MSE 1058–Electromagnetic Properties 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 that are 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: 1034400783

Teaching Assistant:

- Viola Chen
- Contact: 2017141522050@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 TAs, include **"MSE 1058"** in the subject field of your message. 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

Review of basic principles – quantum theory, band and zone theory. Transport, electrical and thermal properties; semiconductors and semiconductor devices; superconductivity; magnetic materials – hard and soft; dielectric and optical properties. 3 Credits Hours

Prerequisites:

- ENGR0022: Material Structure and Properties

Course Objectives

1. Understand the physical origins of electronic, magnetic, and optical properties of materials.
2. Predict how and why these properties vary between different types of materials.
3. Learn the operating principles of devices exploiting functional materials.
4. Choose appropriate materials for devices based on their functional properties.
5. Describe common methods for material synthesis and device fabrication.

Textbook and References

- **Textbook:** Rolf E. Hummel, *Electronic Properties of Materials*, (4th ed.), 2011; ISBN 978-1-4419-8163-9
- Charles Kittel, and Paul McEuen. *Introduction to solid state physics*. New York: Wiley, 1996.
- John J. Quinn, and Kyung-Soo Yi. *Solid state physics: principles and modern applications*. Springer Science & Business Media, 2009.
- Safa O. Kasap. *Principles of electronic materials and devices*. New York: McGraw-Hill, 2006.
- Laszlo Solymar, and Donald Walsh. *Electrical properties of materials*. Oxford university press, 2014.

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	Electrical Conduction 1
4	Mar. 23, 2021	Wave-Particle Duality
5	Mar. 30, 2021	Schrödinger Equation
6	Apr. 06, 2021	Energy Bands
7	Apr. 13, 2021	Electrons in Crystal
8	Apr. 20, 2021	Electrical Conduction 2
9	Apr. 27, 2021	**Midterm Exam** (Tentative)
10	May. 04, 2021	Semiconductor 1
	(**subject to change**)	
11	May. 11, 2021	Semiconductor 2
12	May. 18, 2021	Semiconductor Device
13	May. 25, 2021	Dielectric Materials and Insulation
14	Jun. 01, 2021	Magnetism Interpretation 1
15	Jun. 08, 2021	Magnetism Interpretation 2
16	Jun. 15, 2021	Optical Properties
17	Jun. 22, 2021	Final Review
18	**TBD**	**Final Exam**