TO: The Engineering Faculty
FROM: The Faculty of the School of Materials Engineering
RE: New Dual-level Course, MSE 581

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 581 **Scanning Electron Microscopy Skills**
Sem. 1, 2, SS. Class 3, lab 3, (weeks 1-5) cr. 1. (Available pass/not-pass only) Prerequisites: Consent of instructor.

Components and operation of the scanning electron microscope (SEM). Limits to resolution; signals, detectors and imaging modes; interpretation of results. Laboratory sessions emphasize the practical operation of the instrument and culminate in a test of student skills. This course must be completed before undertaking any SEM research in the School of Materials Engineering .

Reason: This class has been offered for more than 4 years under the designator MSE 595B. It is fully enrolled each Fall, Spring and Maymester 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.

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Alexander H. King
Head, School of Materials Engineering

MSE 581
Scanning 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 scanning electron microscope (SEM). Classes will cover the components and operation of the SEM; limits to resolution; signals, detectors and imaging 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 SEM in their research: it must be passed with a grade of S before undertaking any research with the SEM.

Prerequisite: Permission of the instructor

Goals: The course goal is for the students to become competent, research-level scanning electron microscopists. They will understand the functions of the SEM 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 scanning electron microscopy theory and principles. This includes:

SEM gun construction	2 lectures
Magnetic lenses	2 lectures
Electron detectors	5 lectures
SEM imaging parameters	4 lectures
High resolution microscopy	2 lectures

2.Get acquainted with scanning electron microscope construction and controls.
3.Provide "hands-on" training on operation of a research-grade scanning electron microscope. This includes:

SEM construction and controls	1 lab
Electron gun parameters	0.5 lab
Imaging parameters	1.5 lab
Image contrast (topographic and atomic number contrasts)	1 lab
High resolution SEM imaging.	1 lab

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

Assessment: Student progress is assessed by their ability to operate the SEM 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 four lab reports, and their ability to pass a certification test on operation of the SEM. The acquired knowledge will qualify students for use of other scanning microscope with minimum training. Upon completion of the course and passing the certification test, students will be certified as "SEM 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: "Scanning Electron Microscopy and X-Ray Microanalysis", 2nd ed., J. I. Goldstein, D. E. Newbury, P. Echlin, D. C. Joy, A. D. Romig, Jr., C. E. Lyman, C. Fiori and E. Lifshin, (Plenum Press, 1992).