how use resistors to properly bias the junctions
3. Describe how a transistor operates as an amplifier and a switching device as it is driven into saturation and cutoff
4. Define the term thyristor
5. Describe the operation of a UJT, SCR, diac and triac
6. Identify the schematic symbols of a UJT, SCR, diac, and triac
7. List the polarities required to properly bias and fire thyristors devices
8. Define the term holding current as it pertains to thyristors
9. List the factors that determine the type of function an Op Amp performs
10. List the factors that determine the amplitude of the output produced by an Op Amp
11. Given the input voltages applied to the inputs of an Op Amp comparator, list the voltages that will be produced at its output
12. Describe the difference between analog and digital signals
13. Given the logic states applied to the inputs of a digital AND gate, list the logic states that will be produced at its output
14. Indicate how the power supply voltages are connected to the pins of an AND gate IC chip.

### **BEE-12 Identify and explain solid state system devices**

1. List advantages of fiber optic cable





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2. Describe common applications of fiber optic cable
3. Differentiate between single mode and multimode fiber optic cable
4. List the different types of fiber optic terminating connectors
5. Identify the purpose and function of barcodes
6. Describe barcode reader hardware
7. Define vision systems
8. Describe the linear array and matrix array
9. Describe pixels
10. Explain camera mounting considerations
11. Identify the types of lighting configurations
12. Describe the source of laser light
13. Explain the behavior of laser light
14. List safety hazards associated with laser equipment and precautionary measures that should be taken

### **BEE-13 Fabricate a circuit using soldering**





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