



Western Technical College

10601145 HVACR System Design

Course Outcome Summary

Course Information

Description	Design and document air conditioning systems for commercial buildings. Design and document a refrigeration system for product storage. Computer programs will be used in component selection and system design. HVACR is a common reference to Heating, Ventilation, Air Conditioning and Refrigeration.
Career Cluster	Architecture and Construction
Instructional Level	Associate Degree Courses
Total Credits	3
Total Hours	90

Pre/Corequisites

Prerequisite	10601108 HVACR Res Heating and Cooling Loads
Pre/Corequisite	10601137 HVACR Hydronic and Steam Systems
Pre/Corequisite	10601112 HVACR Basic CAD

Textbooks

Refrigeration and Air Conditioning Technology. 9th Edition. Copyright 2021. Whitman, Bill, Bill Johnson, John Timczyk, and Eugene Silberstein. Publisher: Cengage Learning. **ISBN-13:978-0-357-12227-3**. Required.

Success Abilities

1. Refine Professionalism: Improve Critical Thinking

Program Outcomes

1. Evaluate HVACR system designs
2. Analyze HVACR systems
3. Design HVACR systems

Course Competencies

1. Calculate the heating and cooling loads.

Learning Objectives

- 1.a. Select indoor and outdoor design conditions
- 1.b. Determine areas where heat loss/gain will occur
- 1.c. Determine heat transfer coefficients
- 1.d. Calculate heat loss/gain
- 1.e. Calculate room loads
- 1.f. Calculate building load

2. Determine ventilation requirements.

Learning Objectives

- 2.a. Determine code requirements for building occupancy
- 2.b. Calculate code ventilation quantities

3. Select the type of systems.

Learning Objectives

- 3.a. Identify the typical components of a commercial heating ventilating and air conditioning system
- 3.b. Select the type of system to be used
- 3.c. Select the individual components that make up a system

4. Determine cooling coil performance specifications.

Learning Objectives

- 4.a. Determine supply air conditions
- 4.b. Determine the coil process line
- 4.c. Calculate coil sensible, latent and total loads
- 4.d. Determine contact factor and effective surface temperature

5. Evaluate HVAC systems using psychrometric analysis.

Learning Objectives

- 5.a. Measure system psychrometric conditions
- 5.b. Evaluate system operational characteristics based measured data

6. Plan the air distribution system.

Learning Objectives

- 6.a. Evaluate the building plans to determine the best location for the equipment
- 6.b. Evaluate the building plans to determine the best location for the ductwork
- 6.c. Sketch the equipment and ductwork layout

7. Design a duct distribution system using the equal friction method.

Criteria

You will know you are successful when

- 7.1. learner correctly determine air flow requirements
- 7.2. learner sketch duct layout
- 7.3. learner calculates section-by-section air flow
- 7.4. learner filled the equal friction worksheet

Learning Objectives

- 7.a. Determine air flow requirements
- 7.b. Sketch duct layout
- 7.c. Label duct sections

- 7.d. Calculate section-by-section air flow
- 7.e. Select appropriate air velocity

8. Determine sizes of air distribution devices and ductwork.

Learning Objectives

- 8.a. Determine total and room air quantities
- 8.b. Select grilles and registers
- 8.c. Lay out duct system
- 8.d. Determine system pressure loss
- 8.e. Determine duct sizes
- 8.f. Select air handler and accessories

9. Select air outlets.

Criteria

You will know you are successful when

- 9.1. learner locates outlets in zone to provide adequate coverage
- 9.2. learner selects appropriate air outlet from lookup tables

Learning Objectives

- 9.a. Use room air distribution terms
- 9.b. Identify appropriate sound levels
- 9.c. Calculate required air volume
- 9.d. Locate outlets in zone
- 9.e. Select air outlet from lookup tables

10. Select a centrifugal fan.

Criteria

You will know you are successful when

- 10.1. learner accurately determines fan static pressure requirement
- 10.2. learner applies proper fan selection criterion
- 10.3. learner determines fan operating point on fan curve

Learning Objectives

- 10.a. Describe fan selection criterion
- 10.b. Use industry accepted terms
- 10.c. Differentiate between fan types
- 10.d. Determine fan static pressure requirement
- 10.e. Interpret fan curves
- 10.f. Explain the fan-system interaction
- 10.g. Match system characteristics with type of fan curve
- 10.h. Evaluate fan outlet connections
- 10.i. Use the fan laws

11. Plan the hydronic system.

Learning Objectives

- 11.a. Evaluate the building plans to determine the best location for the equipment
- 11.b. Evaluate the building plans to determine the best location for the piping
- 11.c. Sketch the equipment and piping layout

12. Determine the type and sizes of piping system.

Learning Objectives

- 12.a. Determine total and room flow rates
- 12.b. Select the terminal units
- 12.c. Lay out the piping system
- 12.d. Determine pipe sizes
- 12.e. Determine system pressure loss
- 12.f. Select pump and accessories

13. Prepare final plans and specifications.

Learning Objectives

- 13.a. Provide and locate accessories required for proper operation and maintenance
- 13.b. Select the control system
- 13.c. Prepare final plans
- 13.d. Prepare final specifications

14. Calculate the refrigeration loads.

Learning Objectives

- 14.a. Select indoor and outdoor design conditions
- 14.b. Calculate heat loss/gain
- 14.c. Calculate product load
- 14.d. Calculate infiltration load
- 14.e. Calculate supplemental load
- 14.f. Determine system requirements

15. Select the type of system.

Learning Objectives

- 15.a. Identify the typical components of a commercial refrigeration system
- 15.b. Select the type of system to be used
- 15.c. Select the individual components that make up a system

16. Plan the equipment and piping locations.

Learning Objectives

- 16.a. Evaluate the building plans to determine the best location for the equipment
- 16.b. Evaluate the building plans to determine the best location for the piping
- 16.c. Sketch the equipment and piping layout

17. Determine sizes of refrigeration devices and piping.

Learning Objectives

- 17.a. Lay out the piping system
- 17.b. Select the refrigeration accessories
- 17.c. Determine pipe sizes

18. Prepare final plans and specifications.

Learning Objectives

- 18.a. Provide and locate accessories required for proper operation and maintenance
- 18.b. Prepare final plans
- 18.c. Prepare final specifications