Engineering Faculty Document No. 27-02
November 5, 2002

TO: The Engineering Faculty
FROM: The Faculty of the School of Materials Engineering
RE: New Dual-level Course, MSE 582

The faculty of the School of Materials Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

MSE 582 Transmission Electron Microscopy Skills
Sem.1, 2. Class 3, lab 3, (weeks 6-10) cr. 1. (Available pass/not-pass only)
Prerequisites: consent of instructor.

Principal components and operation of the transmission electron microscope (TEM). Limits to resolution; imaging and diffraction modes; interpretation of results. Laboratory sessions will emphasize the practical operation of the instrument and culminate in a test of student skills. This course must be completed before undertaking any TEM research in the School of Materials Engineering.

Reason: This class has been offered for more than 4 years under the designator MSE 595T. It is fully enrolled each Fall and Spring with enrollment capped at 20 students. There are waiting lists to enroll in this course. As an essential part of the curriculum for experimental researchers, it is appropriate to provide a regular course number for this course.

_____
Alexander H. King
Head, School of Materials Engineering

MSE 582
Transmission Electron Microscopy Skills
Instructor: A.H. King, alexking@ecn.purdue.edu, MSEE 150E, 494-4100
E.P. Kvam, kvam@ecn.purdue.edu, MSEE 386C, 494-4097

Course Description: An introduction to practical aspects of the operation of the transmission electron microscope (TEM). Classes will cover the principal components and operation of the TEM; limits to resolution; imaging and diffraction modes; interpretation of results. Laboratory sessions will familiarize the students the practical operation of the instrument, and culminate in a test of the students' skills.

Note: this course is *required* for all students who intend to use the TEM in their research: it must be passed with a grade of S before undertaking any research with the TEM.

Prerequisite: Permission of the instructor

Goals: The course goal is for the students to become competent, research-level transmission electron microscopists. They will understand the functions of the TEM and how it works. They will be competent in basic operating techniques, and ready to learn more advanced ones as needed.

Objectives:
1.Provide an understanding of Transmission Electron Microscopy (TEM) theory and principles. This includes:

Electro-optics of the TEM (lenses, lens aberrations)	2 lectures
Image formation and imaging modes in TEM	2 lectures
Diffraction theory and Diffraction patterns	3 lectures
Dark and bright field imaging	1 lecture
Image interpretation	3 lectures
High resolution microscopy and Lattice imaging	3 lectures
TEM Sample preparation	1 lecture

2.Provide "hands-on" training on operation of a research-grade transmission electron microscope. This includes:

Construction of TEMs	1 lab
Basic TEM alignment	2 labs
TEM imaging	1 lab
High resolution and lattice image microscopy	1 lab

Strategies: The course is taught in three lectures and a weekly three-hour lab, for five weeks followed by a certification lab.

Assessment: Student progress is assessed by their ability to operate the TEM with increasing independence and decreasing instructor intervention, as the labs progress. Students add to their own "user manual" throughout the course.

Evaluation: Students will be evaluated based on writing a lab report in the form of a user manual, and their ability to pass a certification test on operation of the TEM. The acquired knowledge will qualify students for use of other transmission microscopes with minimum training. Upon completion of the course and passing the certification test, students will be certified as "TEM Users" which will give them access to the microscope.

Feedback: Feedback is provided by anonymous written evaluation by students at the conclusion of the course.

Textbook: "Transmission Electron Microscopy", 1st ed., D. Williams and C. B. Carter, (Plenum Press, 1996).