

**COURSE OUTLINE**  
**CET 223 Applied Building System Controls**  
**5 Credit Hours**

**Course Description**

This course builds on topics introduced in CET electrical, controls and programming courses. It examines sequences of operations and related programming for major equipment and devices used in building systems. Students will interact with a commercial air handling unit and air distribution system via application and building automation controllers, learning to adjust setpoints and troubleshoot problems.

**Prerequisite(s)**

CET 101 OSHA 30 – Safety Orientation OSHA 30  
CET 111 Electrical Fundamentals I or HVA 1104 Electrical Fundamentals  
CET 122 Building Systems and CET: HVAC or HVA 1044 HVAC Fundamentals  
CET 221 Basic Controls  
CET 222 Building Automation System Controls and Programming

**Purpose of Course**

The purpose of this course is to prepare students to work with controllers and control systems in buildings, including critical environments, and to troubleshoot problems that might involve programming code.

**Required Materials**

ATP Staff. *HVAC Control Systems*. 4<sup>th</sup> ed. Orland Park, IL: American Technical Publishers. ISBN 978-0-8269-0779-0.

**Learning Outcomes**

The intention is for the student to be able to:

1. Demonstrate an understanding of thermodynamic terms and psychrometric charts.
  - a. Define the following: dewpoint, enthalpy, dry-bulb, wet-bulb, relative humidity, partial pressure, ideal gas law, saturation temperature, sensible heat, latent heat, specific volume.
  - b. Determine an unknown psychrometric chart value given two other known values.
  - c. Trace the path of a refrigeration loop on a psychrometric chart.
2. Demonstrate an understanding of common commercial building heating systems.
  - a. Describe differences among different types of boilers.
  - b. Discuss properties of safety valves, valves, vents, and fittings required for steam applications.
  - c. Discuss properties of steam and hot-water boiler accessories, such as pumps, heaters, regulators, steam traps, compression tanks, pressure-reducing valves, and control valves.
  - d. Discuss use of combustion fuels and combustion control in operating heating systems.
  - e. Discuss equipment and operational differences among heat pump systems, fuel-based systems, and solar heating systems.
3. Demonstrate an understanding of common commercial building cooling systems.
  - a. Discuss the purpose and functionality of economizer systems.
  - b. Describe key equipment and functionality of a refrigeration loop in a cooling system.

- c. Describe key equipment and functionality of a chilled water system.
  - d. Describe key equipment and functionality of a cooling tower.
  - e. Identify different types of compressors.
  - f. Identify different types of water distribution systems.
- 4. Demonstrate an understanding of air handling units.
  - a. Describe major components of an air handling unit.
  - b. Describe how air handling units regulate ventilation, temperature, and humidity control.
- 5. Write and edit programs to operate an air handling unit in both heating and cooling modes via electrical control.
  - a. Write code segments for each of the following: an economizer, humidity level control, temperature control, pressure control.
  - b. Write code to operate a PID control loop.
  - c. Upload program to a controller.
  - d. Wire controller to equipment.
  - e. Run program to operate equipment.
- 6. Demonstrate an understanding of different types of control systems.
  - a. Describe differences between pneumatic, electrical, electronic, and automated control systems.
  - b. Identify components of a pneumatic control system, including air compressor stations, pneumatic actuators, dampers, valves, and transmitters.
- 7. Demonstrate an understanding of Building Automation System wiring and control strategies.
  - a. Properly wire equipment to a BAS controller.
  - b. Wire a VAV Terminal box controller to a BAS controller.
  - c. Describe different supervisory control strategies and how multiple control strategies can be prioritized and integrated.
- 8. Demonstrate an understanding of critical environment considerations in building control.
  - a. Discuss the importance of maintaining proper air pressure differences.
  - b. Discuss the importance of backup electrical and lighting systems and what types of control strategies could be used to operate backup systems.

### Learning Units

- I. HVAC Fundamentals and Psychrometrics
- II. Commercial Building Heating Systems
- III. Commercial Building Cooling Systems
- IV. Indoor Air Quality and Commercial AHUs
- V. Air Handling Unit Programming and Operation
- VI. Types of Control Systems
- VII. Building Automation Systems
- VIII. Building System Control and Critical Environments

### Method of Delivery/Instruction

☒ Face-to-Face

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Blended

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Online

Learning activities will be assigned within and outside the classroom or online to assist the student to achieve the intended learning outcomes through lecture, Instructor-led class discussion, hands-on experiences, and others at the discretion of the instructor.

**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 or forum posts, and other methods of evaluation employed at the discretion of the instructor.