MSE 321: Materials Characterization

Course description: Properties of X-rays, scattering and diffraction; crystal structures; X-ray diffraction methods, transmission electron microscopy and scanning electron microscopy.

Number of credits: 3

Course Coordinator: Q. Li

Prerequisites by course: MSE 201

Prerequisites by topic:

1. Atomic structure
2. Bonding
3. Introduction to crystal structures
4. Optics
5. Interference
6. Diffraction

Postrequisites: MSE 323 (or concurrently)

Textbooks/other required materials:

1. P.J. Goodhew, F.J. Humphreys, and R. Beanland, *Electron Microscopy and Analysis: 3rd Edition*, Taylor and Francis, NY, 2001.

Course objectives:

1. To provide an introduction to materials characterization and its importance.
2. To discuss different types of characterization techniques and their uses.
3. To review the topic of crystal structure and how structures can be determined using diffraction methods.
4. To describe the properties and behavior of x-rays and their use in materials characterization.
5. To describe the operation and use of a TEM and a SEM.

Topics covered:

1. Introduction to materials characterization methods
2. Crystal structures
3. Crystallography
4. Diffraction
5. Properties and production of X-rays
6. The application of X-ray diffraction in materials science
7. Properties and production of electrons
8. Scanning electron microscopy
9. Transmission electron microscopy

Expected student outcomes:

1. To be able to explain the production of characteristic x-rays.
2. To be able to explain the principles of diffraction (Bragg's Law) and its use in crystal structure determination.
3. To explain the properties of electrons and the affect of accelerating potential.
4. To know the basic operational modes of a SEM.
5. To know the basic operational modes of a TEM.
6. To be able to explain the formation of diffraction patterns in the EMs.
7. To understand stereographic projections and their use in characterization of crystalline materials.

Class schedule: Three 50-minute lecture sessions per week, for one semester

Laboratory schedule: None

Contribution to meeting the professional component:	Engineering Topics
Relationship of course to program objectives:	Meets: 1. School of MME Educational Objectives: 1, 2, 3 2. School of MME Program Outcomes: (a), (e), (k), (l), (o) 3. ABET EC2000, Criterion 3: (a), (e), (k), (l), (o)

Prepared by: David P. Field *Date:* June 21, 2016

POLICIES

A. **Reasonable Accommodation** (the nature of the particular course determines which one applies):

- Pullman Campus. Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center.
- WSU Online Course. Reasonable accommodations are available in online classes for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend you begin the process as soon as possible. For more information contact a Disability Specialist on your home campus: Pullman or WSU Online (http://accesscenter.wsu.edu), Spokane (http://spokane.wsu.edu/students/current/studentaffairs/disability/), Tri-Cities (http://www.tricity.wsu.edu/disability), Vancouver (http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services).

B. **Academic Integrity**

WSU expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The Standards of Conduct for Students can be found at http://conduct.wsu.edu.

C. **WSU Safety**

WSU is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan, http://safetyplan.wsu.edu. It is highly recommended that you visit this web site as well as the University emergency management web site at http://oem.wsu.edu/ to become familiar with the information provided.