Thermal System Design

Course Code:

ME 427

Course Period:

Autumn

Course Type:

Core

Credits:

3

Theoric:

2

Practice:

2

Laboratory Hour:

0

ECTS:

6

Prerequisite Courses:

Fluid Mechanics [1]
Course Language:

English

Courses given by:

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

The goals of this course are to understand engineering design process, to learn characteristics of thermal system components and their effects on overall system performance, and to design and build a thermal system as a team.

Course Content:

Applications of principles of thermodynamics, fluid mechanics and heat transfer to design of components and thermal systems. Study of component characteristics and their effect on overall system performance.

Course Methodology:

1: Lecture, 2: Solving problems, 3: Homework, 4: Project, 5: Lab, 6: Working in group

Course Evaluation Methods:

A: Exam, B: Quiz, C:Homework, D: Report, E: Presentation, F: Oral, G: In-class practice, H: Attendance, J: Progress at project meetings and Project competition

Learning Outcomes	Program Outcomes	Teaching Methods	Assessment Methods
1. To understand engineering design process	3, 12	1	H
1. To learn characteristics of thermal system components and their effects on overall system performance	1, 2, 12	1, 2, 3	A, C
1. To design and build a simple thermal system as a team	3, 6, 7, 9, 12	4, 5, 6	E, J

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Design process	Lecture note
2	Patents	Lecture note
3	Pressure drop in pipe systems + Design meeting as a team	Textbook 1 Ch.8
4	Pressure drop in pipe systems + Design meeting as a team	Textbook 1 Ch.8
5	characteristics of fans and pumps + Design meeting as a team	Textbook 1 Ch.14
6	Systems with pipes and fans/pumps + Design meeting as a team	Textbook 1 Ch.14

7	Systems with pipes and fans/pumps + Design meeting as a team	Textbook 1 Ch.14
8	Introduction to heat exchangers + Design meeting as a team	Textbook 2 Ch.11
9	Midterm exam #1	
10	Overall heat transfer coefficient and fouling factor + Design meeting as a team	Textbook 2 Ch.11
11	LMTD method for heat exchanger analysis + Design meeting as a team	Textbook 2 Ch.11
12	e-NTU method for heat exchanger analysis + Design meeting as a team	Textbook 2 Ch.11
13	Midterm exam #2	
14	Design competition	

RECOMMENDED SOURCES	
Textbook	1. Fluid Mechanics (ISBN-13: 978-007-125764-0) by Yunus Çengel, John Cimbala, 1st ed. in SI units, McGraw-Hill, 2006 2. 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	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	80
Assignment	5	20
Total		**100**
FINAL PROJECT	**NUMBER**	**PERCENTAGE**
Project meetings in a team	9	40
Design presentation	1	10
Design competition	1	50
Total		**100**

CONTRIBUTION OF FINAL PROJECT TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
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	2	28
Design meeting in a team	9	2	18
Hours for off-the-classroom study (Pre-study, practice)	14	1	14
Hours for off-the-classroom design project meeting	9	3	27
Mid-terms	2	10	20
Homework	5	5	25
Final project presentation and its preparation	1	10	10
Final project competition and its preparation	1	8	8
Total Work Load			150
Total Work Load / 25 (h)			6.00

ECTS Credit of the Course			6