MSE 405, Microstructure Determination, Spring 2019
Syllabus

Instructor:
Prof. Daniel Shoemaker, dpshoema@illinois.edu
Office: 1017 MRL
Office hours: by appointment

Teaching assistants:
Joseph Flanagan     jcflana2     Optical Microscopy + SEM
Zhelong Jiang       zjiang18     XRD + Raman
Gregory Kutyla      kutyla1      XRD + Raman
Devon Samuel        devonms2     Optical Microscopy + SEM

Online resources:
Compass: Course content, assessment, and grades
Piazza: Discussion

Schedule:
Lectures held M and W, 1:00-1:50 pm in 114 Transportation Building
Lab sections held M-F (per your signup), 2:00-4:20 pm in 113A Ceramics Building

Textbook:
Y. Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, 4th edition
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
EMAPS – Electron diffraction simulations
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.

**Clickers and Daily problem:**
Some lectures will include a clicker-driven “daily problems” that will cover the material of the assigned reading. You are expected to complete the reading and problems before class. Clicker points are assigned per day. The lowest two clicker days will be dropped for each student.

**Homework:**
There are no standalone homework assignments in MSE 405 this year. The problems from old homeworks have not disappeared. They have been built into the prelabs, laboratory reports, and clicker questions.

**Laboratory:**
The laboratory experiments will give you hands-on experience in x-ray diffraction, optical microscopy, scanning electron microscopy, and Raman spectroscopy.

**Prelab assignments:**
Prelabs are posted on Compass and must be completed individually before arriving in lab. Each time you start a new lab module (e.g. SEM session 1), you must submit the prelab via Compass. For subsequent sessions (e.g. SEM session 2), the prelab questions are included in the previous (e.g. SEM 1) lab report.

**Prelabs and lab reports are due by 12:30PM on the day of 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. Reports are due at 12:30PM on the day when you begin the next experiment (typically 1 week, but you get an extra week over spring break).

**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 immediately. Your TA will arrange for you to make up the session on a different day. Non-emergency absences (e.g. conference attendance, job interviews) we 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.

**Ethics:**
Plagiarism of text, data, figures, graphs, etc., is strictly prohibited. Instances of plagiarism will result in at least a 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, or old answer sets) will result in sanctions in accordance with the Illinois Student Code, ranging from a zero grade for that assignment to immediate failure in the course. **Members of the same lab group turning in partially identical lab reports or prelabs 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.

Sharing clickers is a quick way to instantly fail the entire course, and is not worth the meager points. Don’t bother.

**Safety is of paramount importance:**
You must complete 3 DRS trainings and submit the proof of completion via Compass by noon of the second day of lecture. 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 **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 show up with safe attire. Like an absence, showing up late will result in a 30% penalty for that lab report.

**Graphics and Plotting Software:**
Any software can be used to create effective graphs and figures, but some are more effective 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% Clicker questions, including other in-class activities
- 5% Standalone Prelab assignments (x4, +1 DRS training)
- 55% Lab reports (x12)
- 25% Final exam

Grades will be assigned using the following scale:

- A+ > 98%
- A > 93%
- A- > 90%
- B+ > 88%
- B > 83%
- B- > 80%
- C+ > 78%
- C > 73%
- C- > 70%
- D+ > 68%
- D > 63%
D-  > 60%
F  < 60%

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!