Thermodynamics II

Course Code:

ME 212

Course Period:

Spring

Course Type:

Core

Credits:

3

Theoric:

3

Practice:

0

Laboratory Hour:

0

ECTS:

5

Prerequisite Courses:

Thermodynamics I [1]
Course Language:

English

Courses given by:

Ali Bahadır Olcay [2]
Course Objectives:

Purpose of this course is that students gain the knowledge and ability to apply 1st and 2nd laws of thermodynamics to power, refrigeration and air conditioning cycles, and chemical reactions.

Course Content:

Exergy. Vapor power and refrigeration cycles. Air standard power and refrigeration cycles. Thermodynamic relations. Ideal gas mixtures. Gas and vapor mixtures. Chemical reactions. Chemical equilibrium. Thermal system design.

Course Methodology:

1: Lecture, 3: Homework, 4: Project work; 10: Guest lecturer

Course Evaluation Methods:

A: Midterm and final exams, B: Quiz, C: Homework, D: Report

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to model and solve engineering problems via mass, energy, entropy and exergy balance equations	1,2	1,3	A,B,C
2) Ability to identify, formulate, and solve complex engineering problems involving power cycles, refrigeration cycles, air conditioning systems and chemical reactions; ability to select and apply proper analysis and modeling methods for this purpose.	1,2,3	1,3,10	A,B,C
3) Ability to design a power cycle (Diesel, Otto, Ericsson, Stirling etc.) conceptually	1,4	1,4	D

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Review of the mass, energy and entropy equations, explanation of the exergy concept	Textbook
2	Derivation of exergy equation and application to engineering problems	Textbook
3	Introduction to power cycles; standard air assumption; Carnot cycle	Textbook
4	Otto, Diesel, Stirling and Ericsson Cycles	Textbook
5	Simple Brayton cycle; Brayton cycle with reheating, intercooling and regeneration	Textbook

6	Ideal simple Rankine cycle; losses in actual Rankine cycles; ideal reheat Rankine cycle	Textbook
7	Ideal Rankine cycle with regeneration, coregeneration; binary vapor cycles	Textbook
8	Ideal and actual gas compressor refrigeration cycles; heat pump systems; gas refrigeration systems	Textbook
9	Properties of gas mixtures	Textbook
10	Gas-vapor mixtures; thermodynamic properties of dry and atmospheric air	Textbook
11	Psychrometric chart	Textbook
12	Comfort conditions; air heating, cooling, humidifying and dehumidifying applicaitons	Textbook
13	Chemical reactions; fuels and combustion; theoretical and actual combustion processes	Textbook
14	Analyzing combustion with the 1st and 2nd laws of thermodynamics	Textbook

RECOMMENDED SOURCES	
Textbook	Principles of Engineering Thermodynamics, Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner and Margaret B. Bailey, 8th edition, 2015, Wiley.
Additional Resources	Thermodynamics – An Engineering Approach, Yunus Cengel and Michael Boles, 8th edition, 2014, McGraw Hill. Fundamentals of Thermodynamics, Claus Borgnakke, Richard E. Sonntag, 8th edition, 2012, Wiley.

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Midterms	4	60
Homeworks	2	2.5
Quizzes	2	2.5
Report	1	5
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 (Excluding exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterms	4	1.5	6
Homework	2	4	8
Quiz	2	3	6
Project	1	10	10
Final examination	1	10	10
Total Work Load			118
Total Work Load / 25 (h)			4.7
ECTS Credit of the Course			5