COURSE OUTLINE
CET 122 Building Systems & CET: HVAC
2 Credit Hours

Course Description
This course introduces students to the design and operational strategies of HVAC systems in both normal buildings and critical environments via lectures and group activities. Topics include basic airflow principles, ventilation equipment, exhaust requirements, regulatory resources, and automation/ control strategies.

Prerequisite(s)
None

Purpose of Course
The purpose of this course is to prepare students to work on equipment in buildings, including critical environments, that have sophisticated and automated HVAC systems.

Required Materials
- ATP Staff. 2008. *Building Automation: Control Devices & Application*. ATP. ISBN**:** 978-0-8269-2000-3

Optional Resources
- ATP Staff. 2017. *HVAC Control Systems*, 4th ed. ATP. ISBN: 978-0-8269-0779-0
- Green, Gosse. 2017. *Industrial Maintenance & Troubleshooting*, 4th. ATP. ISBN: 978-0-8269-3686-8
- Wilson, Memarzadeh. 2008. *BSL3 Laboratory Certification Requirements*. National Institute of Health.

Learning Outcomes
The intention is for the student to be able to:
1. Demonstrate knowledge of how typical commercial HVAC systems operate.
    a. Correctly identify the main components and sequence of operation of an all-air commercial HVAC system.
    b. Correctly identify the main components and sequence of operation of a commercial HVAC system that distributes heated or chilled water through a building to condition air locally.
    c. Label air distribution elements, including ductwork, dampers, terminal units, and other components, using proper terms and equations.
    d. Describe the relationship between fan or blower speeds and pressure in HVAC design.
    e. Discuss placement of sensors that are important to monitoring and control.
2. Demonstrate an understanding of the basic principles of ventilation.
    a. Identify the different points in a building where natural and mechanical ventilation occur.
    b. Describe how fresh air is integrated into an air distribution system.
    c. Properly perform smoke pattern testing.
    d. Correctly use airflow measurements to calculate room air exchange rates.
    e. Calculate the ventilation airflow required to achieve make up fresh air in a specified space.
    f. List and describe the key components of building exhaust and stack designs.
3. Demonstrate an understanding of the different control schemes used to operate a building HVAC system.
    a. Describe the control sequence for supply air-fan control.
    b. Describe the control sequence for exhaust air fan control.
    c. Describe the control sequence for terminal unit control.

   d. Describe the control sequence for cooling control.
   e. Describe the control sequence for heating control.
   f. Describe the control sequence for humidification control.
4. Demonstrate an understanding of the special HVAC equipment and control strategies used in critical environments.
   a. List examples of clean rooms (clean labs, food/drug manufacturing, data server farms).
   b. List examples of containment spaces (containment labs, hazardous chemical production).
   c. Explain the importance of pressure relationships between rooms in lab design.
   d. Explain the relationship between the purpose of clean rooms the unique HVAC systems they require.
   e. Explain the relationship between the purpose of containment spaces and the unique HVAC systems they require.
   f. Illustrate directional airflow and relative room pressures on drawings of containment spaces and clean rooms.
   g. Illustrate directional airflow and relative space pressures on drawings of a vent hood.
   h. Discuss and explain automation strategies used to monitor, control and verify proper airflow in critical environments.
   i. Describe types of fail-safe devices and control loops that are used in critical environments.
   j. Describe types of alarms that can be automated in critical environment control systems.
   k. Compare the control tolerances between public buildings and CET environments.
   l. Predict the results of control variability exceeding CET tolerances.
5. Demonstrate an understanding of how to find important regulatory information.
   a. Look up and extract information from regulations published by agencies (e.g., OSHA, ANSI, ASHRAE, and NPFA) that are commonly important to building HVAC design.
   b. Look up and extract information from regulations published by agencies (e.g., OSHA, ANSI, ASHRAE, and NPFA) that are important to critical environment HVAC design.

Learning Units

I. HVAC Sequence of Operations
II. Ventilation
III. HVAC Control
IV. HVAC Features of Critical Environments
V. Regulations

Method of Delivery/Instruction

X Face-to-face X Blended ☐ Online

Method of Grading and Evaluation

The student will be graded on learning activities and assessment tasks. Grade determinants may include the following: daily work, quizzes, chapter or unit tests, comprehensive examinations, student projects, student presentations, class participation, and other methods of evaluation employed at the discretion of the instructor.