

MENG443- Heating, Ventilation and Air Conditioning

Department:
Mechanical Engineering

Program Name:
Mechanical Engineering

Program Code: 23

Course Code:
MENG443

Credits:
4 Credits

Year/Semester:
Spring 2019-2020

- Engineering or Area Core
 Engineering Course offered by other programs
 Engineering or Area Elective
 Mathematics and Basic Sciences
 General Education

Prerequisite(s): MENG345

Prerequisite by topic: The students are expected to have a good background in thermodynamics, heat transfer, and fluid mechanics.

Catalog Description:

Psychrometrics and elementary psychrometric processes. Simultaneous heat and mass transfer in external flows. Direct contact transfer devices. Heating and cooling coils-compact heat exchangers. Thermal comfort. Hot water heating systems. Heating and Cooling load calculations. Vapor compression refrigeration cycles.

Course Web Page:

<https://staff.emu.edu.tr/muratozdenefe/en/teaching/meng443>

Textbook(s):

Course lecture notes will be followed.

Reference Books and Sources

- Heating, Ventilating, and Air Conditioning: Analysis and Design, McQuiston F. C., Parker J.D. and Spitler J. D. Wiley, USA, 2005, 6th Ed.
- Refrigeration & Air Conditioning, Wilbert F. Stoecker, Jerold W. Jones, second edition, McGraw Hill 1982
- ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigerating and Air-Conditioning Engineers, SI Edition, Atlanta 2013
- Environmental design CIBSE Guide A, Chartered Institution of Building Services Engineers, 8th ed, London 2015
- Thermodynamics: An Engineering Approach, Yunus A. Çengel, Mc Graw Hill, 6th Ed.
- Heat Transfer, A Practical Approach, Yunus A. Çengel, Mc Graw Hill, 2nd Ed.
- Fundamentals of Heat and Mass Transfer", F. P. Incropera, D. P. DeWitt.

Topics covered (4 hours of lectures + 1 hour of tutorial per week)

Week 1 and week 2	Thermal comfort: Thermal environment, comfort, PMV and PPD, heat balance model of thermal comfort, design criteria, ventilation requirement
Week 3	External environment: Climatic design, external design conditions, degree days and degree hours, design day data,
Week 4 and week 5	Heating load: Overview, building heat losses, thermal transmittance, Infiltration, design heat loss,
Week 5 and week 6	Heating system design: Design heating load, heating systems: distribution, hydronic systems, air systems, unitary systems
Week 7 and week 8	Hydraulic design: Pipework, pumps, pipe sizing, pump selection
Week 8 and week 9	Midterm examination week

Week 10 and week 11	Cooling load: Overview, cyclic model, cooling load evaluation: cooling load via windows, cooling load via conduction, sol air temperature, decrement factor, admittance, cooling load via conduction, cooling load due to internal gains, cooling load via infiltration
Week 12 and week 13	Ventilation: Ventilation and infiltration, ventilation systems, mechanical systems, duct systems, mechanical ventilation design
Week 14 and week 15	Air conditioning: Design procedure for AC, methods of air cooling, methods of refrigeration, Psychrometric chart and typical AC processes, AC systems

<p>Course Learning Outcomes: The students will be asked to demonstrate their knowledge of the material covered in HVAC through their mastery of the following course objectives. The student will be able to: Understand the scope of modern HVAC</p> <ol style="list-style-type: none"> 1. Define the issues considered in HVAC design 2. Name major systems 3. Understand the basic air conditioning system 4. Choose an air conditioning system 5. List the factors influencing thermal comfort 6. Describe how to maintain indoor quality 7. Calculate heating and cooling loads 8. analyse heat exchangers 9. Discuss some advantages and disadvantages of central plants. 10. Identify the main types of boilers. 11. Understand the main concepts of the Turkish Standards-TS 2164 heating load (heat loss) calculations, and thermal Insulation in Buildings - TS 825. 12. Select heating elements. 13. Understand the operation of cooling towers, spray dehumidifiers 14. Describe how the vapour compression refrigeration cycle works 		
<p>Relationship of course to criteria 3 outcomes a-k (“N/A” {Not Applicable}, “minor” or Major” contributions):</p>		
Criteria 3 Outcomes a-k	Contribution	Discussion: Students must
a. Math, science, engineering	major	Apply principles of math, science and engineering in solving HVAC problems.
b. Design, conduct experiments	minor	Design, build, and conduct an experiment to cool and humidify air by evaporative cooling.
c. Design project	major	HVAC design and simulation of a typical house in Cyprus
d. Multi-disciplinary teams	major	demonstrate ability to function in design teams
e. Engineering problems	major	Solve HVAC problems.
f. Professional, ethics	minor	Identify ethical issues associated with engineering solutions to design related problems.

g. Communicate	minor	Demonstrate effective solution procedures to communicate solutions to engineering problems.
h. Impact of engineering	minor	Identify ways in which knowledge of HVAC aids in the design of a refrigeration system.
i. Life-long learning	major	Demonstrate effective use of the internet to find more information on applications of VAV.
j. Contemporary issues	minor	Write an essay (2 pages) on the applications of HVAC in every day life.
k. Skills, techniques, and modern tools	minor	apply software to the solution of HVAC problems
Assesment Midterm exam: 30 % Laboratory: 0 % Design and conduct a project: 20 % Homework: 0% Quizzes: 10% Final examination: 40%		
Prepared by: Assoc. Prof. Dr. Murat Özdenefe		Date Prepared: 18 th February 2020

Important Notes Regarding the Course:

Quiz Dates:

1st Quiz: During tutorial hour of week 4 → 12th March, Thursday at 10:30

2nd Quiz: During tutorial hour of week 12 → 7th May, Thursday at 10:30

Exam and Quiz Policy:

The midterm and final exams as well as quizzes are open notes (only the course lecture notes are allowed).

NG Policy:

Students,

- who do not attend both mid-term and final exams or
- who do not submit the project or
- who have less than 60 % lecture attendance and fail

will be given NG.

Appeals:

Any appeal against the marks of any assessment component must be made to the course instructor within one week following the announcement of the marks.

Any appeal concerning a semester grade must be made to the course instructor no later than the end of the registration period of the following semester.

Makeups:

There will be no make up for quizzes.

A student who fails to sit for an examination for a valid reason is given a make-up exam. Within three working days after the examination, students who wish to take a make-up must submit a written statement to the course instructor explaining the reason(s) for his/her request.

The student also must fill in the makeup examination form (available at the course website) and submit to the course instructor within three working days after the examination.