

EMA6507L: Scanning Electron Microscopy Laboratory

Summer C 2016

1 Credit

Pre-/co-requisite: EMA6507

Classroom location: NRF 134

Meeting times: TBD (once per week for about 1 h, in pairs)

A. Instructor information

Dr. Nicholas G. Rudawski

Office location: 203 Nanoscale Research Facility (building #0070)

Office phone: (352) 392-3077

E-mail: ngr@ufl.edu (preferred contact method)

Office hours: by appointment only (please do not come to my office unannounced)

Class website: run through e-learning in canvas at <https://lss.at.ufl.edu/>

B. Course description and objectives

This course provides a hands-on introduction to the operation of scanning electron microscopes (SEMs) and related instrumentation and analysis of SEM-related data as emphasized for materials scientists and those studying the physical sciences.

Specifically, the following topics will be covered:

- SEM-related instrumentation (specimen holders, detectors, etc.)
- Operation and alignment of an SEM
- Relationship between SEM operating parameters and resulting SEM data
- Demonstrations of atomic number and topographical contrast
- Analog and digital contrast/brightness adjustment of SEM images
- Working with SEM imaging parameters (pixel size, dwell time, etc.)
- High-resolution SEM imaging
- Energy dispersive spectroscopy

These topics will all build around the course goals of being able to independently operate the FEI Nova NanoSEM 430 at the Nanoscale Research Facility and understand/analyze SEM-related data (images, spectra, etc).

C. Course outline

A. Tentative course schedule (subject to change)

Week	Topic(s)
05/16/16	Specimen holders; specimen adhesives; instrument/operating software introduction; loading/unloading specimens; free-field mode alignment
05/23/16	Loading/unloading specimens; free-field mode alignment; effect of spot size on image resolution and signal

05/30/16	Loading/unloading specimens; free-field mode alignment; controlling depth of field via working distance
06/06/16	Loading/unloading specimens; alignment; operating in immersion mode; immersion mode limitations (magnification and working distance)
06/13/16	Loading/unloading specimens; alignment; detector selection (ETD vs. TLD) and configurations (bias)
06/27/16	Loading/unloading specimens; alignment; manual contrast/brightness adjustment; image adjustments (histograms)
07/04/16	Loading/unloading specimens; alignment; topographical contrast
07/13/16	Loading/unloading specimens; alignment; atomic number contrast
07/18/16	Loading/unloading specimens; alignment; settings for performing EDS (voltage, spot size, working distance); EDS spectrum acquisition
07/25/16	Loading/unloading specimens; alignment; settings for performing EDS (voltage, spot size, working distance); EDS mapping
08/01/16	Driver's tests

B. List of assessments

1. Weekly quizzes (50% of final score)

All quizzes will be composed of true/false questions; each quiz take 10 min, will contain 5 questions, and will be graded as follows: 100% for 4 or 5 questions correct; 75% for 3 questions correct; 50% for 2 questions correct; 25% for 1 question correct; 0% for 0 questions correct. Quizzes will be graded *immediately* after being taken to give you immediate feedback.

2. Driver's test (50% of final score)

Towards the end of the term, each student will take a time-constrained "Driver's test" on the FEI Nova NanoSEM, which covers basic instrument operating and data collection. A detailed list of what is contained on the Driver's test will be disseminated a few weeks into the course. *Unlike the weekly quizzes, grading of the driver's tests will be more subjective in nature and driver's test grades will not be determined until completion of the driver's test by all students.* In addition to comprising 50% of the student's final score, passing of the driver's test will complete the student's training on the instrument and allow him or her to start unsupervised usage. Lastly, to encourage a little healthy competition, the top 3 performers on the driver's test will have their lowest quiz grades changed to full credit.

C. Make-up lab policy

Make-ups for missed labs and/or quizzes will not be given except in cases of extenuating circumstances (illness, etc). *If you are planning on traveling to a scientific conference at some point during this term, you have until 5:00 PM Friday, 05/20/16 to notify me of this so I can plan accordingly.* If you feel you will be unable to be present for a lab or quiz due to extenuating circumstances known in advance, you should contact me *beforehand* for me to evaluate the situation and determine if something can be worked out.

D. Attendance and classroom conduct

Attendance is not optional; If any lab is missed without being made up, the student will fail the course and only absences for legitimate reasons may be made up; if you were not present for a lab, you are still responsible for the material that you missed that will likely be included on the following week's quiz. During the labs, please be respectful and pay attention; *silence your cell phones and put them away;* please do not bring in and read newspapers during lab; you may bring in your laptop computers to take digital notes, but please do not use your computers for leisurely activities (aimlessly surfing the internet, accessing social networking sites, etc.).

E. Grading procedure

At the end of the term, students will be ranked in terms of final scores. Different letter grades will be assigned to distinct groupings of scores (i.e., the top group will receive A and A- grades, the next group will receive B+ through B- grades, etc.); thus, you are effectively been graded relative to the performance of the rest of the students in the case. *There is no predetermined or preset scale for grading,* but I will give projected final grades at certain points throughout the term. Based on my experience running similar laboratory courses previously, I expect grades to be high and no lower than B range. Greater information on current UF policies for assigning grade points may be found at: <http://gradcatalog.ufl.edu/>.

F. Academic misconduct

Academic misconduct (cheating, plagiarism, leaking of quiz questions, etc.) is a very serious matter and will not be tolerated in any capacity; all students are required to abide by the Student Honor Code as described in detail at:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

It is the responsibility of you, the students, to understand what does and does not constitute a violation of the student honor code. If I believe any student violated the student honor code, he/she will be reported immediately to academic services in the MSE department, fully investigated, and (if necessary) properly sanctioned.

G. Accommodations for students with disabilities

Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.