

MSE 405, Microstructure Determination, Spring 2021

Syllabus

Instructor:

Prof. Daniel Shoemaker, dpshoema@illinois.edu

Office: 1017 MRL

Office hours: by appointment

Teaching assistants:

Aravind Baby (baby2)

Sai Venkata Gayathri Ayyagiri (sva2)

Chengxi Zhao (chengxi2)

Keith Coffman (devonc2)

Online resources:

Compass: Course content, assessment, and grades

Campuswire: Discussion

Schedule:

Lectures held synchronously M and W, 1:00-1:50 pm. Available for download after.

In-person Lab sections M-F (per your signup) in 113A Ceramics, or Online Lab (Section O)

No lab session the first week of class (January 25-29)

Textbook:

Y. Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, 4th edition (you must be on IllinoisNet or Campus VPN to download)

<http://dx.doi.org/10.1002/9780470823002>

Additional Texts:

C. Hammond, The Basics of Crystallography and Diffraction

<http://dx.doi.org/10.1093/acprof:oso/9780198738671.001.0001>

C. Suryanarayana, X-Ray Diffraction: A Practical Approach

M. M. Woolfson, An Introduction to X-ray Crystallography

<http://dx.doi.org/10.1017/CBO9780511622557>

Useful software and databases:

VESTA – Crystal structure visualization

ASM Phase Diagrams Database

Inorganic Crystal Structure Database (ICSD)

SDBS Spectroscopy Database (organic), RRUFF Mineral Database (inorganic)

ImageJ – Quantitative image analysis

ISOTROPY – Powder diffraction simulations

Paid software available in labs or EWS: Jade, Diamond, Matlab, Mathematica

Learning objectives:

Your goal as a student in this course is to understand the fundamentals of crystallography, diffraction, spectroscopy, and microscopy. You should be able to choose and apply these methods to characterize the microstructure of materials.

Exams:

There will be one final examination. The final exam will be comprehensive, covering lecture and laboratory content.

Pre-lecture problems:

You are expected to complete the reading and Compass-driven pre-lecture problems by noon before each class. Pre-lecture points are assigned per day, with two submission attempts and a 50% credit for incorrect responses. The lowest two days will be dropped for each student.

Homework:

There are no standalone homework assignments in MSE 405. In-depth homework-style problems are included where they are most relevant: laboratory reports (including prelab questions therein), and daily questions.

Laboratory:

The laboratory experiments will give you hands-on experience in x-ray diffraction, optical microscopy, scanning electron microscopy, and Raman spectroscopy. Your lab group will be assigned in the first week of class and will be the same for the whole semester.

Prelab assignments:

There are no standalone prelab assignments. Prelab-style questions are included as part of the previous week's lab report.

Lab reports:

Reports are completed in question-and-answer format and are **due on Compass by 9:30AM on the day of your next lab session**. The final lab report will be due one week after your lab session. You will work in groups of ~3. You will upload an **individual report** PDF each week. A penalty of 30% per day (*including* weekend days) will be taken for late lab reports.

Effort of lab group members:

All members of each lab group should perform their fair share of the work involved. **Data** should be shared between group members. **Figures** and **text** should be prepared individually. If you are concerned that a member of your lab group is not contributing adequately, work as a team to divide responsibilities and deadlines fairly. If the problem persists, corrective actions can be taken in consultation with Prof. Shoemaker.

Attendance:

The TAs will take attendance. If you need to be absent from a lab for a justified reason (sickness, family emergency) contact your TA *and* Prof. Shoemaker via Campuswire immediately. Your TA will arrange for you to make up the session. Non-emergency absences (e.g. conference attendance, job interviews) must be notified **at least 7 days prior, since your makeup lab session may be before your normal time**. Unexcused absences result in a 50% penalty for that report, and zero credit for any subsequent unexcused absences. Late arrival to lab is disruptive and disrespectful to your groupmates, and will be penalized by 30% per report.

Ethics:

Plagiarism of text, data, figures, graphs, etc., is prohibited. Instances of plagiarism will result in at least a **triple-zero grade** for the assignment for all authors. Please read and understand the rules:

<http://engineering.illinois.edu/online/current-students/policies/academic-integrity.html>
http://studentcode.illinois.edu/article1_part4_1-401.html

Instances in which answers are copied (from *any source*, including references, classmates, data from previous years, or old answer sets) will result in sanctions in accordance with the Illinois Student Code, which may include immediate failure in the course. **Members of the same lab group turning in partially identical lab reports or prelabs is plagiarism. Pasting text from a source is plagiarism. Using someone else's plot is plagiarism. You are responsible for preparation of your own unique figures and text, although the underlying data may be the same.** All reports are checked automatically via SafeAssign against each other and web sources. Incidents are reported via the campus-wide FAIR system in accordance with the Student Code.

Safety is of paramount importance:

You must complete 3 DRS trainings and submit the proof of completion via Compass by **9:30 am of the second day of lecture. See lecture 1 slides for details. You must do this even if you are doing lab online.** We will not tolerate unsafe operating procedures or behavior. Read the safety instructions at the start of each lab manual before beginning work. Always follow the TA's instructions and proper safety protocols. The laboratory contains high voltage, powerful lasers, chemical hazards, and high temperature equipment.

You are required to bring your own **mask, safety glasses, closed-toe shoes, and long pants** to every laboratory. No food or drink is allowed in 113A Ceramics. You are not considered present for lab until you are participating with safe attire.

Graphics and Plotting Software:

Any software can be used to create effective graphs and figures, but some are more effective or efficient than others. Some suggestions:

Data plotting: Matlab, Octave, Mathematica, Grace, Origin, R, gnuplot, matplotlib

Graphics: GIMP (raster), Photoshop (raster), Inkscape (vector), Illustrator (vector)

Grading:

The following weighting factors will be used to determine your final grade:

15% Pre-lab questions, including other in-class activities

60% Lab reports (x12)

25% Final exam

Grades will be assigned using the following scale. Round to the nearest integer.

A+ (98–100) B+ (88–90) C+ (78–80) D+ (68–70)

A (94–97) B (84–87) C (74–77) D (64–67)

A– (91–93) B– (81–83) C– (71–73) D– (61–63)

At my discretion, the minimum score needed to earn a certain letter grade may be lowered, but it will not be raised.

Thank you. I look forward to an excellent semester together!