MENG345 – Heat Transfer

Eastern Mediterranean University
Faculty of Engineering

Department: Mechanical Engineering

Program Code: 23	**Program:** Mechanical Engineering	**Year/Semester:** 2021-2022 FALL

Course Code:	**Course Title:**	**Credit hours**		
		Lec.	**Tut/Lab**	**Total**
MENG345	Heat Transfer	**4**	**1**	**4**

Categorization of Course:
- ☒ Engineering or Area Core
- ☐ Engineering Course offered by other programs
- ☐ Engineering Area Elective
- ☐ Mathematics and Basic Sciences
- ☐ General Education

Categorization of Credits:
- a. Mathematics & Basic Science: -
- b. **Engineering Topics:** **4**
- c. General Education: -
- d. Major Engineering Design: -

Instructor Name: Assoc. Prof. Dr. Murat Özdenefe

Office No: ME145 **Office Tel:** 1355

Email: murat.ozdenefe@emu.edu.tr

Course Web Page: https://staff.emu.edu.tr/muratozdenefe/en/teaching/meng345

Textbook(s): Yunus A. Çengel, Afshin J. Ghajar "Heat and Mass Transfer, Fundamentals and Applications", 5th Ed. Mc Graw Hill, 2015.

Catalog Description: Introduction to heat transfer. Heat conduction equation. 1D steady state conduction in solids, analysis of fins and multidimensional steady state heat conduction: shape factor method. Transient heat conduction. Numerical methods in conduction. Convection heat transfer; external flow, internal flow and free convection. Boiling and condensation. Heat exchangers. Thermal radiation.

Prerequisite(s)	MENG245 & MATH207
Type of Course	☒ Required ☐ Selected Elective ☐ Elective

Student Outcomes		
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	☒
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	☐
3	An ability to communicate effectively with a range of audiences.	☐
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	☐
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	☐
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	☒
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	☐

Course Learning Outcomes		Student Outcomes							Assessment Percentages
		1	2	3	4	5	6	7	
1	Understand the basic mechanisms of heat transfer.	X					X		Quiz 1 ➔ 5% Quiz 2 ➔ 5% Midterm ➔ 25% Final ➔ 35% Project ➔ 15% Lab. work ➔ 15%
2	Be able to obtain and solve DE of heat conduction.	X							
3	Comprehend steady conduction, solve steady conduction problems by resistance concept and analyze fins.	X					X		
4	Be able to solve transient heat transfer problems for lumped systems & systems with spatial effects.	X							
5	Understand the numerical solution of steady, 1D & 2D and transient, 1D & 2D heat conduction problems.	X							
6	Evaluate convection coefficient, heat transfer and associated temperatures for external flow.	X					X		
7	Calculate convection coefficient, heat transfer and associated temperatures for internal flow.	X							
8	Evaluate convection coefficient and heat transfer for free convection cases.	X							
9	Analyze & size HEXs by LMTD and ε-NTU method.	X							
	Weight of Student Outcomes	**H**					**M**		

Topics Covered and Class Schedule:	
Week 1	Basic concepts of thermodynamics and introduction to heat transfer mechanisms.
Week 2	1D and general heat conduction equation.
Week 3-4	Steady heat conduction, resistance concept, fins and common configurations.
Week 5	Transient heat conduction: Lumped systems and systems with spatial effects.
Week 6	FD formulation of cond. eq. and numerical solution of 1&2 D steady/unsteady problems.
Week 7	Mechanism of convection, classification of flows, velocity and thermal boundary layer.
Week 8-9	**Midterm Examinations**
Week 10	Heat transfer in external flow: Over flat plates, across cylinders, spheres and tube banks.
Week 11-12	Internal forced conv.: Entry region, general thermal analysis, laminar & turbulent flow.
Week 13	Free convection over surfaces: enclosures, finned surfaces, combined free & forced conv.
Week 14	Types of heat exchangers, overall heat transfer coefficient, LMTD & ε-NTU method.
Week 15	Blackbody & rad. properties. View factor, rad. from black, diffuse and gray surfaces.
Week 16-17	**Final Examinations**

Laboratory Work				
No.	**Experiment Title and Equipment Used**	**CLO**	**SO**	**Percentage**
1	**Title**: Steady state conduction through a uniform wall **Equipment:** HT10XC & HT11C computer controlled heat transfer teaching equipment and linear heat conduction accessory	1, 3	6	7.5%
2	**Title:** Combined forced convection and radiation **Equipment:** HT10XC & HT14 computer controlled heat transfer teaching equipment and combined convection and radiation accessory	1, 6	6	7.5%

Important Notes Regarding the Course: University rules and regulations are applied to this course. For details, please see http://mevzuat.emu.edu.tr

Lab. Dates:
1st Lab: Week 4➔ 25-29 October 2021
2nd Lab: Week 12➔ 20-24 December 2021

Quiz Dates:
1st Quiz: During tutorial hour of week 5➔ 5 November, Friday at 09:30 (Cyprus time)
2nd Quiz: During last class hour of week 13➔ 30 December, Thursday at 15:30 (Cyprus time)

Exam Policy:
The midterm and final exams as well as quizzes are open book (only the course textbook is allowed).

NG Policy:
Students,

- who do not attend the midterm and final exam or
- who do not submit the project and Laboratory works

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:
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.