

Process Thermodynamics

ECH 3101

Class Periods: M,W,F | Period 4 | 10:40 am – 11:30 am

Location: Larsen Hall 301

Academic Term: Fall 2021

Instructor:

Dr. Janani Sampath

jsampath@ufl.edu

321 ChE Building

Office Hours: Monday from 1:00 – 2:00 and Wednesday from 1:00 – 2:00

Zoom link for office hours: <https://ufl.zoom.us/j/92127260351>

Supervised Teaching Student:

Please contact through the Canvas website

Hayden Good

haydengood34@ufl.edu

Office hours: Thursday from 9-10am, Friday from 2-3pm

Zoom link for office hours: <https://ufl.zoom.us/j/3038777584>

Grader:

TBH

Course Description

The main goal is to introduce fundamental principles of thermodynamics including the first and second laws of thermodynamics. The main focus is on the development of skills allowing solving problems that involve closed and open systems as well as selected processes.

Course Pre-Requisites / Co-Requisites

CHM 4411 or PHY 3513, COT 3502 and ECH 3264

Course Objectives

- Knowledge of the definition and origin of the extensive and intensive thermodynamic variables used to solve problems involving closed and open systems as well as selected thermodynamic processes
- Derivation of a mathematical description of closed and open systems with pure substances using 1st and 2nd laws of thermodynamics
- Determination of the properties of pure substances using the ideal gas approximation and other equations of state or thermodynamic tables
- Learn how to solve problems involving change of state of pure substances using the partial derivatives method

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with	

consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	Medium
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

Engineering and Chemical Thermodynamics
Milo D. Koretsky
2nd Edition
ISBN: 978-0-470-25961-0

Exams and Quizzes:

There will be 2 exams during the semester. **The final exam will be on December 17.** There will be 2 announced quizzes during the semester. Quizzes will be announced at least 1 week in advance. No credit will be given for problems that have a solution but all the work leading to this solution is not shown. Partial credit will be assigned based on the rules that will be consistently applied to all students.

All quizzes and exams are open book. Exams will be held online during the evening period. On the day of the exam, we will have a Q&A class.

Homework:

- You will have a total of 7 homework sets.
- Solutions will be posted on the course website.
- The homework must be turned in on canvas by the due date.
- Late homework will be accepted only with instructor approval. As a rule, there will be a 20% penalty for each day it is late. No late homework accepted after the solutions are posted.
- No credit will be given for problems that only have a solution without the work leading to the solution.

Tentative Course Schedule

- Weeks 1,2: **Chapter 1 (pages 1 – 30):** Thermodynamic systems, Thermodynamic properties, Equilibrium, PVT surface | **Chapter 2 (pages 37 – 60):** First law of thermodynamics, Reversible and Irreversible and Irreversible Processes, Closed systems
- Weeks 3,4: **Chapter 2 (pages 60 – 108):** Open Systems, Thermochemical Data for U and H, Reversible processes in open systems, Energy balances on Process Equipment, Carnot cycle
- Weeks 5,6: **Chapter 3 (pages 128 – 160):** Directionality, Entropy, Second law of thermodynamics, Calculating ΔS for different cases | **Exam 1**
- Weeks 7,8: **Chapter 3 (pages 160 – 190):** Bernoulli equation, Refrigeration cycle, Molecular view of entropy | **Chapter 4 (pages 210 – 249):** Overview of the following for single component systems – Ideal gas, Intermolecular forces, Equations of state
- Weeks 9,10: **Chapter 5 (pages 265 – 290):** Types of thermodynamic properties, Thermodynamic property relations, Calculating fundamental and derived properties
- Weeks 11,12: **Chapter 5 (pages 290 – 304):** Departure functions, Joule-Thomson expansion and liquefaction | **Exam 2**
- Weeks 13,14: **Chapter 6 (pages 315 – 334):** Phase equilibria, Gibbs energy, Clausius Clapeyron equation
- Weeks 15: **Chapter 7 (pages 391 – 403):** Fugacity of pure gases | **Finals**

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

F2F Course Policy in Response to COVID-19

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

Attendance Policy, Class Expectations, and Make-Up Policy:

Class attendance is strongly recommended. Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation. Requests for make-up tests will be granted only if appropriate documentation about illness, family emergency or UF-related travel are given to the Instructor.

Evaluation of Grades:

Assignment	Total Points	Percentage of Final Grade
Homework Sets (7)	10 each	15%
Quizzes (2)	10 each	15%
Midterm Exam 1, 09/29	100	20%
Midterm Exam 2, 11/10	100	20%
Final Exam, 12/17	100	30%

Grading Policy:

Final grades will be assigned using the standard deviation (σ) method. The scale for the course will be as follows:

Percent	Grade	Grade Points
Mean + σ < Score	A	4.00
Mean + 0.67 σ < Score \leq Mean + σ	A-	3.67
Mean + 0.33 σ < Score \leq Mean + 0.67 σ	B+	3.33
Mean < Score \leq Mean + 0.33 σ	B	3.00
Mean - 0.33 σ < Score \leq Mean	B-	2.67
Mean - 0.67 σ < Score \leq Mean - 0.33 σ	C+	2.33
Mean - σ < Score \leq Mean - 0.67 σ	C	2.00
Mean - 1.33 σ < Score \leq Mean - σ	C-	1.67
Mean - 1.67 σ < Score \leq Mean - 1.33 σ	D+	1.33
Mean - 2 σ < Score \leq Mean - 1.67 σ	D	1.00
Mean - 2.33 σ < Score \leq Mean - 2 σ	D-	0.67
Score \leq Mean - 2.33 σ	E	0.00

Instructor may lower the threshold for attaining the letter grades specified above (to the benefit of the students), but will not raise the threshold.

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations:

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation:

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

University Honesty Policy:

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any

condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment:

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use:

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy:

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](mailto:title-ix@ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.