

CE 41400 Building Mechanical and Electrical System Design

Sem. 1 or Sem. 2, Lecture 3, Cr. 3.

Restriction: Junior status in the College of Engineering; Pre-requisite: CE 31100 Architectural Engineering or permission from the instructor.

Description: This course covers the design of building mechanical and electrical systems. In the first part of the course students learn principles of designing and integrating heating, ventilation, and air conditioning systems into buildings including air delivery systems, mechanical cooling and heating technologies, duct design and layout, blower and pump selection, and hydronic systems. They also learn to design heating, ventilation, and air conditioning systems within the constraint of achieving satisfactory occupant thermal comfort in buildings. The second part of the course covers design concepts related to building electrical systems; including, single and three-phase power systems, motors, transformers, switching, and relays. The course includes a design project related to mechanical and electrical systems for a commercial building.

Level: Undergraduate Level

Course Instructor: Travis Horton

Course Outline:

- **Introduction and Concept Review.** Define the design scope for building mechanical and electrical systems; Review of fundamental engineering principles, including thermodynamic properties and processes, and fluid dynamics. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 55. Introduce computer programming and basic numerical methods. [2 weeks]
- **Air Distribution System Design.** Introduction to air delivery system configurations. Constant and variable volume air delivery systems. Duct sizing methods, including equal friction, static regain, equal velocity, and optimization-based techniques. Air system components, including air handling units, grilles, and diffusers. [4 weeks]
- **Building Ventilation Design.** Indoor air quality. Requirements for building ventilation systems and building ventilation standards. ASHRAE Standard 62. Energy recovery devices used in ventilation systems. [1 week]
- **Energy Estimating Techniques for Mechanical Systems.** HVAC energy estimating. Engineering Equation Solver (EES) thermodynamic modeling. ASHRAE Standard 90. [1 week]
- **Heating and Air Conditioning Systems.** Analysis of components and systems, including air conditioners, heat pumps, heat exchangers, boilers, furnaces, and combined heat and power systems. [4 weeks]
- **Building Electrical Systems.** Electrical system fundamentals, including single and three-phase power, voltage drop in conductors, and over-current protection systems. Building electrical system components; motors, transformers, switching, and relays. [3 weeks]