



**Alabama
Department of
Postsecondary Education**

Representing the Alabama Community College System

STATEWIDE CAREER/TECHNICAL EDUCATION COURSE ARTICULATION REVIEW MINUTES

Articulation Agreement Identifier: ACR 123 (2006-1) Identifier is the postsecondary course prefix followed by Plan-of-Instruction version number (e.g.; INT 100 (2007-1)).

Applicable CIP code(s): 15.0501, 47.0201

Postsecondary course prefix, number, and title: ACR123/ASC123 – HVAC/R Electrical Components

Secondary Education course(s) title and number: 431802/430122 - Basic Compression Refrigeration + 431801/430121 - Introduction to Heating, Ventilation, Air-Conditioning, and Refrigeration + 431805/430125 - HVACR Electrical Components and Controls + 431804/430124 - Introduction to Electricity for HVACR Systems

Initial Review: Oct 13, 2009

Annual DPE Review: January 30, 2012

Effective dates: 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 Objectives	TEDAC Comments
<p>MODULE A – HVAC/R ELECTRIC COMPONENTS</p> <p>Competency A1.0 Value the importance of following safety precautions. Performance Objective – None Learning Objective: A1.1.1 State the importance of following safety precautions. Competency: A2.0 Explain the characteristics and functions of various HVAC/R electric components. Performance Objective – None Learning Objectives: A1.1.2 Explain the use of personal protective equipment. A1.1.3 Explain hazards associated with HVAC/R electrical circuits. A1.1.4 Explain lockout/tag out procedures. A1.1.5 Explain hazards associated with specific types of equipment and tools. A1.1.6 Match HVACR electrical components and their function.</p>	<p>Basic Compression Refrigeration</p> <p>Unit 1 – Safety</p> <p>Content Standard(s)</p> <ol style="list-style-type: none"> 1. Demonstrate safety rules, regulations, and procedures for HVACR. <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Given a variety of lab situations, perform assigned tasks in a safe manner. 2. Handle and dispose of hazardous materials associated with HVAC/R in accordance with EPA guidelines. 3. Explain the purpose and importance of safety policies. 4. Explain the use of Material Safety Data Sheets (MSDS). 5. Describe procedures for disposing of hazardous materials. <p>Unit 2 – Drawing</p> <p>Content Standard(s)</p> <ol style="list-style-type: none"> 2. Draw a basic refrigeration system, including refrigerant flow, components, and lines. <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Interpret refrigeration symbols and components found on blueprints and schematics. 2. Define terms associated with HVAC/R systems. 3. Identify HVAC/R measurement instruments. 4. Explain theory and principles of refrigeration systems. 5. Explain heat flow and direction. 6. Explain BTUs. 7. Calculate total heat in BTU's. 	
<p>MODULE B – INSTALLING AND TESTING ELECTRICAL COMPONENTS</p> <p>Competency: B1.0 Install and test HVACR electric components. Performance Objective:</p>	<p>Unit 3 – Dryers</p> <p>Content Standard(s)</p> <ol style="list-style-type: none"> 3. Demonstrate the procedure for installing filter dryers. <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Remove, install, and test HVAC/R components. 	

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<p>B1.1 Given specifications, HVAC/R components, install the components and test for proper operation.</p> <p>Learning Objectives:</p> <p>B1.1.1 Explain considerations for installing HVAC/R electrical components.</p> <p>B1.1.2 Explain the use of HVAC/R electrical test equipment.</p>	<p>2. Explain the function of various components of HVAC/R systems.</p> <p>Unit 4 – Gauge Sets Content Standard(s)</p> <p>4. Demonstrate the procedure for installing and removing a gauge set.</p> <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Understand Industry accepted procedure standards. 2. Identify low and high side of system. <p>Unit 5 – Refrigerants Content Standard(s)</p> <p>5. Demonstrate pressure temperature conversion procedures.</p> <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Compute temperature-pressure problems. 2. Find P/T relation for different refrigerants. 3. Identify different refrigerants using PT chart. <p>Unit 6 – Temperature and Pressure Content Standard(s)</p> <p>6. Determine pressures and temperatures on domestic and commercial refrigeration systems.</p> <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Demonstrate use of HVAC/R measurement instruments. 2. Consult manufacturer’s material to determine pressures or superheat required. 3. Practice determining pressures and temperatures on refrigeration systems. <p>Unit 7 – Vacuum Pumps Content Standard(s)</p> <p>7. Demonstrate industry-recognized evacuation procedures for a refrigeration system.</p> <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Use vacuum pump and vacuum gauge. <ul style="list-style-type: none"> • Define micron. • Define vacuum and atmospheric pressure. 	

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	<p>Unit 8 – Refrigerant Leaks Content Standard(s) 8. Demonstrate the detection and repair of a refrigerant leak.</p> <p>Learning Objective(s) 1. Demonstrate use of different detection devices. 2. Determine type of refrigerant. 3. Repair leaks.</p> <p>Unit 9 System Charging Content Standard(s) 9. Demonstrate the process of charging a refrigeration system.</p> <p>Learning Objective(s) 1. Charge a system per manufactures recommendations. <ul style="list-style-type: none"> • Calculate required charge per model number plate • Determine superheat and sub-cooling </p> <p>Unit 10 – Component Replacement Content Standard(s) 10. Demonstrate the removal and replacement of a major refrigeration component.</p> <p>Learning Objective(s) 1. Demonstrate use of tools and reference material necessary to replace components. <ul style="list-style-type: none"> • Identify components to be replaced. • Obtain necessary components. • Install components. </p> <p>Unit 11 – Accessories Content Standard(s) 11. Describe the operation of basic components of a refrigeration system.</p> <p>Learning Objective(s) 1. Identify accessories. 2. Describe the operation and function of accessories.</p>	

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	<p>Introduction to Heating, Ventilation, Air-Conditioning, and Refrigeration Unit 8 – Blueprints and Terms Content Standard(s) 8. Interpret blueprints for HVACR, including symbols, components, and specifications. Learning Standard(s) 1. Define terms associated with HVAC/R. 2. Identify HVAC/R measurement instruments. 3. Explain the use of various HVAC/R measurement instruments. 4. Explain theory and principles of refrigeration. 5. Explain heat flow and direction. 6. Explain methods of heat transfer. 7. Differentiate between reference points of temperature. 8. Differentiate between latent and sensible heat. 9. Explain heat and cool storage. 10. Explain BTUs. 11. Interpret refrigeration symbols and components found on blueprints and schematics.</p> <p>12. Interpret HVAC/R symbols and components found on blueprints.</p> <p>Introduction to Electricity for HVACR Systems Unit 3-6 – Test Equipment Content Standard(s) 3. Use various meters to measure electrical values. 4. Demonstrate the use of Ohm’s law and Joule’s law. 5. Demonstrate procedures for testing fuses and capacitors. 6. Demonstrate procedures for building series, parallel, and series-parallel circuits. Learning Objective(s) 1. Obtain safe operation skills regarding the use of</p>	

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	<p>electrical meters and measuring devices.</p> <ol style="list-style-type: none"> 2. Demonstrate the ability to calculate resistance, amperage, voltage using Ohm's Law and derivatives of Ohm's Law such as the Power Circle 3. Demonstrate the ability to measure resistance, amperage, voltage with analog and digital multi-meters. 4. Demonstrate the ability to test electrical components 5. Build and test electrical circuits. <p>Unit 7-9 – Components Content Standard(s)</p> <ol style="list-style-type: none"> 7. Determine the functional condition of motor windings in a single-phase compressor. 8. Demonstrate testing procedures for electrical components, including fan relays, contactor relays, capacitors, and motor windings. 9. Determine procedures for measuring heat anticipator amperes. <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Explain the function of motor windings 2. Discuss motor winding condition 3. Test motor windings 4. Identify relays, contactors, capacitors 5. Discuss the function of relays, contactors, capacitors 6. Test relays, contactors, capacitors 7. Discuss procedures measuring heat anticipator amperes 8. Measure heat anticipator amperes. <p>Unit 10-11 – Installations</p>	

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	<p>Content Standard(s)</p> <ol style="list-style-type: none"> 10. Demonstrate procedures for installing heating and cooling thermostats. 11. Explain conductors, insulators, and related symbols used in HVACR. 12. Demonstrate procedures for making proper electrical connections. 13. Explain various types of wiring diagrams, including pictorial, line, and schematic used in HVACR. <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Explain the function of heating and cooling thermostats. 2. Explain procedures for installing heating and cooling thermostats. 3. Install heating and cooling thermostats. 4. Explain the function of conductors and insulators 5. Identify and define electrical related symbols used in HVACR. 6. Discuss the importance of making proper electrical connections. 7. Demonstrate the ability to make proper electrical connections. 8. Explain various types of wiring diagrams, including pictorial, line, and schematic used in HVACR. <p>HVACR Electrical Components and Controls Unit 2 – Motors Content Standard(s)</p> <ol style="list-style-type: none"> 2. Demonstrate techniques involved with assembly and disassembly of a single-phase motor. <p>Learning Objective(s)</p> <ol style="list-style-type: none"> 1. Identify different types of electric motors. 2. Identify different parts of electric motor. 3. Explain single phase motor types and their construction. 4. Explain three phase motor types and their construction. 	

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	<p>Unit 3 – Motor Windings Content Standard(s) 3. Determine resistance of windings in a split-phase motor to identify start-run windings.</p> <p>Learning Objective(s) 1. Multi-meter use 2. Ohm meter use 3. Taking a variety of different ohm meter readings 4. Terminal identification</p> <p>Unit 4 – Motor Terminals Content Standard(s) 4. Determine common start and run terminals of a single-phase compressor motor.</p> <p>Learning Objective(s) 1. Determine condition of windings. 2. Identify terminals. 3. Motor construction</p> <p>Unit 5 – Preventive Maintenance Content Standard(s) 5. Demonstrate preventive maintenance procedures for a window air conditioner.</p> <p>Learning Objective(s) 1. Explain the importance of routine maintenance. 2. Explain routine maintenance procedures. 3. Wash coils and oil motors. 4. Discuss safety precautions to be employed while conducting maintenance tasks. 5. Identify chemicals used for cleaning coils. 6. Demonstrate preventive maintenance procedures for a window air conditioner.</p>	

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	<p>Unit 6-9 – Troubleshooting and Repair</p> <p>Content Standard(s)</p> <ul style="list-style-type: none"> 6. Demonstrate the procedure for replacing a double-shaft fan motor. 7. Demonstrate troubleshooting techniques to solve electrical problems encountered in HVACR electrical systems. 8. Demonstrate procedures used for replacing electrical components in an HVACR system. 9. Interpret schematic wiring diagrams for HVACR systems and system components. <p>Learning Objective(s)</p> <ul style="list-style-type: none"> 1. Select replacement motor. 2. Discuss motor characteristics. 3. Interpret wiring diagrams. 4. Wire replacement motor. 5. Practice electrical troubleshooting 6. Use schematic drawings to help solve electrical problems 7. Replace electrical components 	