

Mechanical Engineering and Mechanics

MEM 413 HVAC Loads

Fall 2006

Designation: Elective

Catalog Description: State-of the art design methods of calculating building peak heating and cooling loads; Human comfort and indoor air quality, standards for ventilation air, air infiltration into buildings, solar loads on buildings, Degree-day methods of calculating annual energy use.

Prerequisites: Thermodynamics II- MEM310 and Heat Transfer MEM 345

Textbook(s) and other required material:

1. Required: Heating and Cooling of Buildings, Kreider, J.F., Curtiss, P.S. and Rabl, A., 2002 2nd Edition, McGraw-Hill, New York, NY.
2. Additional handouts as required

Course Objectives:

1. Apply principles of heat transfer and thermodynamics to heat flows in buildings
2. Analyze human comfort, and determine necessary indoor conditions to achieve it
3. Describe effect of indoor air pollutants and ways to control them
4. Determine solar irradiation on surfaces
5. Calculate air infiltration rates into building structures
6. Calculate the various components which constitute peak heat loads in buildings
7. Calculate the various components which constitute peak cooling loads of buildings
8. Calculate annual energy use of buildings using degree-day and bin methods

Topics:

1. Introduction to HVAC&R profession
2. Review of heat transfer applied to buildings
3. Solar radiation: basics and intensity on surfaces
4. Windows and daylighting
5. Infiltration in buildings
6. Heating load calculations
7. Cooling load calculations- CLTD/CLF method and the Transfer function method
8. Thermal comfort and indoor air quality
9. Energy estimation methods

Class Schedule: 3 hours/week lecture (3 credits)

Contribution to Professional Component:

Contributes toward the 1 ½ year of engineering topics appropriate to developing the ability to work in the thermal systems area. Prepares students for professional practice in HVAC&R system design.

Relationship to Program Outcomes:

Outcomes a - k	Content	Explanation	Evidence
a. An ability to apply knowledge of mathematics, science and engineering	2	This course requires the students to apply their knowledge of thermodynamics and heat transfer as well as synthesize their knowledge of mathematics, science, and engineering.	Homework, Exams, Design Project
b. An ability to design and conduct experiments as well as to analyze and interpret data	2	The software assignment involving designing the HVAC&R systems of a building using a detailed state-of-the-art building energy simulation program	Written group report counts for 10% of total grades; some groups were also asked to make presentations in class
c. An ability to design a system, component or process to meet desired needs	2	Software project as described above	As explained above
d. An ability to function on multidisciplinary teams	2	Software project as described above involving 2-3 members	As explained above
e. An ability to identify, formulate and solve engineering problems	2	The problems and project require students to identify, formulate and solve engineering problems.	Homework, exams, design project
f. An understanding of professional and ethical responsibility	1	Need to design buildings and HVAC a energy efficiently as possible	Lecture; Final report for the design project
g. An ability to communicate effectively	2	Written presentation of the final design problem is required.	Final report for the design project
h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	1	The impact of engineering design on building energy use and environment (pollution, greenhouse effect, etc.) was highlighted.	Presentation on energy problem and how energy conservation can help; Final report for the design project
i. A recognition of the need for and an ability to engage in lifelong learning	1	Stressed the fact that professional practice keeps changing with time and need to keep abreast; specific instances highlighted during course	Lectures, assignments
j. A knowledge of contemporary issues	1	Energy issue and how good building and HVAC design can help alleviate the problem	Lecture
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	1	Computer packages are used to explore the solution domain for homework and the design project	Final report for the design project

Prepared by:

Dr. T. Agami Reddy, 16 November 2006