ENG ME 304: Energy and Thermodynamics, Spring 2017

Instructor:
M. Sc. Constantino Grau
Dep. of Mechanical Engineering
Institute of Power Engineering
(first part: April 5 to May 11)

M.Sc. Angel Ochoa
Dep. of Mechanical Engineering
Institute of Power Engineering
(second part: May 24 to July 12)

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 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 topic of the week before 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 one week before. 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 1-5, and for the final exam, tasks are related to lectures 6-10.

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.

New feature this year will be the use online tools for solving calculation tasks which serve as additional training opportunities for the discussion rounds.
Prerequisite for use of these tools is a valid TU Dresden ZIH-login.

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
5.4.2017	1a	1	Why thermodynamics?	M.Sc. C. Grau
	1b	1	What are state and process properties?	
12.4.2017	2a	3	How can we describe gases, liquids and solids?	
	2b	3	What is the ideal gas equation of state?	
19.4.2017	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?	
26.4.2017	4a	2/4	What is the first law of thermodynamics –continued?	
	4b	2/4 4/2	How can we describe closed and open systems? How can we visualize characteristic processes and works in diagrams?	
3.5.2017	5a	5	What is entropy?	
	5b	5	Why do we need the second law of thermodynamics?	
10.5.2017	-	-	Preparation	
	-	-	**Midterm exam**	
11.5.2017	-	-	**Lab I**	
24.5.2017	6a	5/6	How can we use the entropy concept?	M.Sc. A. Ochoa
	6b	5/6	Which characteristic diagrams can we apply for evaluating entropy?	
31.5.2017	7a	7	What is exergy good for?	
	7b	8	Vapor power plants and Rankine Cycle (Part 1)	
14.6.2017	8a	8	Vapor power plants and Rankine Cycle (Part 2)	
	8b	9	*Gas turbines and Brayton Cycle*	
21.6.2017	9a	9	Internal Combustion engines	
	9b	9	**Lab II**	
28.6.2017	10a	10	Refrigeration cycles	
	10b	8,9,10	Review of Power and Refrigeration Cycles	
5.7.2017	-	-	Preparation for exam/ repetition and questions	
12.7.2017	-	-	**Final Exam**	

* after the two lectures on Wednesday (see table), one *discussion round* of 60 min follows the next day on Thursday (not shown in table separately), which is related to the main topic(s) of the lecture one week before. Remaining questions from the lectures one week before and homework will be discussed.

Dates for ***discussion rounds***: 6.4., 13.4., 20.4., 27.4., 4.5., 1.6., 15.6., 22.6., 29.6., 6.7.

Lab: 11.5., 21.6.

No lectures/ teaching on: Ascension Day 25.5., Dies Academicus 17.5. and in the week of Pentecost 5.6.-11.6.