

CNST-2210: MECHANICAL AND ELECTRICAL SYSTEMS

Cuyahoga Community College

Viewing: CNST-2210 : Mechanical and Electrical Systems

Board of Trustees:

January 2023

Academic Term:

Fall 2023

Subject Code

CNST - Construction Engineering Tech

Course Number:

2210

Title:

Mechanical and Electrical Systems

Catalog Description:

Study of mechanical and electrical systems for building construction, water supply, waste and sanitation. Heat loss, heat gain and hydronic heating systems; forced air and solar heating systems used in buildings; electrical systems of power distribution and lighting for commercial buildings among the topics covered.

Credit Hour(s):

3

Lecture Hour(s):

3

Requisites

Prerequisite and Corequisite

CNST-2131 Construction Methods and Materials or concurrent enrollment; and eligibility for MATH-0955 Beginning Algebra; or departmental approval.

Outcomes

Course Outcome(s):

Recognize and identify heating and cooling systems in commercial and/or residential buildings in order to determine the method(s) used for heating and cooling in the building.

Objective(s):

1. Identify the electrical systems that are specified for a building design.
2. Explain the principles of electrical service delivery from a transformer substation to an actual building.
3. Identify mechanical systems specified for a building design including plumbing, heating, and cooling.

Course Outcome(s):

Participate in planning and design of electrical distribution, lighting, and electrical energy management from reading a set of working "as-built" plans.

Objective(s):

1. Explain the principles of electrical service delivery from a transformer substation to an actual building.
2. Analyze and select proper methods applicable for installation of electrical and mechanical systems for buildings.
3. Explain current fire protection systems and national codes for buildings.

Course Outcome(s):

Participate in the planning, design, and economical selection of mechanical equipment for buildings from reading a set of working "as-built" plans.

Objective(s):

1. Explain the principles of environmental control required for water treatment and sewer systems.
 2. Explain the principles of heating and cooling operations required for environmental control in buildings.
 3. Identify mechanical systems specified for a building design including plumbing, heating, and cooling.
 4. Analyze and select proper methods applicable for installation of electrical and mechanical systems for buildings.
 5. Explain current fire protection systems and national codes for buildings.
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Methods of Evaluation:

- a. Quizzes
- b. Written Assignments
- c. Exams
- d. Instructor observation/evaluation of student lab exercise performance
- e. Participation
- f. Projects
- g. Oral presentations

Course Content Outline:

- a. Water Systems
 - i. Public and private water systems and pumping methods
 - ii. Line types used in structural drawing
 - iii. Water treatment operation
 - iv. System maintenance
 1. thermal expansion
 2. shock expansion
 - v. Up-feed distribution & pumping and applications
 - vi. Down-feed pumping and applications
 - vii. Hot water supply
 1. capacity calculations
 2. circulation system
 3. storage tank size
 - viii. Water supply
 1. water pressure & pipe size
 2. water consumption
- b. Sanitary systems
 - i. Principles
 - ii. Governing codes
 - iii. Sanitary drainage
 1. building drains
 2. soil & waste vent stacks
 3. plumbing codes
 4. system design
 - iv. Special Equipment
 1. sumps and ejectors
 2. backflow preventers
 3. backwater valves
- c. Plumbing Systems
 - i. Pipe & fittings
 - ii. Pipe flow & venting
 - iii. Plumbing fixtures
 1. water closets
 2. lavatories
 3. tubs and showers
 4. laundry sinks
- d. Storm Sewer Systems
 - i. Waste problems
 - ii. Water pollution control

- iii. Water retention
- iv. Water drainage and run-off
- e. Sanitary Sewage Disposal Systems
 - i. Municipal sewage treatment
 - ii. Private sewage treatment
 - iii. Sewer piping and materials
 - 1. pipe size
 - 2. manhole location
- f. Fire Protection Systems
 - i. National codes
 - ii. Building materials
 - iii. Building design
 - iv. Signal and alarm planning
 - v. Lighting protection
 - vi. Standpipes
- g. Heating and Cooling Systems
 - i. Heat loss
 - ii. Heat flow and transfer
 - iii. Effects of air motion
 - iv. Heat gain
 - v. Methods of heating
 - 1. boilers, furnace, radiant, electrical
 - 2. system controls
 - 3. geothermal
 - vi. Air Conditioning
 - 1. compression cooling
 - 2. absorption cooling
 - 3. air distribution
 - 4. unit capacity
 - 5. equipment selection
- h. Electricity Principles
 - i. Amps, volts, watts, ohms
 - ii. DC series & parallel circuits
 - iii. AC-DC circuits
 - iv. Electricity generation
- i. Electrical Systems
 - i. Conductors and raceways
 - ii. Equipment ratings
 - 1. voltage, wattage, current
 - 2. ampacity
 - 3. gauge
 - 4. insulation
 - 5. cable
 - 6. busway
 - 7. bus
 - 8. connections
 - iii. Service and utilization
 - 1. underground
 - 2. overhead
 - 3. metering
 - 4. transformers & poles
 - 5. service switch
 - 6. wiring devices
 - iv. Protective devices
 - 1. fuses, circuit breakers
 - 2. lighting protection
 - v. Emergency power generation
- j. Wiring Design

- i. Load estimating
- ii. 2-3-4 wire service
- iii. Single and three-phase service
- iv. Panel design
- v. Circuit design
- vi. Safety switches
- k. Electronic Security
 - i. Fire detection systems
 - ii. Security devices
 - 1. smoke
 - 2. fume
 - 3. gas detection
 - iii. Control systems & monitors
- l. Energy Management Systems
 - i. Timers, photoelectric cells
 - ii. Computer control
- m. Lighting Systems
 - i. Luminance
 - ii. Contrast
 - iii. Exposure, glare, diffusion
 - iv. Color
 - v. Sources
 - 1. incandescent lamps
 - 2. fluorescent lamps
 - 3. neon lamps
 - 4. tungsten lamps
 - 5. HID lamps
 - 6. mercury lamps
 - vi. Design
 - 1. General & local lighting
 - 2. Indirect
 - 3. Fixture mounting height

Resources

Ching, Francis and Adams, Cassandra. (2020) *Building Construction Illustrated*, New York: John Wiley and Sons.

Grondzik, Kwok, Stein & Reynolds. (2019) *Mechanical and Electrical Equipment for Buildings*, New York: John Wiley and Sons.

Stein, Benjamin. (1997) *Building Technology: Mechanical & Electrical Systems*, New York: John Wiley and Sons.

ATP Staff. (2013) *Mechanical and Electrical Systems for Construction Managers*, ATP.

Janis, Richard and William Tao. (2018) *mechanical and Electrical Systems in Buildings*, Pearson.
