Course Information:

CH410 (CRN 42591)/PHYS410 (CRN 42690), 4 credits

Prerequisites: CH223 or CH226H or PHYS253

Instructors:

- Kurt Langworthy, klangwor@uoregon.edu
- Josh Razink, jrazink@uoregon.edu
- Valerie Brogden, vbrogden@uoregon.edu
- Julie Chouinard, jbarkman@uoregon.edu
- Stephen Golledge, golledge@uoregon.edu

Time: Mondays and Wednesdays, 10:00am -11:20am

Location: Knight Campus 1, Room #108

Office hours: Mondays and Wednesdays, 11:30am-12:30pm. To be held the instructors’ office in CAMCOR/Lokey Laboratories.

- Kurt: #150A (at the top of the stairs before you head down into CAMCOR)
- Josh: #66
- Valerie: #70
- Julie: #74
- Steve: #64

Important Dates: Midterm Exam (7/24) and Final Exam (8/16)

Course Description:

This course will introduce students to advanced techniques on several analytical instruments. Students will learn how techniques such as Scanning Electron Microscopy (SEM), Focused Ion Beam (FIB), Transmission Electron Microscopy (TEM), Electron Probe Microanalysis (EPMA), and X-ray Photoelectron Spectroscopy (XPS) are applied to materials science and receive live demos on each instrument.

Grade Assessment:

Students grade will be based on a midterm (40%) and cumulative final (60%):
**Midterm Exam:** This exam will cover all material presented in class and reading assignments from the first half of the course (SEM, FIB, and EPMA). The test format will include short answer and essay questions. It will be held during regular class hours on Wednesday, July 26\textsuperscript{th}.

**Final Exam:** This final comprehensive exam will cover all material presented in class and reading assignments during the quarter, with an emphasis on material covered following the mid-term exam (XPS and TEM). The test format will include short answer and essay questions. It will be held during regular class hours on Wednesday, August 16\textsuperscript{th}.

**Grade Scale:**

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<thead>
<tr>
<th>Grade</th>
<th>Percentage Range</th>
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<tbody>
<tr>
<td>A+</td>
<td>98%-100.00%</td>
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<tr>
<td>A</td>
<td>94%-97.99%</td>
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<tr>
<td>A-</td>
<td>90%-93.99%</td>
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<tr>
<td>B+</td>
<td>87%-89.99%</td>
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<td>B</td>
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<td>C+</td>
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<td>D+</td>
<td>67%-69.99%</td>
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<tr>
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<td>64%-66.99%</td>
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<tr>
<td>D-</td>
<td>60%-63.99%</td>
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**Course Schedule:**

**June 26\textsuperscript{th} and 28\textsuperscript{th}**

**Scanning Electron Microscopy (SEM) Lectures:**

- Understand basic theory of electron beam: sample interactions and how backscattered and secondary electrons are generated, collected and interpreted
- Learn the basic theory of energy dispersive x-ray spectroscopy (EDS) and how to collect and interpret an x-ray spectra

**July 3\textsuperscript{rd}**

**SEM and FIB demonstrations**

**July 5\textsuperscript{th} and 10\textsuperscript{th}**

**Focused Ion Beam (FIB) Lectures:**

- Understand how a liquid metal ion source (LMIS) works and compares with a plasma-FIB (PFIB)
Learn the effect of various beam currents and energies
Get exposure to basic FIB applications: cross sections, depositions, and TEM prep

July 12th, 17th and 19th

Electron Microprobe Analysis (EPMA) Lectures and Demonstration:

- Understand the fundamentals of electron interactions in solid materials relevant to EPMA
- Learn about wavelength dispersive x-ray spectroscopy (WDS) and how it compares with EDS
- Get an overview of data corrections required and applications for this technique

July 24th

Midterm

July 26th, 31st, and August 2nd

X-Ray Photoelectron Spectroscopy (XPS) Lectures and Demonstration:

- Learn the basics of the photoemission process, quantitative XPS analysis, and its limitations
- Understand why some elements give rise to multiple photoelectron peaks, the physical basis of bonding-related peak shifts, and the information that is gained by determining exact peak positions
- Explore multiple strategies for generating subsurface data and the physical basis for surface sensitivity

August 7th, 9th and 14th

Transmission Electron Microscopy (TEM) Lectures and Demonstration:

- Learn about the use of TEM and STEM in materials science
  - Understand the types of data one can collect on a TEM/STEM and how they can be used to understand the composition, structure, morphology, and dimensions of materials
  - Get an introduction to basic operations of the tool and the theory behind them

August 16th

Final Exam
Course Policies

Grading, Assignments, & Examinations: There will be no "make-ups" on any exams. Exceptions and extensions to this policy are rare and will only be given in the event of documented emergencies. You must notify instructors as soon as possible if you experience an emergency that will prevent you from completing an assignment on time or attending an exam. *Plagiarism or any other form of cheating will result in an automatic grade of F.* All materials submitted for evaluation must be legible. Please retain copies of all work submitted and the original copy of all work returned to you during the quarter until the final course grade has been posted. In the event of any question concerning whether grades have been accurately recorded, it is your responsibility to provide these copies as documentation.

Cancellations: Instructors will try to post on Canvas and email an announcement of any lecture cancellations/changes with as much advanced notice as possible. In the event of inclement weather and the university is closed we will also not be meeting and will try to make up missed material in the remaining classes or schedule a make-up lecture if possible.

Academic Misconduct: The University Student Conduct Code (available at conduct.uoregon.edu) defines academic misconduct. Students are prohibited from committing or attempting to commit any act that constitutes academic misconduct. By way of example, students should not give or receive (or attempt to give or receive) unauthorized help on examinations without express permission from the instructor. Students should properly acknowledge and document all sources of information (e.g. quotations, paraphrases, ideas) and use only the sources and resources authorized by the instructor. If there is any question about whether an act constitutes academic misconduct, it is the students’ obligation to clarify the question with the instructor before committing or attempting to commit the act. Additional information about a common form of academic misconduct, plagiarism, is available at [http://library.uoregon.edu/guides/plagiarism/students/index.html](http://library.uoregon.edu/guides/plagiarism/students/index.html).

Accessibility: The University of Oregon is working to create inclusive learning environments. Please notify me if there are aspects of this course that result in disability related barriers to your participation. For more information or assistance, you are also encouraged to contact the Accessible Education Center, 164 Oregon Hall, 346-1155; website: [http://aec.uoregon.edu/](http://aec.uoregon.edu/).