

**Physics 4230/7230      Fall 2014**  
**Electron Microscopy and Microanalysis**

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**Text:** *Scanning Electron Microscopy and X-ray Microanalysis*, Goldstein et al. Plenum,  
*Transmission Electron Microscopy: a Textbook for Materials Science*, Williams and  
 Carter, 2<sup>nd</sup> edition

**Lectures:** Connaway 316, TR 2:30-3:45 – with a few exceptions

**Demos/Labs:** Electron Microscopy Core, W125-W137 Veterinary Medicine Bldg (basement)

| <b><u>DATE</u></b> | <b><u>FORMAT</u></b>      | <b><u>TOPIC</u></b>  |
|--------------------|---------------------------|--|
| 8/26               | <a href="#">Lecture 1</a> | Course Outline; Lab Schedules; Intro to SEM; Vacuum Systems & EMC Tour |
| 8/28               | <a href="#">Lecture 2</a> | Electron Optics; Interaction Volume, Signal and Image Formation        |
| 9/2-5              | Lab 1                     | SEM: Basic Operating Parameters (Hitachi S-4700)                       |
| 9/8-12             | Lab 2                     | SEM: Basic Beam/Specimen Interactions (Hitachi S-4700)                 |
| 9/15-19            | Lab 3                     | SEM: High Resolution Imaging (Hitachi)                                 |
| 9/23               | <a href="#">Lecture 3</a> | Specimen Preparation and Variable Pressure SEM                         |
| 9/25               | <a href="#">Lecture 4</a> | EDS in SEM   |
| 9/29-10/3          | Lab 4                     | SEM: LV Operation and Imaging (FEI Quanta 600F)                        |
| 10/6-10            | Lab 5                     | SEM/EDS Qualitative Analysis: (FEI Quanta 600F/NSS 6)                  |
| 10/14              | <a href="#">Lecture 5</a> | Introduction to TEM 1  |
| 10/16              | <a href="#">Lecture 6</a> | Introduction to TEM 2  |
| 10/20-24           | Lab 6                     | TEM: Direct Alignments and High Resolution Imaging                     |
| 10/28              | <a href="#">Lecture 7</a> | Introduction to Scanning TEM and EDS                                   |
| 10/30              | <a href="#">Lecture 8</a> | Introduction to Energy Filtered TEM and EELS                           |
| 11/3-7             | Lab 7                     | TEM: Scanning TEM and EDS  |
| 11/10-14           | Lab 8                     | TEM: Energy Filtered TEM and EELS                                      |
| 11/18              | Rm 316                    | Abstract Presentations for Individual Projects                         |
| 11/20              | Rm 316                    | Abstract Presentations for Individual Projects                         |
| 11/24-28           | EMC                       | Thanksgiving Break (Individual Projects)                               |
| 12/1-5             | EMC                       | Individual Projects  |
| 12/8-12            | EMC                       | Individual Projects  |
| 12/16              | Rm 316                    | Individual Project Presentations                                       |
| 12/18              | Rm 316                    | Individual Project Presentations                                       |
| 12/19              |                           | Final Project Report Due   |

## Class Policy

1. 12 students maximum.
2. Grades:

|                     |   |
|---------------------|---|
| Lab reports         | 60%   |
| Individual Projects | 40% (25% abstract presentation, 25% final presentation, 50% final report) |

Penalty for late homework: 10% off each day being late. Exceptions apply depending on circumstances.
3. 8 lectures, 8 labs, 8 lab reports.
4. Each student has 1 hour consulting time prior to projects: sample prep, decision on scope time on Quanta (EDS), Hitachi (imaging) or Tecnai. Small to moderate number of samples can be characterized (this is for class projects only).
5. Scope time is non-transferrable to other peers in your lab.
6. Cancellations or rescheduling on scope have to be at least 24 hours prior to appointments.

This policy applies to labs, consulting time and individual projects time. Last minute notice will be subject to loss of your hours on scope.

### **History of the Scanning Electron Microscope**

<http://inventors.about.com/gi/dynamic/offsite.htm?zi=1/XJ&sdn=inventors&cdn=money&tm=65&f=00&tt=2&bt=0&bts=1&zu=http%3A/www2.eng.cam.ac.uk/%7Ebc/cwo1.htm>

### **Journals**

Microscopy Today <http://www.microscopy-today.com/>

Microscopy and Analysis <http://www.microscopy-analysis.com/>

Materials Today <http://www.materialstoday.com/>

Scanning <http://www3.interscience.wiley.com/journal/113412420/home?CRETRY=1&SRETRY=0>

Microscopy and Microanalysis <http://journals.cambridge.org/action/displayJournal?jid=MAM>

### **Societies**

Microscopy Society of America <http://www.microscopy.org/>

Microbeam Analysis Society <http://www.microbeamanalysis.org/>

Central States Microscopy & Microanalysis Soc. <http://www.emc.missouri.edu/csmms/>

### **Meetings**

Microscopy and Microanalysis 2015 <http://www.microscopy.org/MMMeetings/MM015/HomePage.html>

### **Web resources from FEI**

<http://www.fei.com/resources/student-learning.aspx>

<http://www.fei.com/resources/web-resources.aspx>

### **Vacuum Pumps and Technology**

[http://en.wikipedia.org/wiki/Vacuum\\_pump](http://en.wikipedia.org/wiki/Vacuum_pump)

[http://www.svc.org/EP/EP\\_FeatureGuide.html](http://www.svc.org/EP/EP_FeatureGuide.html)

[http://www.barc.ernet.in/webpages/technologies/tsip\\_br/tsip\\_br.html](http://www.barc.ernet.in/webpages/technologies/tsip_br/tsip_br.html)