University of Toledo
Electrical Engineering Technology
Master Syllabus

Course Title: Automatic Control Systems **Course Code & Number: EET 4450**

Credit Hour Total: 4 Semester Hours

Lecture Contact Hours: 3 **Lab Contact Hours: 2**

Prerequisite: EET 3250, Network Analysis

Texts: Introduction to Control System Technology, Robert Bateson, Prentice Hall, 7th Edition.

Software: MathLab

A. Course Description

This course is an introduction to industrial controls, including the PID control of closed loop servo and process systems. It covers the basic elements of a closed loop control system including process transfer functions, sensors, actuators and controllers. The Mathlab simulation software is used for control system analysis and design.

B. Related Program Outcomes (a, b, c, d, f):

- An understanding of the analytical and laboratory skills associated with electrical engineering technology, as evidenced by analyzing closed loop control systems using different control strategies in homework and exams.
- An ability to apply current knowledge and adapt to emerging applications of mathematics, science and technology, as evidenced by the use of mathematical equations and Mathlab to analyze control systems in homework and exams.
- An ability to conduct, analyze and interpret experiments concerning electrical engineering technology, as evidenced by data collection and analysis in lab reports.
- An ability to use creativity in the design of electrical systems, as evidenced by design projects in exams and lab reports.
- An ability to identify, analyze and solve technical problems associated with Electrical Engineering Technology, as evidenced by solving and troubleshooting design problems in homework, exams and lab reports.

C. Course Objectives:

- To study the basic elements of an automatic control system.
- To use block diagrams to describe the elements of a control system.
- To study the difference between open-loop and closed-loop systems.
- To use the knowledge of math and science in deriving the process model and use it in the controller design.
- To determine and design signal conditioning for the system.
- To study the operation of different transducers/sensors and their importance in a control system.
- To be able to design a controller for a system to satisfy a certain performance criterion.
- To study the operation and performance of different control strategies such as: P, PI, PD and PID.
- To use Bode plots to study the stability of controlled systems.
- To use lab for hands on experience with different measuring devices and study and compare different control techniques.
- To troubleshoot system malfunctions.
- To design and build projects in a team environment.
- To enhance creativity through innovative project designs.
- To integrate real life applications and latest technology into labs and projects.

D. Course Outline – Major Content Areas

- Control Concepts
- Control Types
- Laplace Transform
- Transfer Functions
- Measuring Instruments
- Signal Conditioning
- Position Sensors
- Motion Sensors
- Force Sensors
- Process Variable Sensors
- Analog Controllers
- Digital Controllers
- Process characteristics
- Methods of Analysis
- Control Design

E. Major Laboratory Topics

- Plotting using Mathlab.
- Laplace and Inverse Laplace using Mathlab.
- Bode plots using Mathlab.
- Process Transfer Function.
- Transducers.
- Signal Conditioning.
- Open Loop Transfer Function of A DC Servo System.
- Servo Controller.
- Closed Loop Position Servo System.
- Closed Loop Position Proportional Only Control.
- Lead Network Compensation For Position Servo System.
- PID Control of Temperature.

AF 3/04/05