Date: February 17, 2011  
Course Number: CME685  
Course Title: Transmission Electron Microscopy

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

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

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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:

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**  
   **Yes**

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:

Heavy metal stains are used for some specimens. Students will be taught the proper procedures for use and disposal to avoid exposure.

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

**CME 685 Transmission Electron Microscopy (5)**  
Two hours of lecture/two hours of laboratory/demonstration/minimum of four or ten hours of individual laboratory per week. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Five credit course spring only. Two credit course fall or spring.  
Prerequisite(s): Permission of instructor
DETAILED COURSE DESCRIPTION

COURSE: CME 685 – Transmission Electron Microscopy
2-5 Credit Hours – Fall and Spring Semester;
5 credit course Spring semester only
2 Hours Lectures/ 2 hours of Laboratory/10 hours of individual
laboratory per week
Prerequisite(s): Permission of Instructor

SCOPE:

1. Level of Instruction:
   a. CME 685 is a graduate level course for students to learn the operation and techniques in
      transmission electron microscope and/or for research in preparation for an advanced
      degree.

2. Relation to curriculum or to other ESF or Syracuse University courses:
   a. CME 685 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, wood science, nanoparticle,
      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. Understand the theory and use of the transmission electron microscope (TEM) as a scientific tool
2. To have knowledge of the wide range of transmission electron microscope techniques in the
   current literature
3. To be able to determine the type of electron microscopy suitable for their specimens
4. To be able to interpret artifacts and specimen structures based on the type of image and specimen
   preparation
5. To be able to prepare specimens for examination with the TEM using the techniques of fixation,
   embedding, thin sectioning, staining, coating of resin and cryo-samples.
6. To be able to image and prepare film and scan images of a variety of samples
7. To have awareness of other advanced microscopy techniques such as light microscopy, scanning
   electron microscopy, confocal and others, and the appropriate technique for the sample and
   research goal.
8. To be able to take and pass the national exam to become a Certified Electron Microscopy
   Technologist (Microscopy Society of America).
9. To be able to operate a TEM for an employer

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)

CME 685Transmission Electron Microscopy (2-5)

Two hours of lecture/two hours of laboratory/demonstration/minimum of four to ten hours of individual laboratory per week. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. 2 credit course Spring or Fall. Five-credit course offered in spring semester only.

Prerequisite(s): Permission of instructor

COURSE HISTORY:

This course was first taught as WPE 675 as approved 12/17/75. The course was renumbered to ERE 685 on 12/16/76. Credit hours changed from 3 to 5 and course re-described by Faculty Action of 4/26/79. The title changed to ERE685 Transmission Electron Microscopy by Faculty Action 4/18/85. The course is submitted for approval in the revised course proposal format with learning outcomes, with variable credit and with the new CME prefix December 2010.


Revised Draft: November 10, 2009 (form in protected format: 2/17/11)