MTSE 5000: THERMODYNAMICS OF MATERIALS

Instructor Contact

Name: Prof. Srinivasan Srivilliputhur
Office Location: Discovery Park C-136C
Phone Number: (940) 369-8273
Class Website: Lecture notes, assignments, quizzes will be posted on CANVAS
Lecture: MON/WED 10:00 AM – 11:20 AM, NTDP B157
Office Hours: Thursday 3 PM or by appointment.
Email: srinivasan.srivilliputhur@unt.edu

Course Structure

The course will be in-person but the Office-Hours will be over Zoom. Participation in the class during lectures is mandatory. The quizzes and homework must be submitted as a PDF file on CANVAS.

Course Prerequisites or Other Restrictions

You must be able to log in to Office-Hours on Zoom, and be familiar with fundamentals of mathematics, especially partial derivatives and calculus. Please review calculus using textbooks or khanacademy.org.


Communication: CANVAS and Email will be the primarily used for communication. I will make efforts to reply to your messages within 48 hours and post exam grades within 2 weeks after an exam. Assignments, quizzes, and exams will be submitted via CANVAS, and students will participate in CANVAS-based discussion board.

Course Objectives: Provide a strong foundation in thermodynamics of materials.

How to Study?

This is a problems-based class. The ability to solve numerical problems is the foundation of any thermodynamics course. Discuss thermodynamics principles with your classmates, and help each other understand the concepts by working in teams. But the work you turn in must be your own. You should not use homework solutions, exams, or other materials from others, and pass it off as your own work. Violations of the Academic Integrity code will be punished to the fullest extent.

Teaching Philosophy

I encourage student questions and participation during lecture. Students must be proactive in getting confusions clarified. To ensure this, I encourage you to attend my office hours and also form your own study groups.
Course Description

Tentative Topics

1. Fundamental concepts and definitions
2. First Law of thermodynamics
3. Second law of thermodynamics and entropy
4. Statistical interpretation of entropy
5. Heat capacity and third law of thermodynamics
6. Free energy and Maxwell’s relations
7. Phase equilibrium in one-component systems
8. Solution thermodynamics
9. Binary phase equilibria
10. Thermodynamics of material defects
11. Reaction thermodynamics
12. Application of thermodynamics – small systems and electrochemistry
13. Introduction to irreversible thermodynamics

Grading

An (A-F) grading scale will be used. The point percentages used to calculate the final grade are:

A >= 90;   B = 80-89;   C = 70-79;   D = 60-69;   F = < 60

Your grading will be based on the following areas of assessment:

- Homework: 20%
- Two Quizzes: 20%
- Two Exams: 60%
- Quiz-1: Mid-September, 2022 (60-minute duration on CANVAS).
- Exam-1: Mid-October, 2022 during your class period.
- Quiz-2: Mid-November, 2022 (60-minute duration on CANVAS).
- Exam-2: In December, 2022. Please do not plan to leave for vacation before your exam.
Course Policies

Attendance Policy
Participation in class lectures is mandatory. If you are unable to attend a class, please email me. Excused absences include illness, conference travel, family emergency, religious holiday, and any other unplanned difficulty as determined by the instructor. Student(s) with 5 or more unexcused absences will be dropped from the class. Don’t disrupt classes by coming late.

Late Work Policy
Late work will not be accepted unless a prior accommodation has been made with the professor. There will be no extra credit opportunities.

Examination Policy
The exams are open or closed-book exams and will be administered in-class. You will complete them in a fixed amount and upload your answer file back on CANVAS for grading. However, quizzes are administered via CANVAS. Work on your quizzes during a time you expect stable Internet connection. A student who misses exam(s) due to unavoidable reasons such conference travel, family emergencies, and sickness must show proof such as doctor’s and/or advisor’s note to the instructor to get permission and/or arrange for a makeup exam. Please do not plan your winter vacation travel before UNT closes. I will not reschedule your exams.

Assignment Policy
The instructions for assignments and their due dates will be posted on CANVAS. You must upload your answers in PDF files on CANVAS.

Note that the University is committed to providing a reliable online course system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will extend the time windows and provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and contact the UNT Student Help Desk: helpdesk@unt.edu or 940.565.2324 and obtain a ticket number. The instructor and the UNT Student Help Desk will work with the student to resolve any issues at the earliest possible time.

Instructor Responsibilities and Feedback

- The instructor will help students grow and learn, provide clear instructions for assessments, answer questions about assignments, identify additional resources as necessary, review, and update course content.
- Please help the instructor by being proactive in asking questions and seeking help.

Course Evaluation
Student Perceptions of Teaching (SPOT) is the student evaluation system for UNT and allows students the ability to confidentially provide constructive feedback to improve the quality of learning in the course. Please fill out the evaluations at the end of the semester.

Syllabus Change Policy
Any changes to the syllabus (in an extraordinary situation) will be clearly communicated to the students.
Homework Guidelines

1. **Late Submissions will not be accepted.** Exceptions will be made only for documented conference attendances, and significant circumstances such as leave to attend funeral, hospitalization, and/or documented medical issues.

2. **Upload your homework solutions on CANVAS.** The key objective of this course is to enable you to apply thermodynamics principles to materials science problems. Homework exercises play a crucial role for this purpose and are mandatory. There will be about six sets of homework problems over the semester, with about ten problems per set.

3. **Collaborate with your peers.** Homework must be a result of your own effort. However, you are encouraged to discuss homework problems with your classmates before you work out detailed solutions. I will NOT tolerate cheating.

4. **Presentation must be professional.** The paper size must be 8-1/2" x 11". Write your name (last name first), the homework assignment number, and the due date on the "cover page." You must write only on one side of each sheet, and only inside the margins. Papers torn out from a notebook are NOT acceptable. Number the pages in the upper right corner and staple in the upper left corner. BE NEAT! Your career will suffer if your work is sloppy, and you will also lose points in this course.

5. **Use SI Units and appropriate significant digits.** Your answers must include the correct units, with the exception of dimensionless quantities! You must round off the final answer appropriately – answers with digits that are not significant will result in a grade reduction.

6. **Grading: The problems will be graded for bona fide attempt on a scale of one (lowest) to ten (highest). I will post solutions to the problems.**

7. **A Useful Problem-Solving Strategy:** You must learn to address thermodynamics problems in a structured manner, thus: (a) **Outline a solution.** Re-phrase the problem in your own words from a materials science perspective, add a sketch if needed. Explicitly state and justify all assumptions you make for solving the problem. List in words the quantities you are given and you need to solve for. Write down the necessary equations. (b) **Execute the solution.** (c) **Evaluate your solution.** Check its units and assess if it is physically reasonable.
UNT Policies

Welcome to UNT!

As members of the UNT community, we have all made a commitment to be part of an institution that respects and values the identities of the students and employees with whom we interact. UNT does not tolerate identity-based discrimination, harassment, and retaliation. UNT’s full Non-Discrimination Policy can be found in the UNT Policies section of the syllabus.

**Academic Integrity Policy**

Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University. Plagiarism and cheating will result in an F grade (Fail) for that assignment and a referral to the committee handling academic misconduct for further action.

**ADA Policy**

UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one’s specific course needs. Students may request accommodations at any time. However, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website (https://disability.unt.edu/).

**Prohibition of Discrimination, Harassment, and Retaliation (Policy 16.004)**

The University of North Texas (UNT) prohibits discrimination and harassment because of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal or state law in its application and admission processes; educational programs and activities; employment policies, procedures, and processes; and university facilities. The University takes active measures to prevent such conduct and investigates and takes remedial action when appropriate.

**Emergency Notification & Procedures**

UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Canvas for contingency plans for covering course materials.

**Prepared by:** Srinivasan G. Srivilliputhur, August 25, 2022.