Engineering Faculty Document No. 28-02
November 5, 2002

TO: The Engineering Faculty
FROM: The Faculty of the School of Materials Engineering
RE: New Graduate Course, MSE 583

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 583 **Energy-Dispersive X-ray Microanalysis Skills**
Sem. 1. Class 3, lab 3, (weeks 11-15) cr. 1. (Available pass/not-pass only) Prerequisites: MSE 581 and consent of instructor.

Theory of x-ray generation, components and operation of the energy dispersive x-ray spectrometer (EDS); limits to resolution; qualitative, semi-quantitative and fully quantitative analysis; interpretation of results. Laboratory sessions emphasize the practical operation of the instrument and culminate in a test of student skills.

Reason: This class has been offered for more than 4 years under the designator MSE 595E. It is heavily enrolled each Fall Semester 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 583
Energy-Dispersive X-ray Microanalysis 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 microanalysis *via* energy-dispersive x-ray spectrometry (EDS) in electron microscopes. Classes will cover the theory of x-ray generation, components and operation of the spectrometer; limits to resolution; qualitative, semi-quantitative and fully quantitative analysis; interpretation of results. Laboratory sessions will familiarize the students the practical operation of the instrument, and culminate in a test of the students' skills.

Prerequisite: MSE 581 and Permission of the instructor

Goals: The course goal is for the students to become competent, research-level energy dispersive x-ray spectroscopists. They will understand the functions of the EDS system 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 theory and fundamentals of energy dispersive x-ray microanalysis. This includes:

Theory of x-ray generation	2 lectures
Detection of x-rays	4 lectures
Qualitative x-ray analysis and strategies	2 lectures
Matrix correction and quantitative analysis	7 lectures

2.Provide "hands-on" training on operation of a research-grade x-ray microanalyser. This includes:

Acquisition of x-ray spectra	1 lab
Detector energy, resolution, and efficiency calibration	1 lab
Qualitative analysis of x-ray spectra	1 lab
Semi-quantitative and quantitative analysis	1 lab
Elemental line profiling and x-ray dot mapping.	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 spectrometer system with increasing independence and decreasing instructor intervention, as the labs progress. Students add to their own "user manual" throughout the course.

Evaluation: Student evaluation will be based on homework exercises, writing four lab reports, and the ability of students to operate the microanalyser for qualitative and quantitative elemental microanalysis, line profiling, and elemental mapping.

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).