MEC 506 Energy Management in Commercial Buildings

Instructor: Dr. Juldeh Sesay
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Office Hours: Wednesdays 04-06 pm

Course Description

Credit 3: Topics include basic heating, ventilating, and air-conditioning (HVAC) system design and selection for commercial buildings (includes both low-rise and high-rise buildings); selection of central plant components and equipment; calculation of space heating and cooling load; computer techniques for estimating annual energy consumption; design tools for reducing energy consumption; ASHRAE codes; building controls;

Course Prerequisites: Mass and Heat Transfer
Fluid Mechanics
Thermodynamics

Textbook

Heating, Ventilating, and Air Conditioning; Analysis and Design by Mcquiston, Parker and Spitler Sixth Edition, Wiley

References

1. Principles of Heating, Ventilation, and Air Conditioning in Buildings, John W. Mitchell and James E. Braun, Wiley
2. Thermodynamics: An Engineering Approach by Yunus A. Cengel, 6rd Ed., McGraw-Hill
3. Fundamentals of Engineering Thermodynamics by Michael J. Moran and Howard N. Shapiro, 5th Edition, John Wiley
4. "Design of Fluid Thermal System", Fourth Ed., William S. Janna, PWS Publishing Company, 1998

Class schedule

Lectures: Mondays at 05:30 pm – 08:30 pm.

Grading and Class Policies

Final grade is determined based on your performance in the following areas:
Homework: 20%
Midterm 1: 40% (March 07, 2022)
Midterm 2: 40% (May 02, 2022)

Course Topics

Week 1: Lecture 1: Course Introduction
Common HVAC Units and Dimensions, Fundamental Physical Concepts

Week 2: Lecture 2: Air Properties Psychrometry
Moist Air and the standard Atmosphere, Fundamental Parameters, Adiabatic Saturation

Week 3: Lecture 3: Continuation Psychrometry
Wet Bulb Temperature and the Psychrometry Chart, Classic Moist Air Processes

Week 4: Lecture 4: Comfort and Health
Indoor Environmental Quality, Comfort-Physiological Considerations, Environmental Comfort Indices, Comfort conditions, Common Contaminants Method of control Humidity, Methods of control Contaminants

Week 5: Lecture 5: Refrigeration cycles and Heat pumps
The performance of refrigeration Systems, Theoretical Single-Stage Compression Cycle, Vapor Compression Heat Pump System, Refrigerants, Refrigeration Equipment Components, The Real Single Stage Cycle

Week 6: Lecture 6: Heat Exchangers
Types of Heat Exchangers, The Log Mean Temperature difference Method, The Number of Transfer Units Method, Heat Transfer- Single- Component Fluids, Transfort Coefficients inside Tubes, Transport Coefficients Outside Tubes and Compact Surfaces

Week 7: Midterm 1 (March 04, 2024)
Topics: Psychrometry, Refrigeration and Heat Pump Systems, Heat Exchangers, Flow Pumps and Piping Designs

Week 8: Lecture 8: Flow Pumps and Piping Design
Fluid Flow Basics, centrifugal Pumps, Combined System and Pump Characteristics, Piping System Fundamentals

Week 9: Lecture 9: Spacing Heating Load
Outdoor Design Condition, Indoor Design Conditions, Transmission Heat Losses, Infiltration, Heat Losses from Air Ducts, .

Week 10: Lecture 10: Heat Transmission
Basic Heat-Transfer Modes, Tabulated Overall Heat-Transfer Coefficients, Moisture Transmission

Week 11: Lecture 11: Solar Radiation
The Earth's Atmosphere, Sun's Electromagnetic Spectrum, Thermal Radiation, The Earth's Motion about the Sun, Solar Calculations,

Week 12: Lecture 12: Energy Calculations and Building Simulation

Week 13: Lecture 13: Special Topic

Week 14: Midterm 2 (April 29, 2024)

Course Policies:

1. Lecture notes will be posted on the Brightspace prior to class**.**
2. Brightspace will be used for posting lectures, making course announcements, grading, and communicating with the class.
3. All lectures shall be held in class every Monday from 05:30 PM to 08:30 PM
4. All midterms are purely online and shall be uploaded under the exams/quizzes folder

Special Needs/Disabilities

If you have a physical, psychological, medical or learning disability that may impact on your ability to carry out assigned course work, I would urge that you contact the staff in the Disabled Student Services office (DSS), ECC (Educational Communications Center) Building, Room 128, (631)632- 6748. DSS will review your concerns and determine with you what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

Statement on Academic Dishonesty

"Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, design, computer programs, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted to the fullest via the CEAS CASA committee. For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn."

Calculator Policy

"Effective Spring, 2008 only the following calculators will be permitted to be used on all midterm and final exams in the department of Mechanical Engineering. There will be no exceptions! This list of calculators is identical to that allowed for the National Council for Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) Exam that many of you will take in your senior year, as well as the professional Engineering (PE) exam that you may take several years now. The sooner you become comfortable on one of these calculators, the better.

NCEES Allowed calculators as of spring, 2008:

► Casio: All **fx-115** models. Any Casio calculator must contain fx-115 in its model name

► Hewlett Packard: The **HP 33s** and **HP 35s** models, but no others.

► Texas Instruments: All **TI-30X** and **TI-36X** models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

The NCEES policy on calculators can be found here:
http://www.ncees.org/exams/calculators/."

Students are expected to attend every class, report for examinations and submit major graded coursework as scheduled. If a student is unable to attend lecture(s), report for any exams or complete major graded coursework as scheduled due to extenuating circumstances, the student must contact the instructor as soon as possible. Students may be requested to provide documentation to support their absence and/or may be referred to the Student Support Team for assistance. Students will be provided reasonable accommodations for missed exams, assignments or projects due to significant illness, tragedy or other personal emergencies. In the instance of missed lectures or labs, the student is responsible for review posted powerpoint slides under the Documents folder and the recorded lecture videos under the Lecture Videos folder Please note, all students must follow Stony Brook, local, state and Centers for Disease Control and Prevention (CDC) guidelines to reduce the risk of transmission of COVID. For questions or more information click here.