ENG ME 304: Energy and Thermodynamics, Spring 2014

Instructor:
Prof. Dr. Cornelia Breitkopf Phone: 0351-463-34711
Dep. of Mechanical Engineering Email:
cornelia.breitkopf@tu-dresden.de
Institute of Power Engineering
Helmholtzstr. 14, Merkel-building
(first part: April 9 to May 28)

Dipl.-Ing. Angel Ochoa Brezmes Phone: 0351-463-34669
Dep. of Mechanical Engineering Email:
Ochoabrez@hotmail.com
Institute of Power Engineering
Helmholtzstr. 14, Merkel-building
(second part: June 4 to July 16)

Website for download of supporting information will be given in the first lecture.

Course objectives
The students will understand basic principles of engineering thermodynamics as prerequisites for studying energy conversion and propulsion. It includes the first and second law of thermodynamics, properties of simple compressible fluids, thermal equation of state for ideal gases, concepts of entropy and exergy balances, humid air and its processes, and simple reversible and irreversible processes.

The students are expected to have prior knowledge about the fundamentals of mathematics and physics (CAS MA 225, CAS PY 211). The course will be held in English.

Grading Criteria
- Preparation of home work & participation: 20%
- Midterm exam (one, 75 min): 35%
- Laboratories (two): 10%
- Final exam (75 min): 35%.

Course policies
The course consists of two lectures per week (each 90 min), one discussion per week (60 min) and laboratories (two per course, each 90 min).

The *lectures* are intended to give an overview about the selected topics (see table) by using the black board (deriving formulas, laws, examples). The students are expected to take notes. Selected graphs and applications will be given as power point presentation (download is possible weekly using the website). The main initiative is coming from the course leader. The lecture follows the text book [1].

The *discussions* subsequent to the lectures are used to finish the present topic of the week by discussing all remaining questions. The initiative is expected to come from the students. They are asked to note open questions during the lecture. Selected tasks will be given as homework. It is expected that the students will present the solutions in front of the group in the following week being proactive during the discussion.

It is expected that students attend the lectures and participate actively in the discussions. Attendance will be registered to support final evaluation of the course.

The *laboratory* includes the execution of experimental investigations and the following data analysis (with instruction by the course leader). All steps have to be summarized in a detailed technical report, which needs to be submitted one week later.

Collaboration is encouraged on homework and labs. However, students should use their own words in their own work! Please see the Conduct Code:
http://www.bu.edu/academics/resources/academic-conduct-code/

The *exams* (75 min) will consist of two parts. The first part consists of answering theoretical questions (without any use of books and notes). The second part consists of solving mathematical problems according to the subject (all books, notes and tables can be used). For the midterm exam, tasks are related to the lectures 1-7, and for the final exam, tasks are related to lectures 9-13.

Absence from the lab or the exams requires the submittal of a written medical certificate. In case of excused absence from lab or exams the student will get the possibility to repeat these activities.

In case of tardiness in lectures or discussions, the student has to repeat the missed topic autonomously.

Bibliography

[1] MORAN, M. J. / SHAPIRO, H. N. / BOETTNER, D.D. / BAILEY, M.B.:
Fundamentals of Engineering Thermodynamics (7th Edition), John Wiley & Sons, Inc., 2011

[2] Thermodynamic Formulary
(pdf provided at the beginning of the course)

Course calendar

Date	Lecture*	Chapter	Topic	Course leader
09.4.2014	1a	1	Why thermodynamics?	Prof. Dr. Cornelia Breitkopf
	1b	1	What are state and process properties?	
16.04.2014	2a	3	How can we describe gases, liquids and solids?	
	2b	3	What is the ideal gas equation of state?	
23.4.2014	3a	2/4	What kinds of energy exist? What are control volumes?	
	3b	3/4	What is enthalpy? What is the first law of thermodynamics?	
30.4.2014	4a	2/4	What is the first law of thermodynamics –continued?	
	4b	2/4	How can we describe closed and open systems?	
07.5.2014	5	4/2	How can we visualize characteristic processes and works in diagrams?	
	-	-	*Lab*	
14.5.2014	6a	12.5	What is moist (humid) air and which state characteristic is needed?	
	6b	12.5	Which processes with humid air exist?	
21.5.2014	7a	5	What is entropy?	
	7b	5	Why do we need the second law of thermodynamics?	
28.5.2014	8	-	Preparation	
	8	-	**Midterm exam**	
04.6.2014	9a	5/6	How can we use the entropy concept?	A. Ochoa Brez
	9b	5/6	Which characteristic diagrams can we apply for evaluating entropy?	
18.6.2014	10a	7	What is exergy good for?	
	10b	8	Which power cycles exist?	
25.6.2014	11	8	How can we determine performances, efficiencies…for power cycles?	

	-	-	*Lab*	
02.7.2014	12a	9	How work gas turbine power plants?	
	12b	9	Which characteristic cycles for turbine processes exist?	
09.7.2014	13a	11	What are Maxwell relations?	
	13b	11	How can we use mathematics to represent complex thermodynamic relations?	
16.7.2014	14	-	Preparation	
	14	-	**Final exam**	

* after the two lectures, one discussion round of 60 min follows, which is related to the main topic(s) of the day. Remaining questions from the lectures and homework will be discussed.