Mech 204 Thermodynamics **Spring 2013**

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Responsible Department: Mechanical Engineering
Course Coordinator: Metin Muradoğlu

Lectures: Tuesday and Thursday 14:00-15:15 in SOS-B10
Office Hour: Tuesday 16:00-17:00 or by appointment
Teaching Assistant: Daulet Izbassarov & Hadi Nozari (Office:Eng Z20, e-mail: dizbassarov@ku.edu.tr& hnozari@ku.edu.tr)
PS: TBA
Web-page: http://home.ku.edu.tr/~mmuradoglu
Course web-page: http://home.ku.edu.tr/~mmuradoglu/ME204/index.htm
Text Book: Thermodynamics: An Engineering Approach, 7th Edition in SI units, by Y.A. Cengel and M.A. Boles, McGraw-Hill (2011)
Prerequisites by Topic: Concept of solid, liquid and gas phases; Concept of molecular mass, Avogadro's number, balancing chemical equations; Forces, direction, balancing of forces and momentum.; Functions and their graphs. Differential and integral calculus.
Objectives: The course is designed to teach students the basic principles of the classical thermodynamics with emphasis on engineering applications.
Learning Outcomes:
Upon successful completion of this course, a student will:

- understand the first and second laws of thermodynamics including the concepts of energy and entropy;
- analyse and develop mathematical models for closed and open systems using the basic conservation laws;
- recognise the importance of quality of energy and conditions for equilibrium based on the second law;
- apply the first and second laws to thermal systems including power generation and refrigeration cycles;
- understand the concepts related to perfect (Carnot), ideal (e.g., Rankine, Brayton, Diesel and refrigeration) and actual cycles;
- describe the main components of energy conversion systems;
- understand and evaluate the limitations of various components of energy conversion systems;
- analyse the power generation and refrigeration systems;
- describe and explain problems relating to intercooling, reheating and regeneration with focus on efficient use of energy;
- describe the main components and perform a thermodynamics analysis of internal combustion engines;
- recognise the environmental and socio-economic implications associated with the desired output (i.e., power generation or heat removal) versus the required input or cost (i.e., fuel);

Koc University Credit: 3
ECTS Credit: 6 (**See the template on the next page for caluculation**)
Study Times (Minimum): An estimate of self-study time (including PS) required outside formal classes is approximately 6 hours per week.
Topics to be covered (Tentative):
Basic Definitions and Concepts (Chapter 1,2) (2 Lectures): Closed and Open Systems, Boundary, Environment , etc., State and State Function, Equilibrium, Processes and Cycles, Forms of Energy, Pressure, Temperature and Zeroth Law of Thermodynamics
Properties of Pure Substances (Chapter 3) (3 Lectures): Pure Substance, Property Diagrams and Tables, Equation of State, Ideal Gas and Ideal, Gas Equation of State, Other Equations of States, Internal Energy, Enthalpy, Specific Heats of Ideal Gases, Liquids and Solids.
Energy Analysis of closed systems (Chapter 4) (1 Lecture) : Moving boundary work, energy balance for closed systems, internal energy, enthalpy, and specific heats.

Mass and Energy Analysis of control volumes (Chapter 5) (4 Lectures) : Conservation of Mass and Energy, and Concept of Control Volume; Some Steady-Flow Engineering Devices.

Midterm I

The Second Law of Thermodynamics (Chapters 6, 7, and 8) (7 Lectures) : Introduction to the Second Law, Heat Engines, Refrigerators and Heat Pumps, Carnot Cycle, Entropy, Inequality of Clasius, Calculation of Entropy Changes, The T-ds Relations, Irreversibility, Availability etc.

Power and Refrigeration Cycles (Chapters 9, 10, and 11) (7 Lectures) : Gas Power Cycles (Chapters 9), Vapor Power Cycles (Chapters 10), Refrigeration Cycles (Chapters 11)

Thermodynamic Property Relations (Chapter 12) (2 Lecture) : Maxwell Relations, Changes in Thermodynamic Properties

Midterm II

Gas-Vapor Mixtures and Air-Conditioning (Chapter 13, 14) (2 Lectures): Gas and Gas-Vapor Mixtures, Air-Conditioning

Tests:

There will be two in-class midterm exams and a final test.

Grading:

1) Quizes and Homework Assignments 15%
2) Two Midterm Exams 45% (22.5% each)
3) Final Exam 35%
4) Attendance 5%

Important Note: Homework problems will be normally assigned on every Thursday and it must be returned by 2:00pm on next Thursday in **homework box**. There will be a quiz based on the homework problems and problems solved in PS regularly. Your average quiz grade **must be** at least **40/100** in order to get a passing grade from this course.

Attendance: Students must attend at **least 2/3 of all lectures** to get a passing grade from this course. Therefore, missing **1/3** or more lectures (days with a health report or any other excuse are also included) will result in an F grade. Students are also expected to attend the problem sessions and quizzes. **Cheating in attendance (signing up for someone else) is a serious offence. A disciplinary action will be taken agaist such offenses and it may result in suspension from the university for up to one semester**.

Calculation of ECTS credit:

Activity	Number	Time (hrs)	Predicted Total Work Load (hrs)
Lectures	2x14=28	1.25	35
PS and Quizzes	14	1.25	17.5
HWs & Self-Study	14	5	70
Project	0	0	0
Lab	0	0	0
Midterm Exams			
(a) Exam	2	2	4
(b) Preparation	2	10	20
Final			
(a) Exam	1	2.5	2.5
(b) Preparation	1	16	16
Total Work Load			165
ECTS Credit*: An integer between(TotalWorkLoad /30=5.5 and TotalWorkLoad /25 = 6.6) = 6			
* 1 ECTS credit is assumed to be 25-30 hours of work load			