Heat Transfer

Course Code:

ME 324

Course Period:

Spring

Course Type:

Core

Credits:

4

Theoric:

2

Practice:

2

Laboratory Hour:

2

ECTS:

8

Prerequisite Courses:

Fluid Mechanics [1]
Course Language:

English

Courses given by:

Hojin Ahn (Erdem An) [2]
Course Objectives:

The goal of this course is to teach fundamentals of three heat transfer modes, and let students have hands-on experience on heat transfer experiments.

Course Content:

Steady and transient one and multi-dimensional heat conduction in systems. Internal and external forced convection, natural convection and condensation. Heat transfer by radiation. Heat exchangers and design of heat transfer systems. Experimental laboratory practice will be offered in parallel with theory. Some problems will be simulated numerically using the finite difference method and comparisons will be made.

Course Methodology:

1: Lecture, 2: Solving problems, 3: Homework, 4: Project, 5: Lab, 7: Working in group

Course Evaluation Methods:

A: Exam, C: Homework, D: Report. H: Attendance

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Understanding basic concepts and governing equations of three modes of heat transfer	1,2,4	1,2,3,5	A,C
2) Ability to conduct, analyze and discuss experiments in a group and to write a group/individual report	5,6,7	5,7	D,H

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction to heat transfer	Ch. 1
2	Basic equations of heat conduction	Ch. 2, 3
3	Basic equations of heat conduction	Ch. 3
4	Heat transfer to the extended surface	Ch. 3
5	Transient heat conduction	Ch. 5
6	Review of fluid mechanics	Lecture note
7	Fundamentals of convection heat transfer / midterm exam #1	Ch. 6
8	Convection heat transfer to external flows	Ch. 7
9	Convection heat transfer to internal flows	Ch. 8

10	Natural convection heat transfer	Ch. 9
11	Fundamentals of thermal radiation	Ch. 12
12	Fundamentals of thermal radiation / midterm exam #2	Ch. 12
13	Radiation heat transfer	Ch. 13
14	Radiation heat transfer	Ch. 13

RECOMMENDED SOURCES	
Textbook	Fundamentals of Heat and Mass Transfer (7th Edition) by Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt. Wiley. ISBN-10: 0470501979 or ISBN-13: 978-0470501979
Additional Resources	Yunus A. Çengel, Heat and Mass Transfer, Fundamentals and Applications, 4th ed., McGraw Hill, 2011

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	50
Labs	3	35
Assignment	6	15
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE'S CONTRIBUTION TO PROGRAM								
No	Program Learning Outcomes		Contribution					
		NA	1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems.					**X**		

2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**X**			
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	**X**						
4	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.			**X**				
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.					**X**		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			**X**				
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.					**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	**X**						
9	Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice.	**X**						
10	Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development.	**X**						
11	Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions.	**X**						
12	Ability to work professionally in both thermal and mechanical systems areas, including design and realization.	**X**						

13	Ability to verify and validate numerical solutions to engineering problems.	**X**						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Experimental labs	2	2	4
Lab reports	2	8	16
Numerical analysis sessions	3	1	3
Numerical project	1	8	8
Mid-terms	2	20	40
Homework	6	5	30
Final examination	1	10	10
Total Work Load			195
Total Work Load / 25 (h)			7.80
ECTS Credit of the Course			8