PHYS 296: Microstructure & Surface Analysis. Spring 2022

Section A
Credits: 1
Class Times:
T, 13:15-14:30
Discovery Hall W403

Instructor:
Matthew White
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Office Hours: F, 13:00 - 15:00 or by appointment
Phone: (802) 656-0064

Course Description: This class will explore the theory and practical operation of several advanced techniques to analyze the structure, composition, and surfaces of micro and nano-scale materials. Students will be fully trained as users of a Field Emission Scanning Electron Microscope (FESEM) including x-ray elemental analysis. There will be five practical assignments and a final presentation.

Prerequisite: PHYS 128 or equivalent.

Online Communication Resources: All students must have reliable access to the University of Vermont Blackboard course website. This access requires internet connection, which is free of charge for all UVM students while on campus. You will need your UVM net ID and password to log into the Blackboard system. All supplementary course materials, course updates and announcements will be made via the Blackboard system. **It is the student responsibility to check his/her UVM email and Blackboard course website for updates regularly.**

Assignments: The five assignments will be completed in pairs (or small groups depending on enrollment) as follows:

1. Obtain training certification for the FESEM and all relevant detectors.
2. High resolution imaging: Obtain high-quality images of dimensional standards at multiple magnification scales and high resolution images of gold nanoparticles on carbon.
3. Resolve the surface topography and the chemical composition of the same location on a duplex brass standard using secondary electron and backscatter detectors.
4. Use Energy Dispersive Spectroscopy (EDS) to identify the chemical composition of an unknown mineral standard.
5. Obtain images of a non-standard sample of your choice. *Graduate students must produce publication quality images of a research-relevant sample.

Presentation: Working in groups (size to be determined), students will prepare and present a final presentation covering one theoretical aspect of the FESEM operation, and showing the results of the imaging and analysis assignments.
*Graduate students will provide a written report in the style of a journal article summarizing all of their imaging and EDS analysis. Report will include introduction, results and discussion, and experimental details. The report will be evaluated both on the quality of the imaging, the analysis, and the science-writing. with half of the grade for the final presentation will be based on the oral presentation and half based on the written report.

Course Grades: Each student will receive a grade based on the grades of the assignments and the final presentation. The individual components will be scaled and converted to letter grades according to:

Assignments	75% (15% each)
Presentation	25%

A	=	90 - 100%
B	=	80 - 89.9%
C	=	70 - 79.9%
D	=	60 - 69.9% (only for undergraduate students)
F	=	59.9% or below *(69.9% and below for graduate students)

Within each letter grade, the + and - will indicate above and below the corresponding 7% and 3%. For example, grades above 77% but below 80% will receive a C+. All grades will be posted on Blackboard to ensure privacy. It is each student's responsibility to verify the accuracy of the postings regularly. **Report any discrepancies promptly.**

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Academic Dishonesty Disclosure:

Academic dishonesty **will not be tolerated.** Perceived failures to abide by the standards of academic integrity will be prosecuted as set forth in the University of Vermont Code of Academic Integrity. The code states the four standards of academic integrity: that students may not plagiarize, fabricate, collude, or cheat. Note that there is a great but subtle difference between collusion and collaboration. Collaboration is one of the greatest tools for learning and creativity in science, and is highly encouraged. This will help you to expand your perspective and your arsenal of problem solving techniques.

Student Learning Accommodations:
In keeping with University policy, any student with a documented disability interested in utilizing ADA accommodations should contact Student Accessibility Services (SAS), the office of Disability Services on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan. Due to the format of the exams, if extra time is needed you are strongly encouraged to discuss your options with the course instructor as soon as possible.
Contact SAS:
A170 Living/Learning Center
802-656-7753
access@uvm.edu
uvm.edu/access.

Religious Holidays:
Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time. The complete policy is here.

Discrimination:
The University of Vermont, including its Schools and Colleges, seeks to maintain a safe learning, living, and working environment. To that end, the University of Vermont strictly prohibits discrimination against, and harassment of, its students, employees, and affiliates on the basis of an individual's membership in a legally protected category as defined in the University's Equal Opportunity in Educational Programs and Activities and Equal Employment Opportunity/Affirmative Action Policies. Any act that falls within the definition of Sexual Misconduct constitutes discrimination or harassment and is a violation of this Policy. Furthermore, the University strictly prohibits retaliation. For more information and resources, please refer to the University's discrimination policy.

Course Evaluation:
All students are expected to complete an evaluation of the course at its conclusion. The evaluations will be anonymous and confidential, and the information gained, including constructive criticisms, will be used to improve the course.