Air Conditioning and Refrigeration Technology Program
Student Learning Outcome Mapping
Course (CLO), Program (PLO), Institutional (ILO)

Program Description: This program is designed to provide students with technical knowledge, skills, and proper work habits/attitudes necessary for employment in the field of air conditioning and refrigeration. The program prepares students to work and advance in their careers in positions such as air conditioning and refrigeration technicians, parts counter salespersons or operators of their own air conditioning and refrigeration service and repair shops.

Program Learning Outcomes	Institutional Learning Outcomes
1. Work as sales technician or manufacturer's representative. 2. Be employed as air conditioning and refrigeration service technician in both government and private business. 3. Manage and operate own air conditioning and refrigeration service shops.	1. **Critical Thinking and Problem Solving**: Analyze and solve problems by using informed judgment based on evidence, sound reasoning, and/or creativity to differentiate facts from opinions and to specify solutions and their consequences. 2. **Communication**: Effectively communicate, both orally and in writing, thoughts in a clear, well-organized manner to persuade, inform and/or convey ideas in academic, work, family and community settings. 3. **Quantitative and Technological Competence**: Use mathematical skills appropriate to our technological society by analyzing and solving problems that are quantitative in nature and use technology for informational, academic, personal and professional needs. 4. **Diversity**: Understand and appreciate differences in cultures and behaviors between the self and others by demonstrating respect, honesty, fairness, and ethical principles in both personal and professional life. 5. **Civic Responsibility**: Apply the principles of civility and morality to situations in the contexts of a healthy family, work, community, environment and world. 6. **Aesthetics**: Apply numerous means of inquiry to experience and appreciate the values of arts and nature.

PLO-ILO Mapping

PLOs	ILOs					
	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
PLO 1	X	X	X	X		
PLO 2	X	X	X			
PLO 3	X	X	X			

CLO-PLO-ILO Mapping

AC 111 - Fundamentals of Refrigeration

This introductory course provides instruction in basic physical, chemical, and engineering principles applicable to refrigeration. This also covers the physical laws, which apply to refrigeration.

CLO	PLO				ILO					
Students will be able to:	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Explain the principles of heat transfer and how cold preserves food.	X	X	X		X	X	X	X		
2. Compare Fahrenheit, Celsius, Kelvin, and Rankine temperatures and use temperature conversion formula to convert from one temperature scale to another.	X	X	X		X					
3. Name and explain the physical law of thermodynamics applied to refrigeration.	X	X	X		X					
4. Identify and describe the functions of the component parts of refrigerating system.	X	X	X		X	X	X	X		
5. List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose.	X	X	X		X	X	X	X		

AC 112 - Refrigeration Tools and Equipment

This course provides instruction in air conditioning and refrigeration shop safety and regulations, uses and care of the tools and equipment of the trade.

CLO	PLO				ILO					
Students will be able to:	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques.	X	X	X		X	X	X			
2. Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners.	X	X	X		X	X	X			
3. Identify thread types and screw fasteners and demonstrate the procedures for threading pipes.	X	X	X		X	X	X			
4. Maintain, calibrate and use vacuum and compound gauges.	X	X	X		X	X	X			
5. Replace the oil, purge air and evacuate and recharge the refrigerating system.	X	X	X		X	X	X			

AC 121 - Compressor Systems and Refrigerant Control

This course provides instruction on the different thermal laws and functions of the different components of refrigeration.

CLO	PLO				ILO					
Students will be able to:	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. State five thermal laws relating to refrigeration and explain the compression cycle for domestic refrigerator.	X	X	X		X	X				
2. Identify and explain the operation or each component of compression system and trace the flow of refrigerant through a complete refrigeration system.	X	X	X		X	X				
3. Name the four different types of motor compressor, explain how it operates, identify the internal parts and replace motor compressor.	X	X	X		X	X				
4. Explain the operation of the different types of refrigerant control, remove and replace each type.	X	X	X		X	X				
5. Remove and replace solenoid valves of a compression system.	X	X	X		X	X				

AC 122 - Electric Motors, Electrical Circuits and Controls

This course covers electrical symbols and electrical circuits used in air conditioning and refrigeration.

CLO Students will be able to:	PLO				ILO					
	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Use volt ohm meter (VOM) to test for short, ground, identify terminals, test run the motor and measure the current using Clamp meter.		X	X		X	X	X			
2. Demonstrate the ability to inspect, service or repair repulsion type motor.	X	X	X		X	X				
3. Demonstrate the ability to inspect, replace capacitor run, capacitor start and capacitor run/start motor.	X	X	X		X	X				
4. Draw, read and interpret common schematic types of electrical diagrams.	X	X	X		X	X				
5. Use air conditioning and refrigeration program to simulate electric motor problems commonly encountered in the field, apply the test procedures and test the actual unit.	X	X	X		X	X	X			

AC 211 - Refrigerants, Domestic Refrigerators and Freezers

This course provides instruction in refrigerant protection, service and repair of refrigerators and freezers, using the latest computer refrigeration simulator.

CLO	PLO				ILO					
Students will be able to:	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Correctly classify and identify different types of refrigerant using numbers and color code and demonstrate proper handling of refrigerant cylinders.		X	X		X	X				
2. Install refrigerator by leveling the legs, checking door seals and gaskets and taking the temperature, pressure and current according to manufacturer's specifications by operating the unit under normal conditions.		X	X		X	X				
3. Use refrigerator simulator to simulate, identify, service and repair refrigerator with mechanical faults commonly encountered in the field.		X	X		X	X				
4. Use commercial refrigeration simulator to simulate, identify, service and repair freezer with mechanical faults commonly encountered in the field.		X	X		X	X				
5. Recognize trouble signals, determine the common causes, repair and test electrical control problems of domestic units using the correct power tools and materials.		X	X		X	X				

AC 212 - Conditioning Systems Cooling and Dehumidifying

This course provides the students practical knowledge and skills necessary to service and repair air-conditioning systems using the latest computer air conditioner simulator.

CLO	PLO				ILO					
Students will be able to:	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Demonstrate the ability to determine electrical requirements and prepare cavity and properly install window type air conditioning unit following the manufacturer's specification.		X	X		X	X				
2. Demonstrate the ability to properly select the appropriate location, make a hole, follow wiring and piping connection instruction, mount the cooling unit, install the condensing unit and test run the split type air conditioning system. According to manufacturer's specifications.		X	X		X	X				
3. Perform preventive maintenance procedures to maintain the normal performance and increase the lifespan of air conditioning unit.		X	X		X	X				
4. Use air conditioner simulator to identify, simulate and repair common customer complaints encountered by technicians in the field.		X	X		X	X				
5. Prepare proper tools, identify faults and problems, rectify troubles, make necessary repair and test the air conditioning unit for proper and safe operation.		X	X		X	X				

AC 213 - Psychrometry and Cooling Load

This course covers the chemistry of air, air and human comfort, psychrometric properties of air, the psychrometric chart, problems for the conditioned air supply, conduction, solar transmission, occupancy and equipment heat gains and losses, coil load, and total air supply.

CLO	PLO				ILO					
Students will be able to:	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Explain the principles of air conditioning, air movement and humidity.	X	X	X		X	X				
2. List and explain important factors involved in the operation of and air conditioning system.	X	X	X		X	X				
3. Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments.	X	X	X		X	X	X			
4. Calculate heat load and identify its sources for both heating and cooling space.	X	X	X		X	X	X			
5. Explain and calculate seasonal energy efficiency Ratio and determine heat load through the use of U or R Valves, square footage and design temperature chart.		X	X		X		X			

AC 221 - Refrigerant Recovery and Recycling

This course enables the learner to understand the effects of CFC's (Chloroflourocarbon) in the Ozone layer and to apply the EPA rules and regulations in the handling of refrigerants.

CLO Students will be able to:	PLO				ILO					
	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Demonstrate the ability to list the environmental protection agency rules and regulations and the effect of CFC's on the ozone layer in the atmosphere.	X	X	X		X	X				
2. Demonstrate the ability to lists the functions of different types of recovery equipment and perform appropriate methods of recovery.	X	X	X		X	X				
3. Perform recycling of refrigerants, safety measures are in accordance with the industry requirements in line with the Montreal Protocol.	X	X	X		X	X				
4. Demonstrate the ability to recover and recycle refrigerant in compliance with the industry standards and safety regulations.	X	X	X		X	X				
5. Demonstrate the ability to maintain recovery instruments and equipment in accordance to the manufacturer's recommendations.		X	X		X	X				

AC 223 - Internship

This course provides the student practical training in the field of air conditioning and refrigeration. With the assistance of an instructor-coordinator, the student is assigned to work under a supervisor in a governmental department or a private firm in order to learn through an actual work experience.

CLO Students will be able to:	PLO				ILO					
	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Demonstrate proper employee behaviors and work habits.	X	X	X		X	X	X	X	X	X
2. Perform air conditioning and refrigeration tasks as assigned by site supervisor.	X	X	X		X	X	X	X	X	X

WE 110 - Gas Welding and Cutting

This course provides an introduction to the safe operation of gas welding equipment and instruction in the fundamentals of fusion welding of ferrous metals in various positions.

CLO	PLO				ILO					
Students will be able to:	PLO 1	PLO 2	PLO 3		ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6
1. Students will be able to set up gas welding equipment and accessories.		X	X		X	X	X			
2. Students will be able to weld sheet metal butt joints in flat, horizontal and vertical positions.		X	X		X	X	X			X
3. Students will be able to perform brazing and torch soldering.		X	X		X	X	X			X
4. Students will be able to cut a steel plate manually using the cutting torch.		X	X		X	X	X			X
5. Students will be able to interpret welding symbols on a blueprint.		X	X		X	X	X			