MEC 301: Thermodynamics

The State University of New York Korea – Stony Brook University

Fall 2021

INSTRUCTOR	Dr. Jongseong Choi	jongseong.choi@sunykorea.ac.kr	Academic Building B625
TA	Mark Anthony Rotor	markanthony.roter@stonybrook.edu	C604
CLASSES	TUTH	3:30 – 4:50 pm	online
OFFICE HOURS	TU	1:20 – 3:20 pm, or by appointment	B625

COURSE TEXTBOOK

Thermodynamics: An Engineering Approach, Çengel Y., Boles M. A., McGraw-Hill Education, 8 ed., 2015.

PREREQUISITE

AMS 261/MAT 203; PHY 131 or 125 or 141; CHE 131; MEC Major

ASSIGNMENTS

As basic preparation for each lecture, you should read the assigned material before coming to class. In-class discussion and examples are designed to help prepare you for homework assignments. In addition to the reading and homework assignments, you should review your past class notes on a daily basis.

Homework: Individual homework is assigned weekly throughout the semester. They will be given every Tuesday. Homework assignment should be scanned and submitted through Blackboard (https://blackboard.stonybrook.edu/) before Tuesday at 11:59 pm of the following week. You can drop one worst score at the end of the course. The detailed course schedule is provided in the following pages of '**Course Schedule**'.

EXAMINATION

There are two midterm examinations and one comprehensive final examination. For all examinations, you can bring one sheet (both sides) for equations and notes. You can bring your TI-30X calculator, pencil(s), and eraser. The use of smartphones, laptop, iPad, or any other sources of communication is strictly prohibited. For the grading, point deduction will occur when you do not represent: the engineering approach, energy flow diagram (EFD), list of assumptions and equations, and sufficient details of the solution. Problem solution format will be provided in detail on the following page.

COURSE GRADING

Homework & Attendance	15%
Midterm #1	25%
Midterm #2	25%
Final Exam	35%
TOTAL	100%

Grading will be curved and normalized to 100% then given in a scale of:

92 ≤	A	< 100	74 ≤	C+	< 78
88 ≤	A-	< 92	70 ≤	C	< 74
85 ≤	B+	< 88	67 ≤	C-	< 70
81 ≤	B	< 85	64 ≤	D+	< 67
78 ≤	B-	< 81	60 ≤	D	< 64

COURSE SCHEDULE

On behalf of Ministry of Education's directive, the University has moved all the classes to 100% online starting this coming Monday, August 30, and continue until October 18, 2021. Therefore, the classes are organized as fully online sessions until further guideline is provided by the University. The location of midterm and final exams will be determined based on further guideline coming up. Please find details in the following pages of '**Course Schedule**'. The link for the online classroom will be provided on the Blackboard.

SAFETY GUIDELINE

Everyone participating in any in-person sessions or meetings ***must wear a mask or face covering at all times*** or have the appropriate documentation for medical exemption. Any student not in compliance with this policy will be asked to leave the classroom. If students need to drink or eat, they should step out of the classroom to do so. Please refer to the 'Guidelines for Fall 2020 in COVID-19 Situation' for more information.'

COURSE LEARNING OBJECTIVES	ASSESSMENT TOOL
1. Determine the thermodynamic properties of a material, given two independent thermodynamic properties and the use of the state postulate	Exams/ Homework
2. Demonstrate the concepts of work, heat, and internal energy in the analysis of thermodynamic systems	Exams/ Homework
3. Demonstrate the First Law (Conservation of Energy) for closed systems	Exams/ Homework
4. Demonstrate the First Law (Conservation of Energy) for open systems	Exams/ Homework
5. Be able to determine the thermodynamic efficiency of a power system, or the coefficient of performance of a refrigeration system	Exams/ Homework
6. Apply the Second Law of thermodynamics in the analysis of thermodynamic systems	Exams/ Homework

COURSE OVERVIEW

Variables that describe the thermodynamic state of a system or control volume, including absolute temperature, internal energy, enthalpy, and entropy are introduced, and basic principles governing the transformations of energy, especially heat and work, are developed. Underlying principles are used to analyze and solve problems related to thermodynamic systems and to determine the changes in properties of the systems and surroundings implied by changes in inputs, configuration, or constraints.

COURSE TOPIC
1. Properties, processes and cycles
2. Energy conservation and the first law
3. Analysis of closed systems
4. Analysis of open systems
5. Entropy
6. The Second Law of Thermodynamics
7. Introduction to thermodynamic cycles

BLACKBOARD

All homework assignments and solutions will be posted on the Blackboard course account (http://blackboard.stonybrook.edu/). For problems logging in, go to the coordinator of the department. It is your responsibility to make sure that you can access the blackboard system.

ACADEMIC HONESTY

The campus policies on academic honesty are available on the Web (http://naples.cc.sunysb.edu/CAS/ajc.nsf/pages/info). Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted. Faculty members are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website: http://www.stonybrook.edu/commcms/academic_integrity/index.html

SPECIAL NOTE ON ADA
If you have a physical, psychological, medical or learning disability that may impact your course work, please contact One-Stop Service Center, Academic Building A201, (82) 32-626-1117. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

CRITICAL INCIDENT MANAGEMENT STATEMENT
The State University of New York, Korea expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

ATTENDANCE POLICY of SUNY KOREA
1. All students of SUNY Korea are required to attend every class.
2. Unexcused absences will affect seriously the student's final grade in the course.
3. If a student has over 20% unexcused absence, the student's final course grade will be an 'F'.
4. Students should report the reason of absence to the instructor in advance, or immediately after the absence.
5. When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the instructor.
6. The instructor of the course reserves the right to excuse absences.
7. The course instructor may excuse the absence if the submitted documentation fulfills the conditions below. • Extreme emergencies (e.g. death in the family) • Severe medical reasons with doctor's note (Not a slight illness) • Very important events (e.g. national conference, official school event)
8. At the end of semester, the course instructor should submit a copy of the attendance sheet to the Academic Affairs Office.

PROBLEM SOLUTION FORMAT
For both homework and examination, use empty A4-size paper, only one side and only one problem per page. If more than one page is needed for a problem, all pages must be transmitted in order. At the top of the paper, you write the following information from left:

Your name (first, last)	Student ID number	Problem number (i.e. HW1, HW2, …)	Page number (i.e. 1/3, 2/3, 3/3, …)

Then, provide the information listed below:
Find: List what the problem wants you to find. You use this information to decide on the system you'll be analyzing, and how you'll sketch the appropriate energy flow diagram. This information will also drive your choice of basic equation(s) for problem solution since the one(s) you chose must include the quantity (or quantities) of interest.

Energy Flow Diagram (EFD): Your Energy Flow Diagram (EFD) will identify your system boundary, indicate where energy and mass flow into/out of your system, and which forms these flows take. Your EFD will guide your choice of terms in the basic equations that you keep or reject.

Given: Given information serves three purposes. First, it helps you determine which terms in your basic equations you can settle on immediately. Second, it helps you determine how many basic equations you need—the number of basic equations must equal the number of unknowns. Third, it provides guidance for constructing your EFD.

Assumptions: Assumptions are listed to help you eliminate terms in your basic equations. e.g. "Steady state," "Uniform flow," "Ideal gas," etc.

Solution: This includes correct units.

Course Schedule
MEC 301: Thermodynamics
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Lecture	Day	Date	Location	Topic	Chap.	HW given	HW due
1	TU	Aug 31	online	Syllabus; Intro; Basic concept	Ch.1		
2	TH	Sep 2	online	Units; Control vol.; SG; Equilibrium; Process & cycle; **0th law**; Pressure	Ch.1	HW #1	
3	TU	Sep 7	online	Eng. approach to prob. solving tech; Energy; Heat; Work	Ch.2		
4	TH	Sep 9	video	Total energy and transfer; **1st law**	Ch.2	HW #2	HW #1
5	TU	Sep 14	online	Energy conversion; Efficiency; Energy analysis of cycles	Ch.2		
6	TH	Sep 16	online	Evaluating properties; Phase-change; Property diagram	Ch.3	HW #3	HW #2
7	TU	Sep 21		Chuseok holiday - No class			
8	TH	Sep 23	online	Property tables	Ch.3		
9	TU	Sep 28	online	Property tables; Practice	Ch.3	HW #4	HW #3
10	TH	Sep 30	online	Ideal gas model; ideal gas properties; Practice	Ch.3		
	TU	Oct 5	online	Midterm #1 – No class			HW #4
11	TH	Oct 7	online	Boundary condition; Review of Ch. 1 – 3	Ch.4		
12	TU	Oct 12	online	Polytropic process	Ch.4	HW #5	
13	TH	Oct 14	online	Energy balance; Specific heats	Ch.4		
14	TU	Oct 19	TBD	Internal energy and enthalpy	Ch.4	HW #6	HW #5
15	TH	Oct 21	TBD	Energy of a flowing fluid; 1st law w/o mass, Steady-flow systems	Ch.5		
16	TU	Oct 26	TBD	Unsteady-flow systems; 1st law practice	Ch.5	HW #7	HW #6
17	TH	Oct 28	TBD	1st law practice	Ch.5		
18	TU	Nov 2	TBD	More 1st law practice; System integration; Review of Ch. 4 – 5	Ch.5	HW #8	HW #7
19	TH	Nov 4	TBD	**2nd law**; Irreversibility; Thermodynamic cycles and 2nd law	Ch.6		
	TU	Nov 9	TBD	Midterm #2 – No class			HW #8
20	TH	Nov 11	TBD	T-ds relations; Carnot cycle; Heat engine	Ch. 6		
21	TU	Nov 16	TBD	Heat pump and refrigerator	Ch.6	HW #9	
22	TH	Nov 18	TBD	Heat pump and refrigerator	Ch.6		
23	TU	Nov 23	TBD	Entropy change for ideal gases; 2nd law w/o mass flow; 2nd law w/t mass flow	Ch.7	HW #10	HW #9
24	TH	Nov 25	TBD	2nd law practice	Ch.7		
25	TU	Nov 30	TBD	Isentropic process	Ch.7	HW #11	HW #10
26	TH	Dec 2	TBD	Entropy of liquids, solids, and ideal gases; Compressor; Entropy balance	Ch.7		
27	TU	Dec 7	TBD	Course Review			HW #11
		TBD	TBD	Final Examination			