COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ADVANCED ENGINEERING THERMODYNAMICS	ChBE 514	1 or 2	3 + 0	3	10

Prerequisites	-

Language of Instruction	English
Course Level	PhD
Course Type	Compulsory
Course Coordinator	-
Instructors	Assist. Prof. Levent Organ
Assistants	-
Goals	The aim of this course in general is to present thermodynamics and its applications in the context of available energy (exergy). Following a detailed classification of thermodynamics, fundamental concepts and derivations of thermodynamics are presented and discussed along the lines of relevant energy and available energy (exergy) applications.
Content	The course comprises the subtitles of classification, basic concepts, definitions and interpretations of thermodynamics; introduction to available energy analysis: goal and definitions; 1. Law of thermodynamics and energy; energy analysis in a control volume; 2.Law of thermodynamics and entropy; entropy generation rate in a control volume; thermodynamic analysis of steady state flow systems; fundamentals of available energy; available energy expression and entropy analysis; available energy analysis in flow systems; available energy (2.Law) efficiency or effectiveness; chemical availability; total (thermomechanical and chemical) available energy and thermoeconomy.

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Acquires the knowledge in mathematics, science and engineering subjects in the context of energy and available energy under thermodynamics at Master's level; ability to use theoretical and applied information	1,2,3	1	A,C

in these areas to solve engineering problems.			
2) Gains the ability to identify, formulate, and solve complicated engineering problems related to energy and available energy at Master's level; ability to select and apply proper analysis methods for this purpose.	1,2,3	1	A,C
3) Gains the ability to communicate effectively in writing and orally in the English language	8	1	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 9: Simulation, 12: Case Study
Assessment Methods:	A: Testing, B: Experiment C: Homework and/or Project

COURSE CONTENT

Week	Topics	Study Materials
1	Thermodynamics: classification, basic concepts, definitions and interpretations	Resources listed, course notes
2	Introduction to available energy analysis: goal and definitions	"
3	1. Law of thermodynamics and energy	"
4	Energy analysis in a control volume	"
5	2.Law of thermodynamics and entropy	"
6	Entropy generation rate in a control volume	"
7	Thermodynamic analysis of steady state flow systems	"
8	Midterm exam	"
9	Fundamentals of available energy; available energy expression and entropy analysis	"
10	Available energy analysis in flow systems; efficiency or effectiveness	"
11	Chemical availability	"
12	Total (thermomechanical and chemical) available energy	"
13	Thermoeconomy	"
14	Project presentation	"

RECOMMENDED SOURCES

Textbook	Moran, M.J., Shapiro, H.N.,"Fundamentals of Engineering Thermodynamics", 4 ed. John Wiley&Sons, Inc., New York, 2000. [MS]
Course Notes	Course notes prepared from various references, mainly Moran, are distributed to the students (unpubl).
Additional Resources	1.Smith,J.M., Van Ness,H.C., Abbott,M.M.,"Introduction to Chemical Engineering Thermodynamics", 7.ed., McGraw-Hill, 2005. [SVN7] 2.Prausnitz,J.M., Lichtenthaler,R.N.,"Molecular Thermodynamics of Fluid-Phase-Equilibria", 3.ed., Prentice Hall, 1999; 1.ed. 1969; 2.ed.1986. [P3] 3.a) Reid,R.C., Prausnitz,J.M., Sherwood,T.K., 3.ed., 1977; b) Reid, R.C., Prausnitz,J.M., Poling,B.E.,4.ed.,1987; c) Poling,B.E., Prausnitz,J.M., O'Connell,J.P., 5.ed.,2001, "The Properties of Gases and Liquids", McGraw-Hill. [PROP] 4.Dinçer, S., "Denge Süreçlerinin Termodinamiği", Boğaziçi Üniversitesi Yayınları, 1984. [D]

MATERIAL SHARING	
Documents	-
Assignments	-
Exams	-

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	41.65
Project	1	41.65
Homework	8	(bonus: add 5% of HW's to the overall grade)
Attendance		16.7
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60 (add 5% bonus points for HW's to the overall grade)
Total		**100 (**add 5% bonus points for HW's to the overall grade)

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Understand and apply fundamental sciences, mathematics and engineering sciences at high level.				X	
2	Have a wide and deep knowledge in his/her field including the latest progresses.				X	
3	Reach the latest knowledge in the field and through its comprehension possess high level competence in required methods and skills for doing research.				X	
4	Ability to do an extensive study which brings novelty to science and technology, develop a new scientific method or technological product/process, or apply a known method to a new field.					
5	Understand a genuine research process independently, design, apply and carry through; manage this process.					
6	Contribute to science and technology literature by publishing the outcomes of his/her academic studies in prestigious media.					
7	Able to do critical analysis, synthesis and evaluation of ideas and progresses in his/her specialization.					
8	Able to communicate and discuss at high level orally, written and visually by using a language at least at the level of European Language Portfolio B2 orally and written.				X	
9	Able to communicate with persons in his/her career and widely with scientific and social ensemble orally and writtten.					
10	Able to evaluate scientific, technological, social and cultural developments and transfer them to society with senses of scientific disinterest and ethical responsibility.					

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	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	8	112
Mid-term	1	3	3
Project	1	40	40
HW	8	6	48
Final examination	1	4	4

Total Work Load			249
Total Work Load / 25 (h)			10
ECTS Credit of the Course			10