

# APSM 119: SMQ-19 HVAC AIR SYSTEMS & DUCT DESIGN

## Foothill College Course Outline of Record

| Heading                            | Value  |
|------------------------------------|--|
| <b>Effective Term:</b>             | Summer 2021  |
| <b>Units:</b>                      | 3  |
| <b>Hours:</b>                      | 36 lecture, 4 laboratory per quarter (40 total per quarter)  |
| <b>Prerequisite:</b>               | Per California Code of Regulations, this course is limited to students admitted to the Sheet Metal Apprenticeship Program. |
| <b>Degree &amp; Credit Status:</b> | Degree-Applicable Credit Course  |
| <b>Foothill GE:</b>                | Non-GE   |
| <b>Transferable:</b>               | None   |
| <b>Grade Type:</b>                 | Letter Grade (Request for Pass/No Pass)  |
| <b>Repeatability:</b>              | Not Repeatable   |

## Student Learning Outcomes

- A successful student will be able to identify common components of a typical HVAC duct system.
- A successful student will be able to size ducts using a duct calculator to produce optimal efficiency.

## Description

Course addresses the basics and critical details of heating, ventilating, and air conditioning (HVAC), and system design, operation, installation, and fabrication standards. Students will learn how HVAC systems can be designed with human comfort and efficient operation in mind. Students will learn basic components, and how to identify loss factors of typical HVAC systems. Load calculations and air flow calculations are performed and duct leak testing is introduced, stressing the importance of energy efficiency with today's environmental concerns.

## Course Objectives

The student will be able to:

- Understand the performance concerns of an HVAC system
- Identify the components of a typical HVAC system
- Identify various types of conditioned air delivery systems
- Identify the best aspect ratio for good duct design
- Understand concepts and requirements of load calculations pertaining to system design
- Calculate air changes per hour for a room
- Calculate CFM and velocity with given data
- Identify airflow loss factors (friction loss, turbulence, etc.)
- Size ducts using a duct calculator with given data
- Leak test a section of duct and make resulting calculations
- Identify requirements, measurements, and filtration for indoor air quality
- Identify the purpose of TAB and commissioning

## Course Content

- Understand the performance concerns of an HVAC system

- Air systems
- Hydronic systems
- Air/hydronic systems
- Identify the components of a typical HVAC system
  - Conditioning air: heating/cooling/humidity/filtration
  - Delivering air: efficient duct systems, fans, air resistance, leakage
- Identify various types of conditioned air delivery systems
  - VAV systems
  - Single and dual path duct systems
  - Fan types (centrifugal, vaneaxial, tubaxial)
- Identify the best aspect ratio for good duct design
  - Best aspect ratio in theory
  - Best aspect ratio given certain job conditions
- Understand concepts of load calculations pertaining to system design
  - Heat transfer coefficients in common building materials
  - Common designs to address typical loads
- Calculate air changes per hour for a room
  - Volume, CFH, and unit conversions
- Calculate CFM and velocity with given data
  - Basic  $A \times V = CFM$  formula
- Identify airflow loss factors (friction loss, turbulence, etc.)
  - Static pressure, velocity pressure, total pressure
  - Duct accessories to reduce loss
- Size ducts using a duct calculator with given data
- Leak test a section of duct and make resulting calculations
  - Test equipment setup and use
  - Leakage calculations
- Identify requirements, measurements, and filtration for indoor air quality
- Identify the purpose of TAB and commissioning

## Lab Content

Students will work individually and in teams. Lab content includes:

- Student observation of various duct system components and configurations
- Demonstration and student practice in duct leak testing
- Students calculate air flow and loss considerations in HVAC system design
- Comparison and analysis of different types of HVAC systems
- Students practice identifying good and poor HVAC system designs

## Special Facilities and/or Equipment

- Laboratory with sheet metal tools
- Personal protective equipment

## Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

- Results of written quizzes and tests
- Shop participation
- Comprehensive written final examination
- Comprehensive final project
- Evaluation of progress by weekly assignments

## Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

- Discussion

Laboratory instruction  
Demonstration

## **Representative Text(s) and Other Materials**

International Training Institute. HVAC, International Training Institute for the Sheet Metal and Air Conditioning Industry (student manual). 2005.

This is the standard Sheet Metal textbook/workbook used for this course. Although it may not be within 5 years of the required published date, it is the most current book used when teaching this course.

## **Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments**

A. Reading assignment, from textbook:

1. Read section describing loss factors in air duct systems and how they can be calculated

B. Writing assignment:

1. Complete written review from student manual listing airflow loss factors

## **Discipline(s)**

Sheet Metal