PROPOSAL NUMBER: 99- 426

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

PROPOSAL TITLE: Microscale Systems

SPONSOR/S: H. Clay Gabler, Associate Professor

DEPARTMENT: Mechanical Engineering 0910.463

CHECK ALL THAT APPLY:
✓ 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

✓ 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] 10/22/98 — DEPT. CURRICULUM CHAIR / DATE

[signature] 10/22/98 — DEPT. CHAIRPERSON / DATE

COLLEGE CURRICULUM COMMITTEE
DATE OF OPEN HEARING (if necessary)____
✓ APPROVED
— NOT APPROVED
COMMENTS:

[signature] 3/22/99
SIGNATURE — DATE

ACADEMIC DEAN (& GRADUATE DEAN, for New Graduate Programs Only)
✓ APPROVED
— NOT APPROVED
COMMENTS:

[signature] 11/23/98
SIGNATURE (Academic Dean) — DATE

SIGNATURE (Graduate Dean) — DATE

UNIVERSITY CURRICULUM COMMITTEE

DATE OF OPEN HEARING (If necessary) 2/10/99 (College Level only)

✓ APPROVED

— NOT APPROVED

COMMENTS:

Juanita Rice 4/1/99

SIGNATURE **DATE**

SENATE

Date announced at Senate 2/23/99

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 C J Mott

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED _____

HEGIS TAXONOMY & COURSE NUMBER ASSIGNED 0910.403

DATE/SIGNATURE OF REGISTRAR Robert A. Kibat 4/14/99

NOTIFICATION FORWARD:

✓ **SENATE CURRICULUM COMMITTEE CHAIRPERSON**

✓ **DEPARTMENT CHAIRPERSONS**

✓ **ACADEMIC DEAN(S)** TM 4/27/99

✓ **REGISTRAR**

SPONSOR(S)

Course Proposal

1. Details:

a) Course Title:	Microscale Systems (0910.403)
b) Sponsor:	Dr. H. Clay Gabler, Department of Mechanical Engineering, College of Engineering
c) Credit Hours:	2 credit hours
d) Course Level:	Senior
e) Curricular Effect:	Required Course for Mechanical Engineering majors.
f) Prerequisites:	Transport Processes (906.311)
g) Suggested Time/ Scale of Implementation	Spring 2000 One section

h) Resources:

Faculty is in place to teach the course within the Dept. of Mechanical Engineering. Library resources are in place. Computer hardware resources are available in the Henry M. Rowan Hall to support this course. No new software resources are required.

2. Rationale:

The proposed course is 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.

Recent trends in science and engineering have placed an increasing emphasis on the miniaturization of engineering systems and the study of microscale phenomena. Examples of such systems include microelectronic systems, micromechanical devices and chips, and microsensors. The emerging micromechanical systems industry has built microdevices ranging from the silicon accelerometers in late model car airbag systems to gas turbines that are smaller than a dime. These devices operate in length scale regimes which are many orders of magnitude smaller than conventional engineering systems. For these systems, traditional macroscopic methods which been have been historically used for analysis and design, e.g. Fourier's Law of Heat Transport, must be replaced with methods which capture the importance of phenomena at the microscale or molecular level.

3. Essence of the Course:

a) Objectives:

The primary objective of the course Microscale Systems, is to provide students with insight into emerging technologies and designs for microscale machinery, microscale manufacturing, and microscale heat transport.

The following are the specific objectives of this course:

1. Review the limits and assumptions of macroscale transport phenomena
2. Introduce the nature of microscale transport phenomena
3. Introduce emerging technologies for manufacture of microscale devices
4. Discuss the application of microscale systems and analysis methods to systems, e.g., micro-turbines, semiconductors, micro heat pipes, and micromachined sensors.
5. Explore the promise and severe technical demands of design and manufacture of nano-machines.

b) Topical Outline:

The topical outline of the course may vary to some extent depending on the interests of the instructor and the students, and the advances in engineering technology. The topics to be covered will include the following:

1. Microscale Energy Transport in Microscale Systems
   - 1.1. Limits and Assumptions of Macroscale Heat Transfer
   - 1.2. Microscale Energy Transport in Solids
   - 1.3. Microscale Radiation Phenomena
   - 1.4. Microscale Clusters
   - 1.5. Melting and Freezing Phenomena
2. Microscale Manufacturing Techniques
   - 2.1. Bulk Micromachining
   - 2.2. Surface Micromachining
   - 2.3. Micromolding Techniques
3. Applications
   - 3.1. Thermal Phenomena in Semiconductor Devices and Interconnects
   - 3.2. Micro Heat Pipes
   - 3.3. Silicon Micromanufactured Thermal Sensors and Actuators
   - 3.4. Micromanufactured Mechanical Sensors
4. Nanomachines

c) Evaluation and Grading Procedure of Students:

Student grades will be determined on the basis of examinations, homework and/or projects, laboratory projects and reports.

d) Course Evaluation:

The proposed course will be evaluated on the basis of student evaluations and curriculum review by appropriate faculty.

4. Results of Consultations:

The proposed course is part of the Engineering Curriculum Proposal approved by the Faculty Senate in December 1994. Consultations were submitted with original proposal as specified by the Curriculum Committee. Additional curriculum consultations were performed with outside consultants including, Professor Skip Fletcher of Texas, A&M. Professor Fletcher is a fellow of the American Society of Mechanical Engineers.

Catalog Description:

Microscale Systems (0910.403)

Prerequisites: Transport Processes-I (906.311) or equivalent.

This course will introduce emerging technologies and designs for microscale machinery, microscale manufacturing, and microscale heat transport. Topics will include a review of limits and assumptions of macroscale heat transfer, microscale energy transport mechanisms, microscale manufacturing techniques, thermal phenomena in semiconductor devices, micro heat pipes, micromanufactured thermal and mechanical sensors, and a brief introduction to nanomachines.