**Welcome to MEEG 58703**

**Indoor Environmental Design (aka HVAC Design and Analysis)**

University of Arkansas MSE – Distance Education

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**Course Description**: This course is a broad use of thermal-fluid concepts toward understanding and applying fundamental theories of heating, ventilating, and air conditioning (HVAC) design. Upon completion of the course, students will be able to apply current engineering techniques and methodologies to design HVAC systems, including heating and cooling loads, and proper selection and sizing of air conditioning equipment. Moreover, through this class, students will gain a physical understanding of HVAC systems and buildings, which is needed for today's HVAC designs. This course may be of interest to engineers in industry, consulting, facilities, and others.

**Text:** Howell, R., *Principles of Heating, Ventilating, and Air Conditioning*, ASHRAE, 8th edition

**Required Prerequisite:** MEEG 44103 or consent of instructor.

**Office Hours:** email preferred or phone/virtual video call by appointment.

**Academic Honesty:**

As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail. I, as your instructor, am committed to the principle of academic honesty and I expect each student in my class to maintain a high stand of academic integrity. To that end, you are required to be familiar with and abide by the University’s ‘Academic Integrity Policy’ which may be found at [http://honesty.uark.edu/policy.](http://honesty.uark.edu/policy) Students with questions about how these policies apply to a particular course or assignment should immediately contact Dr. Nutter.

**Grades: (final grading scale based on 90/80/70/60…)** GRADE PERCENTAGE

|  |  |
| --- | --- |
| Homework, Quizzes, and In-class problems | 20% |
| Design project and/or report | 10% |
| Two hourly exams | 50% |
| Final exam (comprehensive) | 20% |

**Homework, Quizzes, and In-class problems: ‘**Homework’ assignments will consist of traditional out- of-class assignments via BlackBoard and BlackBoard quizzes. Collaboration on out-of-class homework, except on Blackboard quizzes, is encouraged, but is should be declared. Assignments will be posted on the Blackboard ([http://learn.uark.edu](http://learn.uark.edu/)) website. Disorganized or messy homework will be penalized. Due dates/times will be posted with each assignment. Also, in an effort to accommodate for unexpected events, the lowest single homework score will be dropped, no matter the reason.

**Exams:** Exams will follow MSE policies and procedures.

**Course objectives – by the end of this or course, students will be able to:**

1. define and recognize key concepts associated with HVAC systems [Reading – text Chapter 1 and instructor supplemental]
   1. Definition of HVAC
   2. Significance of HVAC industry
   3. Engineer’s roles in HVAC system design, analysis, and consulting
   4. History of HVAC history
   5. Factors associated HVAC systems
2. understand modern design techniques and methods [Reading – text Chapter 1 and instructor supplemental]
   1. Traditional engineering design process of HVAC systems
   2. Green building design and rating systems (LEED and Green Globes)
   3. ASHRAE, the international HVAC professional society
3. analyze air-conditioning and heat pump system configurations [Reading – text Chapter 2]
   1. Ideal refrigeration cycle
   2. Pressure-enthalpy diagram
   3. Standard HVAC&R system performance factors
4. identify and apply the key engineering units and calculations of psychrometrics [Reading – text Chapter 2 and Chapter 3]
   1. Thermodynamic basics and properties
   2. Psychrometric chart
   3. Individual classic moist air processes
   4. Whole system-level
5. apply standards for internal, external, and energy design conditions [Reading – text Chapter 4]
   1. ASHRAE/ANSI standard 62.1 – Ventilation for acceptable indoor air quality
   2. ASHRAE/ANSI standard 55 – Thermal environmental conditions for human occupancy
   3. ASHRAE/ANSI standard 90.1 – Energy standard for buildings except low-rise residential buildings
6. evaluate load estimating fundamentals for various designs [Reading – text Chapter 4 and 5]
   1. infiltration
   2. Overall heat transfer coefficients
   3. Temperature in adjacent unheated spaces
   4. Inner surface temperatures subject to condensation
7. determine heating system load estimates [Reading – text Chapter 7]
   1. Manual heating load procedure
   2. Zoning and coincidental peak
   3. Special allowance consideration, including start-up
   4. Supply air volumetric air flow rates
8. determine cooling system load estimates [Reading – text Chapter 7]
   1. Heat balance method for cooling
   2. Solar heat gain through fenestrations
   3. Internal heat gain from people, equipment, and lights
   4. Zoning and coincidental peak
   5. Supply air volumetric air flow rates
9. determine duct sizing [Reading – text Chapter 9]
   1. Pressure changes during flow in ducts
   2. Friction and dynamic losses
   3. Equivalent duct sizing
   4. Design velocities
   5. Critical path
   6. Duct design method(s)
10. apply basic building modeling [Reading – instructor supplemental]
    1. Energy simulation
    2. Building information modeling (BIM)
11. create and evaluate an HVAC system design [Reading – n/a]
    1. Application of topics above
    2. Custom project per student

**Definition of air-conditioning:**

The process of treating air to control simultaneously its temperature, humidity, cleanliness, and distribution as required by occupants, a process, or a product in a space.

*By Willis Carrier*