UNIVERSITY OF KENTUCKY

FEB 1 6 2004

The Graduate School
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TRANSMITTAL

DATE: February 11, 2004

TO: Rebecca Scott
Senate Council

FROM: Lissa Holland
Graduate Council

The Graduate Council met on December 11, 2003 and approved the following:

COLLEGE OF ENGINEERING

Electrical Engineering

EE 664 Multidisciplinary Sensors Laboratory (3 credits)
To be cross-listed as CHE/CME/MSE 664. A multidisciplinary laboratory course with laboratory experiences in areas related to sensors and sensing architectures, typically including chemistry, chemical and materials engineering, and electrical engineering. *Lecture: 1 hour, Lab: 2 hours.*
Prerequisites: One year of college chemistry, calculus, and physics. GS 660 (Multidisciplinary Sensing Technologies) or by consent of instructor.

Signatures of Approval:

Department Chair	11/26/02 Date
Dean of the College	Date
	Date of Notice to the Faculty
*Undergraduate Council	Date
*University Studies	Date
*Graduate Council	Date
*Academic Council for the Medical Center	Date
*Senate Council (Chair)	Date of Notice to University Senate

*If applicable, as provided by the Rules of the University Senate

ACTION OTHER THAN APPROVAL

Signatures of Approval:

Boyd E Haley (CHEMISTRY)	11-18-02
Department Chair	Date
David Leap (A+S)	11/20/02
	Date
	Date of Notice to the Faculty
*Undergraduate Council	Date
*University Studies	Date
Jeannine Blackwell	12/15/03
*Graduate Council	Date
*Academic Council for the Medical Center	Date
*Senate Council (Chair)	Date of Notice to University Senate

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ACTION OTHER THAN APPROVAL

Signatures of Approval:

Department Chair	3/3/03 Date
Dean of the College	10/6/03 Date
	Date of Notice to the Faculty
*Undergraduate Council	Date
*University Studies	Date
*Graduate Council	Date
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ACTION OTHER THAN APPROVAL

C068

APPLICATION FOR NEW COURSE

1. Submitted by College of Engineering, Arts & Sciences Date October 8, 2002

   Department/Division offering course Elec. and Comp. Enq., Chem. and Materials Enq., Chemistry

2. Proposed designation and Bulletin description of this course

   a. Prefix and Number EE 664 b. Title* Multidisciplinary Sensors Laboratory

   *NOTE: If the title is longer than 24 characters (including spaces), write A sensible title (not exceeding 24 characters) for use on transcripts Multidis Sensors Lab

   c. Lecture/Discussion hours per week 1 d. Laboratory hours per week 2

   e. Studio hours per week 0 f. Credits 3

   g. Course description

   A multidisciplinary laboratory course with laboratory experiences in areas related to sensors and sensing architectures, typically including chem, chem/mat Eng,& ECE

   h. Prerequisites (if any)

   One year of college chemistry, calculus, & physics. GS 660 (Multidisciplinary Sensing Technologies) or by consent of instructor.

   i. May be repeated to a maximum of _____ (if applicable)

4. To be cross-listed as CHE/CME/MSE 664 (Prefix and Number) see attached sheets (Signature, Chairman, cross-listing department)

5. Effective Date Spring 2003 (semester and year)

6. Course to be offered ☐ Fall ☑ Spring ☐ Summer

7. Will the course be offered each year? (Explain if not annually) ☐ Yes ☑ No

   The course will be offered every other year as there are sufficient interested students.

8. Why is this course needed?

   To introduce graduate students from various departments to lab facilities and fabrication techniques available for sensors research

9. a. By whom will the course be taught? Dr. Janet Lumpp, Electrical and Computer Engineering

   b. Are facilities for teaching the course now available? ☑ Yes ☐ No
   If not, what plans have been made for providing them?

ORIGINAL

OCT 10 2003

10. What enrollment may be reasonably anticipated? 8

11. Will this course serve students in the Department primarily? ☐ Yes ☑ No

Will it be of service to a significant number of students outside the Department? ☑ Yes ☐ No
If so, explain.

This is an interdisciplinary course that will benefit students in all three departments.

Will the course serve as a University Studies Program course? ☐ Yes ☑ No

If yes, under what Area? _____

12. Check the category most applicable to this course

☐ traditional; offered in corresponding departments elsewhere;

☐ relatively new, now being widely established

☑ not yet to be found in many (or any) other universities

13. Is this course part of a proposed new program: ☐ Yes ☑ No
If yes, which?

14. Will adding this course change the degree requirements in one or more programs?* ☐ Yes ☑ No
If yes, explain the change(s) below

15. Attach a list of the major teaching objectives of the proposed course and outline and/or reference list to be used.

16. If the course is a 100-200 level course, please submit evidence (e.g., correspondence) that the Community College System has been consulted.

17. Within the Department, who should be contacted for further information about the proposed course?

Name Janet K. Lumpp Phone Extension 7-4985

*NOTE: Approval of this course will constitute approval of the program change unless other program modifications are proposed.

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ACTION OTHER THAN APPROVAL

EE/CHE/CME/MSE 664 Multidisciplinary Sensors Laboratory

Instructor: Dr. Janet K. Lumpp, Electrical Engineering Dept.
697 F. Paul Anderson Tower
257-4985
jklumpp@engr.uky.edu

Textbooks:

Fundamentals of Microfabrication, Marc Madou, CRC Press, 1997.

Handbook of Modern Sensors: Physics, Designs and Applications, Second Edition, Jacob Fraden, AIP Press, 1996.

Course Description:

A multidisciplinary course with laboratory experiences in areas related to sensors and sensing architectures, typically including chemistry, chemical and materials engineering, and electrical engineering.

Objectives

1. To overview various sensing methods and fabrication techniques.
2. To provide an interdisciplinary team environment to work on a sensor design project.

Outcomes

1. Describe various process steps used to fabricate sensor devices.
2. Compare and contrast sensor performance characteristics.
3. Work on a multidisciplinary team to design, fabricate and test a prototype sensor and document the results.

Organization

- Introductory lectures from each discipline, Chemistry, Electrical Engineering, Chemical & Materials Engineering
- Interdisciplinary groups of 2-3 students
- Laboratory lessons and demonstrations
- Design and fabrication of a prototype sensor device

Grading

10% Class participation
30% Project proposal
30% Final presentation
30% Final report

Letter grades

Letter grades will be assigned as follows: 90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, <60% = E.

Course Emphasis

Structures

- Laser machined microchannels
- Laser machined microvials
- Laser machined nanovials
- Screen printed electrodes and circuit interconnects
- Screen printed sensor films
- Cast membranes
- Deposited and patterned thin films
- Deposited and patterned magnetic foils
- Media for biochemical sensors
- Immobilization of enzymes - site directed, patterned

Measurement Methods

- Electrical – direct measurement of current,voltage, resistance
- Optical – bioluminescence, fluorescence, absorption
- Magnetic – resonance shift
- Temperature
- pH
- Discrimination - identification of stimulants and analytes
- Concentration of stimulants and analytes

Design and Build Prototype Devices

- Choose a sensor and target analytes
- Choose a structure type
- Design structure and fabricate
- Design measurement method
- Calibration
- Test
- Considerations
  - Single element vs. array of elements
  - Array of identical elements (homogeneous) vs. heterogeneous array
  - Single use vs. reusable, how to clear and reset detector before next measurement
  - Sampling and delivery of sample to sensor element(s)
  - Overlapping response to multiple stimuli, temperature, pH, humidity
  - Converting raw data to displayed data
  - User interface
  - Reliability
  - Accuracy
  - Sensitivity
  - Range
  - Lifetime, shelf life, storage conditions
  - Packaging

Team Project

Interdisciplinary teams will be organized to develop prototype sensor devices. Teams are not in competition with each other. Collaboration, consultation, and cross-training are encouraged. Each team will select a project topic and prepare a proposal, final report and oral presentation defining the type of sensor, applications, transduction method, fabrication technologies, testing methods, and plans for scaling up the device. The format of the final report will be that of a journal paper.