Please consider the following course as a new permanent course:

MATS 679 PRINCIPLES OF TRANSMISSION ELECTRON MICROSCOPY
Instructor: Melissa K. Santala
4 lecture credits

This lecture-only graduate course covers principles of transmission electron microscopy (TEM) including instrument components, electron optics, electron diffraction, and the origins and interpretation of image contrast. Coverage of experimental techniques will focus on those useful for addressing problems in materials science. This course is intended to help graduate students understand an experimental tool that is used very widely in materials science and other fields of engineering and physical sciences. It is also intended to help students using TEM in their research make more effective use of the instrument and the resulting, however it is not a hands-on laboratory class. There is very little overlap with existing MATS and ME courses or courses offered in other departments at the university.

This course has been taught once before as a MATS 599 course. The course content is planned to be the same as when taught as MATS 599 in Spring 2017, however, in that offering Transmission Electron Microscopy Transmission by D.B. Williams & C.B. Carter was used as the required text and Electron Microscopy and Diffractometry of Materials by B. Fultz & J.M. Howe was used as a supplemental text. In future offerings, the text by Fultz & Howe will be used as the required text and the text by Williams and Carter will be the supplemental text.

In its offering as a MATS 599 course, ten students were enrolled. Of the ten, eight students responded to the Student Evaluation of Teaching. The course as a whole (question 1) received a mean evaluation of a 5.6 (department and university means were 4.7 and 4.9, respectively, for the same quarter). It is proposed that the course be offered once every other year with the next offering in Spring 2019.

With regard to scheduling: this course should not conflict with MATS 509, MATS 555, MATS 571, MATS 578, MATS 581, MATS 584, MATS 587, MATS 588, and MATS 671.

A syllabus for the course is below.
**MATS 679  **  **PRINCIPLES OF TRANSMISSION ELECTRON MICROSCOPY**  **(4 lecture credits)**

<table>
<thead>
<tr>
<th>Description</th>
<th>This course will cover basic principles of transmission electron microscopy (TEM) including instrument components, electron optics, electron diffraction, and the origins and interpretation of image contrast. Spectroscopic techniques will be covered, but diffraction and imaging techniques will be emphasized. Coverage of experimental techniques will focus on those useful for addressing problems in materials science. Familiarity with the basic concepts of diffraction, crystallography, and electron wave functions will be assumed.</th>
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<tr>
<td>Prerequisites  (uninforced)</td>
<td>MATS 570 and either CH 616 or MATS 555, or equivalent. Interested students are encouraged to talk to the instructor about course equivalents or other experience (e.g. self study) that will ensure they have the necessary prerequisite knowledge.</td>
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| Course Objectives | By the completion of this course, it is expected students will be able to:  
1. Describe the role of the major components in a TEM column  
2. Index and interpret electron diffraction patterns  
3. Describe the origins of contrast in TEM images  
4. Describe the most commonly used spectroscopic techniques  
5. Describe the experimental strengths and limitations of TEM |
| Instructor | Melissa K. Santala |
| Course content | TEM components:  
- Electron sources, electron optics  
- Optical aberrations  
Principles of electron diffraction:  
- Scattering  
- Structure factors  
- Reciprocal lattice  
- Ewald's sphere  
- Diffraction groups, point groups, space groups  
Electron diffraction techniques:  
- Selected area diffraction and microdiffraction  
- Convergent beam electron diffraction (CBED)  
- Kikuchi electron diffraction  
Principles of electron imaging:  
- Origins of imaging contrast  
- Diffraction contrast and defect analysis  
- Phase Contrast  
- Inelastic scattering  
Electron imaging techniques:  
- Bright field, dark field imaging  
- Phase contrast imaging (high resolution TEM)  
- Scanning transmission electron microscopy (STEM)  
Spectrometry |
| Textbooks | Required: B. Fultz & J.M. Howe, *Transmission Electron Microscopy and Diffractometry of Materials*  
### Evaluation
Course grades will be derived from performance on exams (one midterm and one final) and homework assignments. Credit will be assigned as follows:
- Homework: 30%
- Mid-term: 30%
- Final: 40%

### Regarding Student with Disabilities
Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at [http://ds.oregonstate.edu](http://ds.oregonstate.edu). DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

### Brief Basic Needs Syllabus Statement
Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Human Services Resource Center (HSRC) for support ([hsrc@oregonstate.edu](mailto:hsrc@oregonstate.edu), 541-737-3747). The HSRC has a [food pantry](#), a [textbook lending program](#) and other resources to help. Furthermore, please notify the professor if you are comfortable in doing so. This will enable them to provide any resources that they may possess.

### Student Conduct
Academic dishonesty (including – but not limited to - plagiarism, fabrication of data, cheating on exams, or assisting cheating) will not be tolerated and will be handled according to Oregon State University policies: [http://studentlife.oregonstate.edu/studentconduct/offenses-0](http://studentlife.oregonstate.edu/studentconduct/offenses-0)