MEC 301 – Thermodynamics (Fall 2022)

Course description: Variables that describe the thermodynamic state of a system or control volume, in cluding 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.

Prerequisites: AMS 261 or MAT 203; PHY 125 or 131 or 141; CHE 131
Credits allocated: 3

Learning objectives: The emphasis in this course will be on learning the fundamentals of thermodynam ics and in applying them to solve engineering problems. Key topical areas include the first and second laws of thermodynamics, the concept of entropy, theoretical and practical maximum efficiencies for heat engines, and refrigeration.

Instructor information: Prof. Jie Gao
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Class schedule: Mon/Wed/Fri, 10:30 – 11:25am, EARTH&SPACE 001
Office hours: M/W/F 11:25am – 12pm, or by email appointment Study session:
once a week, time and location TBD

Textbook: Thermodynamics: An Engineering Approach (9^{th} edition), with Properties Table Booklet

Grading: Midterm1 25%
Midterm2 25%
Final 40%
Homework 10%
100%

- Letter graded (A, A-, B+, B, B-, etc.)
- Questions regarding exam/homework grades must be discussed with the instructor within three days of their distribution.
- There will be 1% extra credit for each midterm exam correction. Please turn in the correction page with your original exam for extra credit considerations. Details will be announced in class.

Course guideline and policy:

- Blackboard will be used for class materials distribution and submission platform this semester. • Lecture handouts will be distributed before the class.
- There will be one homework assignment posted on blackboard every week, which is due next week unless otherwise noted.
- Homework problems should be neat, in order, written on the letter-size paper and submitted online as a single pdf document, showing the approaches and steps.
- Graded homework will be returned on blackboard and solutions will be posted.

- Class attendance is **required**. If there are some specific reasons for you to miss the class, it is necessary for the student to contact the instructor and explain the situation clearly with signed official document.

- **No late homework will be accepted.**
- The midterm exams will be held in-class. The comprehensive final exam will be administered during the regularly scheduled exam period. Each exam is taken with closed book, closed notes, opened "Prop erty Tables Booklet" and calculator. Formula sheets will be provided for exams if necessary. Details will be announced in class.
- **An unexcused absence will result a zero for that exam.** If it is impossible for you to be present due to illness, emergency or other reasons, you must ask my permission before the exam and provide offi cial documents to explain the situation as soon as possible. The instructor has the final authority to determine whether a student will be given a make-up exam.

Course Schedule (tentative):

** This schedule is subject to change due to necessary content changes or other reasons

No.	Date	Topic	
Lecture 1	8/22 M	Syllabus; Basic concepts	Chap 1
Lecture 2	8/24 W	Basic concepts	Chap 1
Lecture 3	8/26 F	Forms of energy; Energy transfer	Chap 2
Lecture 4	8/29 M	Energy transfer; 1st law	Chap 2
Lecture 5	8/31 W	Conversion efficiency	Chap 2
Lecture 6	9/2 F	Phase; Property diagram	Chap 3
	9/5 M	Labor Day	
Lecture 7	9/7 W	Property tables	Chap 3
Lecture 8	9/9 F	Property tables	Chap 3
Lecture 9	9/12 M	Ideal gas	Chap 3
Lecture 10	9/14 W	Boundary work; Energy balance	Chap 4
Lecture 11	9/16 F	Energy balance for closed system	Chap 4
Lecture 12	9/19 M	Specific heats	Chap 4
Lecture 13	9/21 W	Review 1; examples	
Lecture 14	9/23 F	**Exam 1**	
Lecture 15	9/26 M	Exam1 return; Mass flow;	Chap 5
Lecture 16	9/28 W	1st law open system and steady flow	Chap 5
Lecture 17	9/30 F	Steady Flow devices	Chap 5

Lecture 18	10/3 M	Steady Flow devices	Chap 5
Lecture 19	10/5 W	Steady Flow devices	Chap 5
Lecture 20	10/7 F	Unsteady Flow process	Chap 5
	10/10 M	Fall Break	
Lecture 21	10/12 W	2nd law intro; Heat engine	Chap 6
Lecture 22	10/14 F	Refrigerators and heat pump	Chap 6
Lecture 23	10/17 M	Reversible Process; Carnot Cycle	Chap 6
Lecture 24	10/19 W	Carnot HE/R/HP	Chap 6
Lecture 25	10/21 F	Review 2; examples	
Lecture 26	10/24 M	**Exam 2**	
Lecture 27	10/26 W	Exam2 return; Entropy	Chap 7
Lecture 28	10/28 F	Entropy; Entropy change	Chap 7
Lecture 29	10/31 M	Entropy change	Chap 7
Lecture 30	11/2 W	Entropy generation S_{gen}	Chap 7
Lecture 31	11/4 F	Isentropic process; Entropy diagram	Chap 7
Lecture 32	11/7 M	Tds relation; Entropy change	Chap 7

Lecture 33	11/9 W	Isentropic process of ideal gases	Chap 7
Lecture 34	11/11 F	Reversible steady-flow work	Chap 7
Lecture 35	11/14 M	Isentropic efficiency	Chap 7
Lecture 36	11/16 W	Isentropic efficiency	Chap 7
Lecture 37	11/18 F	Entropy balance	Chap 7
Lecture 38	11/21 M	Entropy balance	Chap 7
	11/23 W	Thanksgiving Break	
	11/25 F	Thanksgiving Break	
Lecture 39	11/28 M	Intro to Exergy	
Lecture 40	11/30 W	Intro to Cycles	

Lecture 41	12/2 F	Final Review; examples	
Lecture 42	12/5 M	Final Review; examples	
	12/14 W	**Final Exam**	

Student Accessibility Support Center Statement
If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631)632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropri ate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu//pro grams/fire-safety/emergency-evacuation/evacuation-guide-disabilities and search Fire Safety and Evacua tion and Disabilities.

Academic Integrity Statement
Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Cen ter (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management
Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhib its students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Un dergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.