Alabama Department of Postsecondary Education

Representing the Alabama Community College System

STATEWIDE CAREER/TECHNICAL EDUCATION COURSE ARTICULATION REVIEW MINUTES

Articulation Agreement Identifier: ILT 195 (2005-1) Identifier is the postsecondary course prefix followed by Plan-of-Instruction version number (e.g.; INT 100 (2005-1)).

Applicable CIP code(s): 47.0105

Postsecondary course prefix, number, and title: ILT 195 – Troubleshooting Techniques I

Secondary Course(s) of Study: 480305/540015 – Semiconductors + 431509/430058 – Direct Current + 431510/430059 – Alternating Current

Initial Review: November 17, 2009 DPE Annual Review: February 23, 2012

Effective date: **Fall Semester 2011**.

Course Content Analysis (all postsecondary course objectives must be sufficiently addressed in the secondary courses):

Notes:

1. **Skills and knowledge contained in the postsecondary course objectives must be present in the corresponding secondary objectives for a "match" to occur.**
2. **Postsecondary and Secondary objectives must reflect similar content and performance levels before the course articulation agreement will be recommended to the TEDAC Oversight Committee.**
3. **More than one Secondary course may be used in order to articulate to a Postsecondary course.**

Postsecondary Course Objectives	Secondary Course(s) and Location(s)	TEDAC Comments
Module A **Competency:** • Use a multimeter • Use an oscilloscope • Interpret industrial electronics systems blueprints and schematic diagrams • Troubleshoot industrial electronics systems • Diagnose industrial electronics systems **Objectives:** • Given the knowledge taught in class, a multimeter, and a functioning electronic system, measure voltage, resistance, and power across the component with 90% of the measurements correct. • Given the knowledge taught in class, an oscilloscope, and a functioning electronic system, measure voltage, resistance, and power across the component with 90% of the measurements correct. • Given the knowledge taught in class, functioning industrial electronic components, operational checkout procedures and test equipment, perform operational checkout of system components. • Given the knowledge taught in class, industrial, electronic systems blueprints and schematic diagram, explain the system operation using the diagrams. • Given the knowledge taught in class, malfunctioning industrial electronic components, test equipment and system specifications, troubleshoot the system components and correctly identify the malfunction. **Learning Objectives** • Define terms used in troubleshooting • Describe the general process of troubleshooting	**Direct Current, Unit 12, Ohm's Law in DC circuits Content Standard** 12. Solve problems in electrical series, parallel, and combination circuits using Ohm's law to determine voltage, current, resistance, and power. **Learning Objective** 1. State Ohm's Law. 2. Explain Ohm's Law. 3. Identify the symbols of Ohm's law. 4. Calculate current using Ohm's Law. 5. Calculate voltage using Ohm's Law. 6. Calculate resistance using Ohm's Law. 7. Describe the linear proportion between current and voltage. 8. Explain electrical power. 9. Describe power dissipation in resistance. 10. Select the appropriate resistor for a given circuit. 11. Identify power formulas. 12. Describe common problems in circuits. 13. Identify a series circuit. 14. Explain the function of a series circuit. 15. Identify a parallel circuit. 16. Explain the function of a parallel circuit. 17. Identify a series parallel circuit. 18. Explain the function of a series parallel circuit. 19. Solve problems in electrical circuits using Ohm's law. • Voltage • Current • Resistance • Power	

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• Define the rules of troubleshooting • Describe the basic problem solving approaches • Explain the operating theory of static devices • Explain the operating theory of active devices • Apply basic troubleshooting techniques to circuit problems • Explain the purpose of a multimeter • Describe the process of using a multimeter to check circuit operation • Analyze circuits down to the component level • Explain the purpose of a clamp on ammeter • Describe the process of using a clamp on ammeter to check circuit operation • Explain the purpose of an oscilloscope • Describe the process of using an oscilloscope to check circuit operation • Perform voltage measurements • Perform current measurements • Perform resistance measurements • Summarize the process of troubleshooting semiconductor components • Summarize the process of troubleshooting half wave power sources • Summarize the process of troubleshooting full wave power sources • Define the symbols used in circuit schematics • Explain the operation of a circuit using circuit schematics • Identify electronic components using circuit schematic symbols • Explain the purpose of a function generator • Describe the process of operating a function generator • Summarize the process of troubleshooting a power supply circuit	20. Draw a schematic diagram of a DC series circuit. 21. Draw a schematic diagram of a DC parallel circuit. 22. Draw a schematic diagram of a DC series-parallel circuit. 23. Construct a DC series circuit. 24. Construct a DC parallel circuit. 25. Construct a DC series-parallel circuit. 26. Measure the voltage, current, and resistance in a series circuit. 27. Measure the voltage, current, and resistance in a DC parallel circuit. 28. Measure the voltage, current, and resistance in a DC series-parallel circuit. 29. Measure the voltage across a voltage divider. **Direct Current, Unit 14, Troubleshooting** **Content Standard** 14. Demonstrate troubleshooting techniques for circuits, including opens, shorts, and grounds. **Learning Objective** 1. Describe and demonstrate the correct method for using the following meters: ammeter, voltmeter, ohmmeter 2. Identify and explain common circuit problems 3. State Kirchhoff's Law 4. Explain and apply Kirchhoff's Law 5. State Thevenin's Law 6. Explain and apply Thevenin's Law 7. Describe open circuits 8. Describe short circuits 9. Describe series parallel circuits	

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	10. Recognize open circuits 11. Recognize short circuits 12. Recognize series parallel circuits 13. Solve problems pertaining to resistance, voltage, current and power in DC circuits 14. Analyze complex DC circuits using Ohm's Law 15. Analyze complex DC circuits using network theorems 16. Analyze voltage dividers using both Ohm's Law and network theorems **Alternating Current, Unit 7, Ohm's Law in AC circuits Content Standard** 7. Solve problems in electrical circuits using Ohm's law, including voltage, current, impedance, and power. **Learning Objective** 1. Draw a schematic diagram of an AC series circuit. 2. Draw a schematic diagram of an AC parallel circuit. 3. Draw a schematic diagram of an AC Series Parallel Circuit. 4. Use common test equipment to analyze an AC series circuit. 5. Use common test equipment to analyze a parallel circuit according to specifications. 6. Use common equipment to analyze a series-parallel circuit according to specifications. 7. Use a function generator to set the required voltage and frequency for a function generator. 8. Use a digital multimeter and an oscilloscope to perform an operational checkout of an AC circuit. 9. Use a digital multimeter to troubleshoot an AC circuit and identify the malfunction.	

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	10. Use an oscilloscope to troubleshoot an AC circuit and identify the malfunction. 11. Construct an AC Parallel Circuit containing resistors, capacitors, inductors, or combinations thereof, and test for continuity. 12. Construct an AC Series-Parallel Circuit containing resistors, capacitors, inductors or combinations thereof, and test for continuity. **Alternating Current, Unit 8-12, Reactive circuits Content Standard** 8. Solve resistive-capacitive circuits. 9. Solve resistive-inductive circuits. 10. Solve resistive-capacitive-inductive circuits. 11. Analyze filter circuits to determine electrical values, including hi-pass, low-pass, band pass, and band stop. 12. Demonstrate troubleshooting techniques for evaluating reactive circuits. **Learning Objective** 1. Explain the function of inductance. 2. Define inductive reactance. 3. Explain the function of inductive reactance. 4. Identify inductive circuits. 5. Define capacitive reactance. 6. Explain the function of capacitive reactance. 7. Identify capacitive circuits. 8. Identify open circuits in AC circuits. 9. Identify short circuits in AC circuits. 10. Define RC time constants. 11. Explain the function of RC time constants. 12. Define LR time constants.	

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	13. Explain the function of LR time constants. 14. Explain the use of complex numbers for Alternating current circuits. 15. State the purpose of transformers. 16. Differentiate between transformers. 17. Explain the characteristics of transformers. 18. Define resonance. 19. Explain the function of resonance. 20. Define filters. 21. Explain the function of filters. 22. Describe the voltage and current phase relationship in a resistive AC circuit. 23. Describe the voltage and current transients that occur in an inductive circuit. 24. Define inductive reactance and state how it is affected by frequency. 25. Describe the voltage and current transients that occur in a capacitive circuit. 26. Define capacitive reactance and state how it is affected by frequency. 27. Explain the relationship between voltage and current in the following types of AC circuits: • RL circuit • RC circuit • LC circuit • RLC circuit 28. Describe the effect that resonant frequency has on impedance and current flow in a series or parallel Resonant circuit. 29. Define bandwidth and describe how it is affected by resistance in a series or parallel resonant circuit. 30. Explain the following terms as they relate to AC circuits: • True power • Apparent power • Reactive power • Power factor 31. Troubleshoot circuits.	

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	Semiconductors, Unit 5-6, Semiconductor circuits Content Standard 5. Construct semiconductor circuits, including diode and transistor. 6. Demonstrate skills related to troubleshooting semiconductor circuits. **Learning Objective** 1. Demonstrate ability to construct half wave, full wave, bridge rectifier circuits, and spike suppression, and polarity protection circuits. 2. Use knowledge gained to construct CE and CC amplifier circuits. 3. Show proper operation of FET circuits. 4. Demonstrate abilities in using signal generators and oscilloscopes in signal tracing. 5. Find, identify, and repair faulty semiconductor circuits. **Semiconductors, Unit 7-9, Analog circuits Content Standard** 7. Construct an analog circuit, including amplifiers and power supply. 8. Practice skills related to troubleshooting analog circuits. 9. Explain developments in emerging technology related to semiconductor materials and usage. **Learning Objective** 1. Demonstrate ability to construct half wave, full wave, bridge rectifier circuits, as well as spike suppression, and polarity protection circuits.	

Postsecondary Course Objectives	Secondary Course(s) and Location(s)	TEDAC Comments
	2. Use knowledge gained to construct CE and CC amplifier circuits. 3. Demonstrate abilities in using signal generators and oscilloscopes in signal tracing. 4. Find, identify, and repair faulty semiconductor circuits. 5. Explain operation of non-through whole technologies. 6. Explore emerging electronic technologies online.	