MENG345 – Heat Transfer

Eastern Mediterranean University
Faculty of Engineering

Department: Mechanical Engineering

Program Code: 23	**Program:** Mechanical Engineering	**Year/Semester:** 2019-2020 SPRING

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

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

Hourly Contribution
- ☐ Basic Science (-)
- ☐ College-level Mathematics (-)
- ☐ Complex Engineering Problems (-)
- ☐ Engineering Design (-)
- ☐ Engineering Science (4)
- ☐ Team (-)

Criterion 5 Subject Area:
- ☐ (a) College-level mathematics and basic sciences with experimental experience appropriate to the program.
- ☒ (b) Engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools.
- ☐ (c) a broad education component that complements the technical content of the curriculum and is consistent with the program educational objectives.
- ☐ (d) a culminating major engineering design experience that
  - ☐ 1) Incorporates appropriate engineering standards and multiple constraints
  - ☐ 2) Based on the knowledge and skills acquired in earlier course work.

Instructor Name: Assoc. Prof. Dr. Murat Özdenefe	**Office no:** ME145	**Office Tel:** 1355

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 heat conduction in common configurations. Transient heat conduction. Numerical methods in conduction. Convection heat transfer; external flow, internal flow and free convection. Heat exchangers. Thermal radiation.

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							Quiz 1: 5% Quiz 2: 5% Midterm Exam: 30% Final Exam: 40% Lab Work: 20%
	Be able to obtain and solve DE of heat conduction.	X							
3	Solve steady conduction problems by resistance concept and analyze fins.	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							
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							
10	Comprehend the temperature distribution for steady cond. of heat through a plane wall experimentally.						X		
11	Analyze thermal conductivity for a range of materials (good and poor conductors) experimentally.						X		
12	Analyze the forced convection heat transfer from a surface experimentally.						X		
	Weight of Student Outcomes	**H**					**H**		

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	Internal forced conv.: Entry region, general thermal analysis, laminar & turbulent flow.
Week 12	Free convection over surfaces: enclosures, finned surfaces, combined free & forced conv.
Week 13	Types of heat exchangers, overall heat transfer coefficient, LMTD & ε-NTU method.
Week 14	Blackbody & rad. properties. View factor, rad. from black, diffuse and gray surfaces.
Week 15	**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	10	6	6%
2	**Title:** Analysis of conductivity for a range of materials (Lab. Project) **Equipment:** HT10XC & HT11C computer controlled heat transfer teaching equipment and linear heat conduction accessory	11	6	8%
3	**Title:** Combined forced convection and radiation **Equipment:** HT10XC & HT14 computer controlled heat transfer teaching equipment and combined convection and radiation accessory	12	6	6%

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:
Lab. 1, Steady state conduction through a uniform wall: Week 4➔ 09-13 March 2020
Lab. 2 (Lab. Project), Analysis of thermal conductivity for a range of materials: Week 5 to Week 10➔ 16 March-24 April 2020, Report submission deadline is 24 April 2020
Lab. 3, Forced convection: Week 12➔ 04-08 May 2020

Quiz Dates:
1st Quiz: During tutorial hour of week 5➔ 20 March, Friday at 10:30
2nd Quiz: During tutorial hour of week 13➔ 15 May, Friday at 10:30

Exam and Quiz Policy:
The midterm and final exams are open book (only the course textbook is allowed), whereas quizzes are closed book (students can bring maximum two A4 formula sheets).

NG Policy:
Students,

- who do not attend both mid-term and final exams or
- who do not fulfill the lab requirements (attendance and report submission) or
- who have less than 60 % lecture attendance and fail (D- or F)

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 or labs.
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.