Date: May 16, 2012
Course Number: MCR 683
Course Title: Operation of the Transmission Electron Microscope

☐ New Course  OR  ☐ Changes in existing course (check all that apply):

☐ Prefix
☐ Number
☐ Credits
☐ Title
☐ Description
☐ Pre-requisite(s)
☐ Co-requisite(s)
☐ Shared Resources
☐ Course Format
☐ Content
☐ Semester Offered

This course meets the General Education standards in the following knowledge and skills area (check all that apply):

☐ American History
☐ The Arts
☐ Basic Communication
☐ Humanities
☐ Mathematics
☐ Natural Sciences
☐ Other World Civilizations
☐ Social Sciences
☐ Western Civilization

Prequisites or co-requisite requirements:

☐ Prerequisites: Permission of Instructor
☐ Co-requisites:

Institutional Impact:

Anticipated Enrollment: 8 per semester

Technology and Classroom Resource Demands: transmission electron microscope

Computing Resources: image processing software; photo quality printer

Library Resources: Access to existing print and digital Moon library holdings. Specific texts to be purchased or put on reserve will be listed by the instructor and provided to the library staff.

Transportation Requirements: none

Forest Properties or Field Practicum Facilities Required: none
Health and Safety Considerations:

Conditions or situations present in association with the course?

1. **Will substances with any of the following properties be used during instruction?** flammability, toxicity, corrosivity, reactivity, registered pesticide, legally controlled, or other characteristics with the potential to cause harm or injury?  
   Yes / No
   - No

2. **Will any physical hazards be present during instruction?** (e.g., machines that need safety guards; razor blades or syringes; compressed gases, etc.).  
   Yes / No
   - No

3. **Will any biological hazards be present during instruction?** (e.g., handling animals (rabies or hantavirus); cultures or stocks of infectious agents (fungal spores, viruses, bacteria, etc.).  
   Yes / No
   - No

4. **Will any radiation hazards be present during instruction?** (e.g., radioisotopes, X-rays, ultraviolet rays, lasers, etc.).  
   Yes / No
   - No

5. **Will any electrical equipment that, due to its design, location, or method of use, pose any threat to safety during instruction?** (Give considerable thought to electrical use outdoors, or any potentially wet location.).  
   Yes / No
   - No

6. **Will there be any personal safety issues related to the class?** (e.g., due to time of day or location, at the end of any organized class exercise, will students be in danger of physical assault, etc.).  
   Yes / No
   - No

7. **Will any students be driving official state or research sponsored land or water vehicles during any class or instructional exercise?**  
   Yes / No
   - No

8. **Will any type of personal protective equipment be necessary during class exercises?** (e.g., hard-hats, eye/face protection, hearing protection, hand/foot protection, lab coat, visibility clothing, etc.)  
   Yes / No
   - No

If the answer was “Yes” to any of the **HEALTH AND SAFETY** questions, please explain:

**CATALOG DESCRIPTION** (Please provide using the precise format currently used in the ESF catalog, please do not exceed 500 characters):

MCR 683 Operation of the Transmission Electron Microscope (3) Two hours of lecture/ 3 hours of demonstration/laboratory per week. Theory and operation of the transmission electron microscope, including specimen preparation, digital imaging, and interpretation of micrographs. Spring.  
Prerequisite(s): Permission of instructor
DETAILED COURSE DESCRIPTION

COURSE: MCR 683 – Operation of the Transmission Electron Microscope

3 Credit Hours – Spring Semester;
2 Hours Lectures/ 3 hours of Laboratory per week
Prerequisite(s): Permission of Instructor

SCOPE:

1. Level of Instruction:
   a. MCR 683 is a graduate level course for students to learn the operation and applications of the transmission electron microscope in preparation for using the TEM for research towards an advanced degree.

2. Relation to curriculum or to other ESF or Syracuse University courses:
   a. MCR 683 is a graduate level elective course offered by faculty in the N.C. Brown Center for Ultrastructure Studies in the Department of Sustainable Construction Management and Engineering. This course is open to all disciplines at ESF, SU, and Upstate Medical University if space allows, especially students in biology, biotechnology, wood science, nanoparticle science, materials science, paper science, chemistry or other structure related disciplines.
   b. Shared resource requirements: None

STUDENT LEARNING OUTCOMES:

After completing this course the student should be able to:

1. Explain the theory and use of the transmission electron microscope (TEM) as a scientific tool
2. Relate in writing the wide range of transmission electron microscope techniques in the current literature
3. Determine the type of electron microscopy suitable for their specimens
4. Interpret artifacts and specimen structures based on the type of image and specimen preparation
5. Image and prepare film and scan images of a variety of samples
6. Contrast and compare what students learn about TEM to other advanced microscopy techniques such as light microscopy, scanning electron microscopy, confocal and others, and the appropriate technique for the sample and research goal.
7. Write parts of the national exam to become a Certified Electron Microscopy Technologist (Microscopy Society of America).
8. Operate a TEM

MAJOR CONCEPTS OR METHODOLOGIES:

This course will cover the theory and operation of the transmission electron microscope, specimen preparation; high vacuum technique, resolving power, the microscope as a research tool. The course will be structured with the goal of preparing students to take and pass the national certification exam for electron microscopy technologist (Microscopy Society of America). Concepts of specimen preparation include replicas, dehydration, staining and embedding, freeze fracture, freeze substitution, 3D reconstruction, ultramicrotomy, and high vacuum evaporation coating. Methods for image capture on film and digital image preparation will be covered. The concept of artifacts and how to recognize artifacts caused by specimen preparation or microscopic imaging technique will be included.
CATALOG DESCRIPTION (Please provide using the precise format to be included in the ESF catalog, please do not exceed 50 words)

MCR 683 Operation of the Transmission Electron Microscope (3)

Two hours of lecture/three hours of laboratory/demonstration per week. Theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Spring.

Prerequisite(s): Permission of instructor

COURSE HISTORY:

This is a new course.

Last approved: NA

Revised Draft: January 24, 2012 (form in protected format: 5/16/12)