MSE 1011: Structure and Properties Laboratory
Syllabus for 2026 Spring

Instructor: Dr. Yingjie Wu (Office: SCUPI N405; Email: yingjie.wu@scupi.cn)

Lecture: 2 Credits, Thursday, 10:15 am – 12:00 am, SCUPI N302 MSE Lab
Lab: Thursday, 10:15 am – 12:00 am, SCUPI N302 MSE Lab
Office Hours: Thursday, 1:50 pm – 4:50 pm, SCUPI N405
TA: Leyao Huo (Email: 2022141520052@stu.scu.edu.cn)
Lab Manager: Yuna Tu (Office: SCUPI N305; Email: yuna.tu@scupi.cn)
QQ Group: 1055662750
Prerequisites: ENGR 0022

Course Description:

This course provides a hands-on exploration of some of the concepts introduced in course ENGR 0022 Materials Structure and Properties. This will include microstructural evolutions during cold working and heat treatment with the observation of optical microscopy and scanning electron microscopy, phase changes in binary phase diagram, mechanical property testing using digital image correlation technologies. Also, Results obtained will be related to the theoretical knowledge and metallurgical mechanisms discussed in ENGR 0022.

Course Objectives:

The goals of this course are 1) to provide exposure to and familiarity with experimental techniques and data collection in materials science and engineering, 2) to develop techniques and approaches for data analysis – and insight what has been measured and why it matters, 3) to gain practice and mastery of scientific presentation in the form of written lab reports, and 4) to familiarize with advanced materials characterization methods for metallographic samples.

Applicable ABET Outcomes:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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. 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
4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
5. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

6. Acquire and apply new knowledge as needed, using appropriate learning strategies

Course Logistics:

Course meeting: Thursday, 10:15 to 12:00 am

i) Lectures will be held in SCUPI N302 MSE Lab
ii) Labs will be either in SCUPI N302 MSE Lab or TBA.
iii) You must keep this timeslot open, although we will not always fill it.

Prerequisites:

You must have taken:

i) ENGR 0022 – Materials Structure and Properties

You should have taken:

i) MEMS 0040 – Manufacturing Processes and Analysis (but not strictly required)

It is assumed that the student has a basic working knowledge of:

i) Phase diagrams: reading and understanding the diagrams, identifying phases and eutectics, solubility, and relative composition of phases.
ii) Basic kinetics: equilibrium cooling (i.e., through a phase boundary) and time-temperature-transformation diagrams.

Required Resources:

Required textbook:

There is no required textbook in this course.

Useful supporting materials:

1. Callister, W.D., and D.G. Rethwisch, ***Materials Science and Engineering: An introduction,*** 9th ed., Hoboken, NJ: Wiley, 2014. Print.
2. Vander Voort, G.F., ***Metallography: Principles and Practice***, Materials Park, OH: ASM International, 1999. Print.
3. Dieter, G.E., ***Mechanical Metallurgy***, 3rd ed., New York: McGraw-Hill, 1986. Print.
4. Périé, J.-N., and J.-C. Passieux, ***Advances in Digital Image Correlation (DIC)***, MDPI, 2020. Online.
5. Reimer, L., ***Scanning Electron Microscopy: Physics of Image Formation and Microanalysis***, 2nd ed., Berlin: Springer, 1998. Print.

Lab Safety Requirements:

A mandatory **LAB SAFETY TRAINING** guide will be uploaded to BlackBoard, please read it and complete the quiz. The students who ***CANNOT*** pass the quiz will not be allowed in lab.

Please always observe correct laboratory safety practices and instructions. A few highlights:

i) Wear eye protection and gloves when required.
ii) Do not come to the laboratory in shorts or open-toed sandals.
iii) Secure long hair when working with machinery with moving parts.
iv) Do not disturb laboratory equipment that is not used directly in the laboratory.

Grading Policies:

Requirements	**Corresponding Percentages**
Final Exam	30%
Lab Reports (6)	45%
Lecture & Lab attendance	25%

Grading Scale:

100% ≥ A ≥ 90%; 90% > A− ≥ 85%; 85% > B+ ≥ 80%; 80% > B ≥ 76%; 76% > B− ≥ 73%; 73% > C+ ≥ 70%; 70% > C ≥ 66%; 66% > C− ≥ 63%; 63% > D ≥ 60%; 60% > F.

Lab Reports:
There will be about five lab reports that will be submitted to Blackboard either as Word document or as pdf ***before the start of the class (10:15 am) on the due day***. If you are unable to attend a class, you may attach a note to your lab report and submit it in advance. ***If the lab report is submitted late, you would lose 10% per day. You may receive no credit if the lab report is not submitted within a week from the due day.***

Each lab report will be checked for plagiarism by using SafeAssign after your submission to BlackBoard. ***You may receive no credit, if the similarity score of your lab report is higher than 15%.***

The detailed format and contents of lab reports will be discussed in lectures.

Exams:
There will be a final exam in this course. The students need to be present during the exam. In case of an emergency (doctors notice), a make-up exam might be given. The only allowed things during the exams are electronic calculators and writing and drawing instruments. Paper and the exam sheet will be provided. Other computational tools, such as mobile phone, are not allowed.

A student found ***cheating***, ***attempting to cheat***, having an ***unauthorized device/tool*** during the exam ***independent of the reason*** will receive a zero on the exam.

Attendance:
Participation through presence but also reading the lab guides and getting prepared, answering questions, asking questions, getting hands-on in the lab, and contributing to activities is very important to improve active learning for each student. Therefore, your participation will be graded during each lecture starting with the second week.

Course Content (tentative):

WEEK	DAY	DATE	TOPIC	ROOM
1	Thu	3/12/26	**Lecture:** Introduction, review syllabus & lab safety training	N302
2	Thu	3/19/26	**Lecture:** Review on Fe-C binary phase, TTT and CCT diagrams	N302
3	Thu	3/26/26	**LAB 1:** Effects of microalloying elements on TTT and CCT diagrams determined by JMatPro software	N302
4	Thu	4/2/26	**Lecture:** Effects of annealing temperature and cold reduction on final microstructures of cold rolled materials	N302
5	Thu	4/9/26	**LAB 2**: Effects of transformation temperatures and cooling rates on austenite decomposition products	N302/TBA
6	Thu	4/16/26	**LAB 2**: Effects of transformation temperatures and cooling rates on austenite decomposition products	N302/TBA
7	Thu	4/23/26	**Lecture:** Nanoindentation	N302
8	Thu	4/30/26	**LAB 3**: Nanohardness measurements and analysis	N302
9	Thu	5/7/26	**LAB 3**: Nanohardness measurements and analysis	N302
10	Thu	5/14/26	**Lecture**: EBSD	N302
11	Thu	5/21/26	**LAB 4:** EBSD analysis of metallic materials	N302
12	Thu	5/28/26	**LAB 4:** EBSD analysis of metallic materials	N302
13	Thu	6/4/26	**Lecture:** Introduction to additivie manufacturing	N302
14	Thu	6/11/26	**LAB 5**: Additive manufacturing of polymer	TBA
15	Thu	6/18/26	**LAB 5**: Additive manufacturing of polymer	TBA
16	Thu	6/25/26	**Lecture:** Lab report review	N302
17	Thu	7/2/26	**Final exam (2 hrs)**	TBA