MSE 0048–Thermodynamics of Materials

Spring 2021

Instructor:	Shan Gong	**Time:**	Tuesdays 8:15am - 11:00am
Email:	shan.gong@scupi.cn	**Place:**	Rm 3-106
Office:	Rm 4-221		

Note: This syllabus is subject to change. Please follow updates announced during class and posted on Blackboard website.

Course Pages:

- https://learn.scupi.cn/

Office Hours:

If you don't understand something, and talking to your classmates doesn't help, then you should be seeking help from the instructor or teaching assistant.

Office hours are times we have specifically set aside to be available to students. During office hours, you can come to my office; you don't need an appointment. I am also available at other times; please email to schedule a time.

- Tentative: Mondays: 1:00-4:00pm; Thursdays: 1:00-4:00pm
- By appointment via Email: shan.gong@scupi.cn
- Online via QQ Group: 364928445

Teaching Assistant:

- Lucy Sheng
- Email: 2018141522005@stu.scu.edu.cn
- If you have any question regarding to homework, please contact TA **within one week** after the homework is returned to you.

When emailing the instructor or TA, please include **"MSE 0048"** in the subject field of your message. Please use your university email account (student_ID_number@stu.scu.edu.cn), since mails from other accounts might be stopped by the SCU spam filter.

Course Description

Thermodynamics of Materials describes the laws of thermodynamics and their applications to the state of materials at equilibrium. It provides a foundation to treat general phenomena in materials science and engineering. Topics include the laws of thermodynamics, the concepts of equilibrium, thermodynamic potentials, phase diagrams, and reactions and transformations of phases. 3 Credit Hours.

Prerequisites:

- ENGR0022: Material Structure and Properties

Course Objectives

1. Develop advanced understanding on the basic concepts and principles of thermodynamics
2. Apply thermodynamic principles to analyze various phenomena in materials
3. Familiarize students with using thermodynamic calculations for material design
4. Provide fundamental knowledge and training for undergraduate student to perform future research in the fields of materials science and engineering

Textbook and References

- **Textbook:** David R. Gaskell and David E. Laughlin, (2016, 6th Edition), *Introduction to the Thermodynamics of Materials*, CRC Press, ISBN-13: 978-1498757003, ISBN-10: 1498757006
- David V. Ragone, *Thermodynamics of Materials*, vol. I, MIT Series in Materials Science and Engineering, John Wiley & Sons, Inc., 1995.
- Mats Hillert, *Phase Equilibria, Phase Diagrams and Phase Transformations: Their Thermodynamic Basis*, Cambridge University Press, 1998.
- N. Saunders and A. P. Miodownik, *CALPHAD: Calculation of Phase Diagrams A Comprehensive Guide*, Pergamon, 1998.

Assessments

Homework:	40%
Midterm Examination:	30%
Final Examination:	30%
	100%
Bonus:	+5%

Class Policy

Regular attendance is essential and expected. Important dates and plans will be announced during class. **It is imperative that you come to class prepared.** This will generally involve reading one or more chapters of the textbook, viewing tutorial videos, thinking, engaging with fellow students, practice and performing preliminary calculations. This is a three credit hour class, which means you should expect to devote at least 9 to 12 hours of effort outside the scheduled class time every week.

- Regular attendance is essential and expected.

- Important dates and plans will be announced during class.

Homework and Other Assignments

Homework problems and other assignments will be assigned periodically and are due as stated in the assigned paper. All work will be submitted electronically through the Blackboard system. Late submission **WILL NOT** be accepted. It is **your duty** to make sure that submission through Blackboard has been properly processed. Unless specifically requested, emailed homework will not be accepted.

All of the homework scores will be used in your grade computation. Unless otherwise indicated, you can work with your fellow classmates in the class, but you must submit a distinct and independent write-up to receive credit.

If you're sick, or have a compelling emergency that prevents you from turning in the homework on time, email Dr. Shan Gong.

If you believe an error has been made in the grading of an assignment, bring it to the attention of your TA **within ONE WEEK** of its return.

Please adhere to these homework guidelines:

- Put your name, ID number (last four digits), and class section at the top of the first page.
- All work must be shown for each solution to receive full credit. Present your solution in a logical fashion, showing and explaining all steps in detail.
- A significant amount of the homework points is associated with obtaining the correct answer. This includes getting the correct quantity, **number of significant digits**, sign, and **unit**.

Exams

The will be a midterm exam in April (tentatively), and a comprehensive final examination at the end of the semester. They are **CLOSED BOOK, CLOSED NOTES, CLOSED COMPUTER**. Students can bring **one A4-page cheat-sheet** and it must be **hand-written** on **two sides** of the paper, which **CANNOT** be a photocopy. You will also find a calculator and a straightedge ruler helpful. If you must miss an exam, you **MUST** make alternative arrangements with the instructor before the exam is given. If you miss an exam without prior notification, you will receive a score of **"ZERO"** for that exam except under extenuating circumstances.

Avoiding Plagiarism

1. Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called **plagiarism** and is a serious offence, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.
2. Paraphrasing, when the original statement is still identifiable and has also no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together Unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

Tentative Schedule

Week	**Date**	**Topic**
1	Mar. 02, 2021	No Class
2	Mar. 09, 2021	Introduction
3	Mar. 16, 2021	First Law of Thermodynamics
4	Mar. 23, 2021	Second Law of Thermodynamics
5	Mar. 30, 2021	Heat Engines
6	Apr. 06, 2021	Calculus of Thermodynamics 1
7	Apr. 13, 2021	Calculus of Thermodynamics 2
8	Apr. 20, 2021	Third Law of Thermodynamics
9	Apr. 27, 2021	**Midterm Exam** (Tentative)
10	May. 04, 2021	Unary Phase Diagram
	(**subject to change**)	
11	May. 11, 2021	Gas Behavior
12	May. 18, 2021	Solution Behavior
13	May. 25, 2021	Binary Phase Diagram
14	Jun. 01, 2021	Reacting Chemical System: Gas
15	Jun. 08, 2021	Reacting Chemical System: Solution
16	Jun. 15, 2021	Electrochemistry
17	Jun. 22, 2021	Final Review
18	**TBD**	**Final Exam**