ENG ME 560 Precision Machine Design and Instrumentation

2008-2009 Catalog Data:

ENG ME 560 Precision Machine Design and Instrumentation Prereq: senior or graduate standing with basic CAD experience or consent of instructor. This interdisciplinary course teaches the student how to design, instrument, and control high-precision, computer-controlled automation equipment, using concrete examples drawn from the photonics, biotech, and semiconductor industries. Topics covered include design strategy, high-precision mechanical components, sensors and measurement, servo control, design for controllability, control software development, controller hardware, as well as automated error detection and recovery. Students will work in teams, both in-classroom and out-of-classroom, to integrate and apply the material covered in class to a term-long multi-part design project in PTC Pro-Engineer or other comparable CAD system, culminating in a group presentation at the end of the class. 4 cr.

Class/Lab Schedule: Two 2 hour lectures per week

Status in the Curriculum: Elective

Textbook(s) and/or Other Required Material: "Precision Machine Design", Alexander H. Slocum

Coordinator: Andre Sharon, Professor, Mechanical Engineering

Prerequisites by topic:
1. Senior or Graduate standing with basic CAD experience or consent from instructor

Goals:
1. Equip engineering students with the knowledge and experience to design instrumented, computer controlled machinery.
2. Teach students how to financially justify and successfully execute a machine development project.
3. Give students interdisciplinary hands-on experience in the design of electro-mechanical systems.

Course Learning Outcomes:

As an outcome of completing this course, students will:

i. Have the tools necessary to design and instrument computer-controlled machinery.
ii. Understand basic actuator technologies.
iii. Understand basic sensing technologies.
iv. Understand basic machine control strategies.
v. Understand basic transmission elements.
vi. Be able to size and select proper actuators, sensors, and controller hardware.

vii. Have the knowledge to financially justify, plan and execute a machine development project.

Course Learning Outcomes mapped to Program Outcomes:

Program:	a	b	c	d	e	f	g	h	i	j	k	l	m	n
Course:	i-vi		i-vii	i,vi, vii	i, vi		i, vii	i, vii	i-vii	i,vi, vii	i-vii	ii,iii, iv, v		i-vi
Emphasis	3		4	4	3		3	2	3	4	4	3		3

Topics (time spent in weeks):

1. Machine Design and Instrumentation Strategy (1)
2. Design Team Formation and Projects Assignment (0.5)
3. Financial Justification and Project Planning (0.5)
4. Actuators (1.5)
5. Transmission Elements (1.5)
6. Joints and Bearings (1)
7. Preliminary Design Review Presentations (1)
8. Sensors (2)
9. Servo Control and Design for Controllability (1)
10. Computer Control Software and Hardware (2)
11. Vision and Image Processing (0.5)
12. User Interface, Error Detection and Recovery (0.5)
13. Critical Design Review Presentations (1)

Contribution of Course to Meeting the Professional Component:
Engineering topics: 100%

Status of Continuous Improvement Review of this Course:
Prepared by: Andre Sharon **Date**: March 26, 2009