PROPOSAL NUMBER: 99- 471

CURRICULUM PROPOSAL FORM

**DEADLINES:*

REGULAR COURSE PROPOSALS: OCTOBER 23, 1998 FOR FALL, 1999 AND FEBRUARY 19, 1999 FOR SPRING, 2000
SHORT-TERM COURSE PROPOSALS: DECEMBER 11, 1998 FOR FALL, 1999 AND MARCH 26, 1998 FOR SPRING 2000

a) PROPOSAL TITLE: Electronic Packaging – 0909.412

b) SPONSOR/S: Dr. Linda M. Head, Dr. John L. Schmalzel and Electrical Engineering curriculum committee

DEPARTMENT: Electrical and Computer Engineering 0909.412

CHECK ALL THAT APPLY:
___X__UNDERGRADUATE _____GRADUATE

COLLEGE: __Engineering_____
If LAS: _____History/Humanities
_____ Math/Sciences
_____Social/Behavioral Sciences

* * * * * * * * * *

TYPE OF PROPOSAL *(Check ALL that Apply)*

_____General Education
___*New Course in* _____*Bank*
___*Existing course, Add To* _____*Bank*
___*Multicultural/Global Designation*
___*Writing Intensive Designation*

_____ New Minor/Concentration/Specialization
_____ New Major/Degree Program
_____ Short Term Course Proposal

_____X__ New Course (NOT Gen. Ed.)
_____ Name Change (Dept., School, Major)
_____Changes in Degree Requirements
____*Changes Involve Gen. Ed. requirements*

_____Minor Changes to Existing Courses
_____ *Course is NOT General Education*
_____ *Course IS General Education*

DEPARTMENT
(SIGNATURE INDICATES APPROVAL)

[signature] 03/01/99 _____ [signature] 03/01/99

DEPT. CURRICULUM CHAIR / DATE DEPT. CHAIRPERSON / DATE

COLLEGE CURRICULUM COMMITTEE
DATE OF OPEN HEARING (if necessary) 4/2/99

X APPROVED

----- NOT APPROVED
Comments:

[signature] 4/2/99
SIGNATURE DATE

ACADEMIC DEAN (& GRADUATE DEAN, for New Graduate Programs Only)

✓ APPROVED

----- NOT APPROVED
Comments:

[signature] 3/9/99
SIGNATURE (Academic Dean) DATE

_____ _____
SIGNATURE (Graduate Dean) DATE

UNIVERSITY CURRICULUM COMMITTEE

DATE OF OPEN HEARING (if necessary) 4/2/09 (College Level)

---- APPROVED

----- NOT APPROVED

Comments:

[signature] 3/7/09

SIGNATURE DATE

SENATE

Date announced at Senate 4/30/09

Voted upon at Senate: _____ Approved _____ Not Approved Date: _____

EXECUTIVE VICE PRESIDENT/PROVOST

_____APPROVED

_____NOT APPROVED If no, reasons are as follows:

STUDENT CREDIT HOURS _____ FACULTY LOAD HOURS _____ EQUALIZED CREDIT HOURS_____

OFFICIAL COPY & APPROVAL SHEET FILED (DATE): _____

DATE/SIGNATURE EXECUTIVE VICE PRESIDENT/PROVOST [signature] 5/28/09

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED _____

HEGIS TAXONOMY & COURSE NUMBER ASSIGNED 0929.412

DATE/SIGNATURE OF REGISTRAR Robert A. Talbot 6/10/09

NOTIFICATION FORWARD:

____/__SENATE CURRICULUM COMMITTEE CHAIRPERSON

____/__DEPARTMENT CHAIRPERSONS

____/__ACADEMIC DEAN(S)

____/__REGISTRAR

_____SPONSOR(S)

Course Proposal

1. Details:

a)	Course Title:	Electronic Packaging (0909.412)
b)	Sponsor:	Dr. Linda M. Head, Dr. John L. Schmalzel and Electrical Engineering curriculum committee
c)	Credit Hours:	3 credit hours
d)	Course Level:	Senior 1, Senior 2
e)	Curricular Effect:	Elective course for electrical/mechanical engineering majors
f)	Prerequisites:	Physics I, Networks I, Electronics I (0909.202, 0909.201, 0909.311)
g)	Suggested Time/ Scale of Implementation	Fall 1999 One section
h)	Resources	Faculty will be hired and laboratory equipment obtained consistent with Engineering School multi-year budget. Library acquisitions will be required.

2. Rationale:

The proposed course is a revision to part of the Engineering Curriculum Proposal approved by the College Senate in December, 1994. The proposed course is consistent with the establishment of the School of Engineering approved by the Board of Trustees in February, 1995.

This course will begin with an introduction to the field of packaging which focuses on the complex interaction of materials science, mechanics of materials, and electrical signal processing. By addressing this interaction at the beginning of the course, the stage will be set take the students from the basic materials used in chip packaging and board construction, through mechanical design and testing, to the electrical modeling of the interconnect structure and finally to reliability assessment. The laboratory exercises will mirror this four part organization by providing opportunities for laboratory experience in each of the four areas.

MATERIALS
Packaging and board materials will be investigated with an emphasis on appropriateness for the intended application. During this segment there will be discussion of the processing techniques for manufacture. The materials studied will include polymers, ceramics, solder, metallization materials, and epoxies.

MECHANAICAL AND THERMAL ISSUES
The mechanics of materials section will be devoted to the thermal and mechanical strength properties of the package and board. During this section discussion of issues such as the formation of intermetallics at solder joints will take place to highlight the interaction between mechanical and material issues.

ELECTRICAL ISSUES
Signal propagation between chips on a package will be addressed by discussing the high frequency response of transmission line systems. The connection with previous sections will be accomplished by investigation of issues such as the dielectric constant of board materials and resistivity of interconnects. At this point the students will be assigned a design project that will focus on a full PSPICE model of a package application.

RELIABILITY
The final section is reliability testing and analysis. In this section the students will use the statistical techniques which they learned in previous coursework to analyze reliability data. Techniques for accelerated lifetime testing will be covered.

3. Essence of the Course:

a) Objectives:

The proposed course has a number of objectives:

(i) Introduce fundamental principles of packages and packaging requirements for electronic circuitry
(ii) Provide an understanding of materials engineering principles as applied to electronic packaging
(iii) Provide a thorough description of how the materials and geometries of packaging components influence their electrical properties
(iv) Develop an ability to analyze and model the driving forces on packaging technology for higher system clock frequencies
(v) Develop and ability to analyze and model the thermal and mechanical requirements for electronic packaging including: heat transfer, strength of materials, thermal stresses and vibration theory

b) Topical Outline:

- Techniques for electronic packaging
- Materials for electronic packaging
- Thermal management in electronic packaging
- Soldering and solder paste technology
- Interconnection technologies
- Reliability analysis and testing
- Packaging of high speed digital electronic systems

c) Evaluation and Grading Procedures:

Student grades will be based on projects, examinations, homework, laboratory reports and written and oral technical communication.

d) Course Evaluation:

The proposed course will be evaluated based on student evaluations and critical review by engineering faculty.

e) Texts:

Harper, C.A., editor, *Electronic Packaging and Interconnection Handbook*, McGraw-Hill, Inc. New York, 1991.

Tummala, R.R. and Eugene J. Rymaszewdki, editors, *Microelectronic Packaging Handbook*, Van Nostrand Reinhold, New York, 1989.

Seraphim, D.P., Ronald Lasky and Che-Yu Li, *Principles of Electronic Packaging*, McGraw-Hill, Inc., New York, 1989.

4. Results of Consultations:

a) Consulted Departments: None
b) Consultants and Consultant Statements: N/A

c) Written Consultations: N/A

5. Additional Supporting Information: N/A

6. **Catalog Description:** Electronic Packaging (0909.412)

This is an introductory course in the fundamentals of electronic packaging. It focuses on the complex interaction of materials science, mechanics of materials, and electrical signal processing. The course will progress from the basic materials used in chip packaging and board construction, through mechanical design and testing, to the electrical modeling of the interconnect structure and finally to reliability assessment. The laboratory exercises will mirror this four part organization by providing opportunities for laboratory experience in each of the four areas.

Prerequisites of Physics I (1902.200), Networks I (0909.201), Electronics I (0909.311)