جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Basic Principles of Thermodynamics - ME 101

Division	Physical Science and Engineering Division
Course Number	ME 101
Course Title	Basic Principles of Thermodynamics
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	10:30 AM - 12:00 PM | Sun Tue

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Deanna Angele Monique Lacoste	deanna.lacoste@kaust.edu.sa	+966128084801	4336, 5, Al-Kindi (bldg. 5)	Available to students anytime I'm in my office, or email for an appointment.

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	1) Thermodynamics (a) Basic concepts: continuum model, system, state, equilibrium, process. Quasi-equilibrium processes. Equations of state. (b) Heat and Work: changing the state of a system. Zeroth law of thermodynamics. Work. (c) The first law of thermodynamics and its corollaries: adiabatic, steady, throttling of a gas, quasi-static expansion of gas, transient filling of a tank. Enthalpy. Specific heats. Conservation of mass and energy in control volum form. (d) Engineering cycles: properties of cycles, work and efficiency, general presentation of cycles, Carnot cycle, refrigerator and heat pump, Otto cycles, Diesel cycle. (a) Reversible processes. (b) The second law of thermodynamics: statements and related concepts. Combining the 1st and 2nd laws of thermodynamics. Entropy changes in an ideal gas. Calculation of entropy change in basic processes. Gibbs equations. 2) Heat Transfer (a) Fundamental concepts. Thermodynamics and heat transfer. Modes of heat transfer. (b) Conductive heat transfer: Fourier's law. Steady-state one-dimensional conduction. Thermal resistance circuits. (c) Convective heat transfer: Thermal boundary layer. Newton's law of cooling. Local and average convection coefficients. Dimensionless numbers. Combining conduction and convection. (d) Radiation heat transfer: ideal radiators. Kirchhoff's law and real bodies. Radiation transfer between planar surfaces. (e) Heat generation: thermochemistry. Fuels and fuel air ratio. Enthalpy of formation. First law analysis of reacting systems.
Course Description from Program Guide	
Goals and Objectives	The goal of the course is to provide the students with the fundamentals of thermodynamics and heat transfer.

Required Knowledge	Undergraduate Calculus.
Reference Texts	1. Thermodynamics: an Engineering Approach, by Y. Cengel & M. Boles, McGraw-Hill Education 2. Heat Transfer: A Practical Approach, by Y. Cengel, McGraw-Hill Education
Method of evaluation	**40.00**% - Final exam **20.00**% - Quiz(zes) **40.00**% - Midterm exam
Nature of the assignments	There are three components to the final grade: 4 quizzes, 1 mid-term exam and the final exam. The 4 quizzes (20% in total of the grade) have a duration of 30 min. The midterm exam (40 % in total of the grade) have a duration of 90 min. The final exam (40% of the grade) have a duration of 90 min. Quizzes and exams are closed book and closed notes.
Course Policies	The students are required to attend all the lectures and to take notes. Students that do not show up for a quiz or an exam should expect zero in that assessment. Quizzes and exam are closed book and closed notes. The student may use one A4 equation sheet and a calculator.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Sun 08/25/2019	Course Introduction. Fundamentals of thermodynamics.
1	Tue 08/27/2019	Work and heat.
2	Sun 09/01/2019	First law of thermodynamics.
2	Tue 09/03/2019	Evaluating properties of state.
3	Sun 09/08/2019	Close system analysis 1.
3	Tue 09/10/2019	Quiz 1. Close system analysis 2.
4	Sun 09/15/2019	Control volume analysis.
4	Tue 09/17/2019	The second law of thermodynamics.
5	Sun 09/22/2019	University holiday
5	Tue 09/24/2019	Carnot cycle.
6	Sun 09/29/2019	Entropy.
6	Tue 10/01/2019	Gibbs equations - isentropic processes.
7	Sun 10/06/2019	Quiz 2. Exergy.
7	Tue 10/08/2019	Engineering cycles 1.
8	Sun 10/13/2019	Engineering cycles 2.
8	Tue 10/15/2019	Review.
9	Sun 10/20/2019	Midterm exam.
9	Tue 10/22/2019	Fundamental concepts of heat transfer.
10	Sun 10/27/2019	Mid-semester break
10	Tue 10/29/2019	Mid-semester break
11	Sun 11/03/2019	Heat conduction equation.
11	Tue 11/05/2019	Steady heat conduction.
12	Sun 11/10/2019	Quiz 3. Fundamentals of convection 1.
12	Tue 11/12/2019	Fundamentals of convection 2.
13	Sun 11/17/2019	External forced convection.
13	Tue 11/19/2019	Internal forced convection.
14	Sun 11/24/2019	Natural convection.
14	Tue 11/26/2019	Quiz 4. Fundamentals of thermal radiation.
15	Sun 12/01/2019	Radiation heat transfer.
15	Tue 12/03/2019	Heat exchangers.
16	Sun 12/08/2019	Review.
16	Tue 12/10/2019	Final exam.

Note

The instructor reserves the right to make changes to this syllabus as necessary.