MSE 6741 Syllabus

Objective:
The object of this course is to teach you practical aspects of TEM operation. There will be a
lecture/demonstration and a 3 hour laboratory per week. Topics will include
• Operation and alignment of the TEM
• Calibration of and the TEM
• Electron Diffraction
• Bright Field, Dark Field, and STEM imaging.
• X-ray analysis in the TEM.

Grading:
Grading is based on lab reports that you will write during the course and on a practical exam at the
end of the term. The practical exam counts the same as one lab report. Unexcused class absences
will factor into the grade. Late reports will also receive a grade penalty.

The laboratory notebook should be a record of all your observations during the lab sessions as well
as discussion of your results. Photomicrographs and diffraction patterns should be printed and
included in your notebooks/reports and sized so as to be legible. You must include all your data so
that we can follow your analysis. You may share the micrographs of your lab session with your
partners, but you are expected to write the lab report individually. Lab reports are due one week
after the lab. In any event, lab reports will not be accepted any later than 5:00 pm on the final day of
class. You may practice for the practical exam any time after the last lab has finished. It is your
responsibility to contact me to schedule your practical. It may be scheduled any time before the end
of finals.

Assumed Knowledge:
You should have some knowledge of elementary crystallography and reciprocal lattice construction.
You should understand Bragg’s Law and the Ewald sphere construction. You can find a good
introduction to the TEM at http://www.materials.ac.uk/elearning/matter/. There is also a
somewhat simpler introduction to TEM at the MyScope site (http://www.ammrf.org.au/myscope/).

Tentative Schedule (subject to revision)
The lab times will be arranged individually with the TA.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lab</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/8/19</td>
<td>Basic operation I</td>
<td>SEM vs. TEM, identification of column parts, gun operation, saturation, gun tilt/trans, condenser aperture, condenser stigmation</td>
</tr>
<tr>
<td>2</td>
<td>1/15/19</td>
<td>Basic Operation II</td>
<td>Eucentric height, rotation center, objective aperture, focus (grain, fresnel fringes), Objective stigmation.</td>
</tr>
<tr>
<td>3</td>
<td>1/22/19</td>
<td>Basic Operation III</td>
<td>Digital camera basics, taking photos, exposure, magnification calibration, sample exchange</td>
</tr>
<tr>
<td>4</td>
<td>1/29/19</td>
<td>Diffraction</td>
<td>Polycrystal/single crystal, Braggs Law (small angle), Selected area diffraction, reciprocal lattice, camera length calibration, microscope effect on diffraction</td>
</tr>
<tr>
<td>5</td>
<td>2/5/19</td>
<td>BF/DF/ single crystal diffraction</td>
<td>Bright Field, Dark Field imaging, objective aperture size consideration (contrast vs. resolution), on-axis vs. off-axis DF</td>
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<tr>
<td>6</td>
<td>2/12/19</td>
<td>STEM</td>
<td>Scanning Transmission EM, BF/DF, HAADF</td>
</tr>
<tr>
<td>7</td>
<td>2/19/19</td>
<td>EDX</td>
<td>TEM vs SEM EDX, acquisition &amp; quantification issues, Cliff-Lorimer method, absorption, k-factor calculation</td>
</tr>
<tr>
<td>8</td>
<td>2/26/19</td>
<td>Sample Prep</td>
<td>Sample Prep overview</td>
</tr>
</tbody>
</table>

Semester Holidays: MLK Day (Jan 21), Spring Break (Mar 11-15),
Last Day of classes: April 22, 2019
Semester Final Exams: April 24-30, 2019

For interested students, I will do an optional lab on Kikuchi lines, sample tilting, and diffraction pattern indexing. This is optional and ungraded.

References:
• [http://www.materials.ac.uk/elearning/matter/](http://www.materials.ac.uk/elearning/matter/)

Academic Misconduct
It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct at [http://studentconduct.osu.edu](http://studentconduct.osu.edu)

Disability Services
Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 292-3307, TDD 292-0901, VRS 429-1334; [http://www.ods.ohio-state.edu/](http://www.ods.ohio-state.edu/).

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