CM430T
Mechanical Systems
[Onsite]

Course Description:

This course explores electrical, plumbing and HVAC systems in commercial construction.

Prerequisite(s) and/or Corequisite(s):

Prerequisites: CD230T Architectural Drafting II, CM340T Building Codes

Credit hours: 4

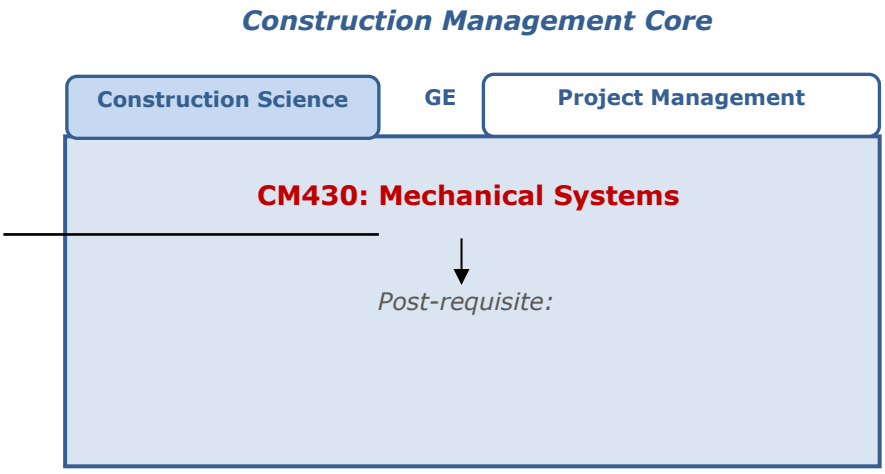
Contact hours: 60 (36 Theory Hours, 24 Lab Hours)

Where Does This Course Belong?

This course is required for the Construction Management program. This program covers the following core areas:

- Construction Science
- GE
- Project Management

The following diagram demonstrates how this course fits in the program:



Course Summary

Course Description

This course explores electrical, plumbing and HVAC systems in commercial construction.

Major Instructional Areas

1. Green design and sustainability
2. Heating, ventilation, and air conditioning (HVAC) systems and concepts in a commercial building
3. Indoor air quality (IAQ) in a commercial building
4. Commercial building electrical design and construction
5. Plumbing systems in a commercial building
6. Proper installation of mechanical systems

Course Objectives

This course has the following instructional objectives:

1. Review the concepts of green engineering, sustainability, efficiency, and ecological footprint as they pertain to the mechanical systems in a typical commercial building.
2. Explain the typical configuration and operation of heating, ventilation, and air conditioning (HVAC) systems used in a commercial building application.
3. Analyze the major control systems used for HVAC systems in a commercial building.
4. Evaluate the indoor air quality (IAQ) of a building structure to make recommendations for maintaining the IAQ of the structure.
5. Examine the electrical distribution tree within a commercial building.
6. Evaluate the three-phase portion of a motor control circuit for proper sizing of all its components.
7. Explain the typical motor control circuitry used in a commercial building.

8. Explain the basic properties of flow and pressure within mechanical systems.
9. Assess the major mechanical piping systems within the building envelope.
10. Examine a mechanical system for proper installation.

Learning Outcomes

Upon completion of this course, the students are expected to:

1. Demonstrate an overall understanding of the Leadership in Energy and Environmental Design (LEED) certification system.
2. Evaluate the efficiency of the energy deliverance methods in a building structure.
3. Describe the major HVAC system types, explaining how each system type performs its function.
4. Compare single-duct, dual-duct, multizone, and reheat systems on the basis of their operation and efficiency.
5. Describe the control methods used in large HVAC systems.
6. Describe the design process to determine and estimate HVAC requirements for a commercial building.
7. Discuss the four major considerations for IAQ.
8. Describe the major contributors to poor IAQ and their impact.
9. Given the electrical requirements of a commercial structure, select the electrical service required for the commercial structure.

10. Describe typical transformer arrangements and voltage distribution in a commercial building.
11. For a given electrical application, discuss contactors, motor starters, fuses, and the size and rating of circuit breakers.
12. Perform voltage drop calculations to determine the proper conductor size of an electrical system.
13. Examine wiring for simple logic functions.
14. Discuss electrical safety issues concerning building commissioning and maintenance.
15. Discuss the methods of transferring energy to a fluid system.
16. Describe the purpose and the typical layout, flow, and pressure for a plumbing system in a commercial building.
17. Given the load and total plumbing fixtures, calculate the average water usage for a commercial building.
18. Given mechanical piping systems requirements, determine a correctly sized centrifugal pump for the system.
19. Discuss the importance of preinstallation checks for mechanical systems.
20. Assess mechanical system operational checks and troubleshooting.

Learning Materials and References

Required Resources

Textbook Package	New to this Course	Carried over from Previous Course(s)	Required for Subsequent Course(s)
Grondzik, W.T., Kwok, A.G., Stein, B., & Reynolds, J.S. (2010). *Mechanical and electrical equipment for buildings* (11th ed.). Hoboken, NJ: John Wiley & Sons, Inc.	■		■

Recommended Resources

Books, Professional Journals

- Merritt, F.S., & Jonathan T. R. (2000). *Building design and construction handbook* (6th ed.). NY: McGraw-Hill Companies, Inc.

  This book is a reference guide for design and construction.

- Benator, B. & Thumann, A. (2003). *Project management and leadership skills for engineering and construction projects*. Lilburn, GA: Fairmont Press, Inc.

  This reference guide provides extensive information on construction projects from an engineering perspective.

Professional Associations

- Project Management Institute (PMI)

  This Web site provides you information about project management standards.

  http://www.pmi.org/ (accessed May 13, 2011)

- The Associated General Contractors of America (AGC)

  AGC is the leading association for the construction industry. This Web site provides the opportunity to interact with a community of privacy professionals and learn from their experiences.

  http://www.agc.org/ (accessed May 13, 2011)

Information Search

Use the following keywords to search for additional online resources that may be used for supporting your work on the course assignments:

- Centrifugal pump
- Circuit breakers
- Conductor
- Green engineering
- HVAC systems
- IAQ
- LEED
- Motor control circuit
- Plumbing fixtures
- Transformer

NOTE: All links are subject to change without prior notice.

Course Plan

Suggested Learning Approach

In this course, you will be studying individually and within a group of your peers. As you work on the course deliverables, you are encouraged to share ideas with your peers and instructor, work collaboratively on projects and team assignments, raise critical questions, and provide constructive feedback.

Use the following advice to receive maximum learning benefits from your participation in this course:

DO	DON'T
▪ Do take a proactive learning approach ▪ Do share your thoughts on critical issues and potential problem solutions ▪ Do plan your course work in advance ▪ Do explore a variety of learning resources in addition to the textbook ▪ Do offer relevant examples from your experience ▪ Do make an effort to understand different points of view ▪ Do connect concepts explored in this course to real-life professional situations and your own experiences	▪ Don't assume there is only one correct answer to a question ▪ Don't be afraid to share your perspective on the issues analyzed in the course ▪ Don't be negative about the points of view that are different from yours ▪ Don't underestimate the impact of collaboration on your learning ▪ Don't limit your course experience to reading the textbook ▪ Don't postpone your work on the course deliverables – work on small assignment

DO	DON'T
	components every day

Course Outline

Unit #	Unit Title	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
1	Green Design and Sustainability	Lab	Case Studies in Design	3.5
		Assignment	LEED System of Certification	3.5
Unit 1 Reading Assignment: Grondzik et al., Pages 3-26 and 27-48				
2	Configuration and Operation of HVAC Systems	Lab	HVAC Zoning	3.5
		Assignment	Rooftop (Curb) HVAC Units	3.5
Unit 2 Reading Assignment: Grondzik et al., Pages 325-333 and 338-350				
3	Control Systems for HVAC Systems	Lab	Failure Analysis of Control Systems	3.5
		Assignment	Zone Troubleshooting	3.5
Unit 3 Reading Assignment: Grondzik et al., Pages 377-398, 401-416, 425-428, and 436-442				
4	IAQ	Lab	Process Calculations	3.5
		Assignment	IAQ Remediation	3.5
Unit 4 Reading Assignment: Grondzik et al., Pages 115-137 and 145-150				
5	Electrical Distribution Tree in a Commercial Building	Lab	Electrical Service Calculations	3.5
		Assignment	Electrical Service Factors	3.5
Unit 5 Reading Assignment: Grondzik et al., Pages 1163-1172, 1177-1180, 1185-1198, and 1207-1210				
6	Three-Phase Portion of a Motor Control	Lab	Conductor and Raceway Sizing	3.5

Unit #	Unit Title	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
	Circuit	Assignment	Electrical Control Troubleshooting	3.5
Unit 6 Reading Assignment: Grondzik et al., Pages 1199-1207, 1215-1219, and 1242-1244				
7	Motor Control Circuitry	Lab	Voltage Drop Troubleshooting	3.5
		Assignment	Emergency Power Case Studies	3.5
Unit 7 Reading Assignment: Grondzik et al., Pages 1245-1256, 1258-1270, 1286-1294, and 1325-1328				
8	Basic Properties of Flow and Pressure Within Mechanical Systems	Lab	Fluid Properties	3.5
		Assignment	Potable Water Supplies	3.5
Unit 8 Reading Assignment: Grondzik et al., Pages 865-871, 876-879, and 909-922				
9	Mechanical Piping Systems	Lab	Building Water Calculations	3.5
		Assignment	Basic Pump Concepts	3.5
Unit 9 Reading Assignment: Grondzik et al., Pages 923-946, 974-994, 1005-1015, 1018-1026, and 1029-1034				
10	Proper Installation of Mechanical Systems	Lab	Mechanical Failures	3.5
		Assignment	Mechanical System Maintenance	3.5
Unit 10 Reading Assignment: Class presentation notes				
11	Course Review and Final Examination	Exam	Final Exam	30

Evaluation and Grading

Evaluation Criteria

The graded assignments will be evaluated using the following weighted categories:

Category	Weight
Assignment	35
Lab	35
Exam	30
TOTAL	**100%**

Grade Conversion

The final grades will be calculated from the percentages earned in the course, as follows:

Grade	Percentage	Credit
A	90–100%	4.0
B+	85–89%	3.5
B	80–84%	3.0
C+	75–79%	2.5
C	70–74%	2.0
D+	65–69%	1.5
D	60–64%	1.0
F	<60%	0.0

Academic Integrity

All students must comply with the policies that regulate all forms of academic dishonesty, or academic misconduct, including plagiarism, self-plagiarism, fabrication, deception, cheating, and sabotage. For more information on the academic honesty policies, refer to the Student Handbook and the Course Catalog.

(End of Syllabus)

