#330

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: INSTRUMENTATION/PROCESS CONTROL

Code No.: ELN 229-4

Program: ELECTRICAL/ELECTRONIC

Semester: _____

Date: NOVEMBER, 1993

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New: _____ Revision: X

APPROVED: L S Charette 93-11-22
Chairperson Date

INSTRUMENTATION/PROCESS CONTROL — COURSE NAME

ELN229-4 — COURSE NUMBER

PHILOSOPHY/GOALS:

It is the intent of this course to familiarize the students of Electrical/Electronic sufficiently in the basics of Process Control, there will be sound understanding of the control equipment encountered.

GENERAL NATURE OF THE COURSE:

Instruction will be presented in two modes; one through the classroom lecture mode (two hours per week) and the other through highly structured laboratory activity.

EVALUATION:

Students will be evaluated as follows:

Test	40	(Mid-term and final)
Labs	20	(2 formal lab reports)
Quizzes	30	(unannounced testing, labs, lectures and homework)
Negotiated	10	(attendance, homework, participation, conduct, etc.)
TOTAL	100%	

Letter grades will relate to test marks, as outlined by instructor, in class.

One re-write covering the entire course work will be provided at end of course as an opportunity to upgrade an "R" to a maximum of "C".

TEXTBOOK(S):

"PROCESS CONTROL FUNDAMENTALS", the Instrument Society of America.

"FUNDAMENTALS OF PROCESS CONTROL THEORY", the Instrument Society of America, Paul W. Merrill

GENERAL OBJECTIVES:

The student will be able to discuss::

- the theoretical concepts of Process Control.
- the role of specific hardware components used in process control.
- the dynamics of a feedback control system.
- how industrial control processes are tuned.

The student will also receive some exposure to more advanced control concepts and techniques such as:

- Cascade Control
- Ratio Control
- Dead time control
- Feed forward control
- Multivariable control

SPECIFIC LEARNING OBJECTIVES

At the completion of the course the student will be able to:

Basic Control Concepts	- State the meanings of the terms defined as controlled quantities, system disturbances, and manipulated quantities. - Explain the basic concept of feedback control using examples related to the human system, and household systems. - Explain, with examples, the meaning of process automation.
Functional Control Layout	- Draw a functional layout for a single feedback loop. - List and explain the components of block diagrams.
Sensors and Measuring Means	- Explain the role played by sensors. - Define the terms: accuracy, precision, sensitivity. - State the qualifications of good dynamic behaviours in a sensor. - List the characteristics of a signal transmission system.
Controllers	- Explain how proportional only control works and list its advantages and disadvantages. - Explain how integral action works and its advantages and disadvantages. - Explain how rate (derivative) control action works, and list the advantages and disadvantages.

	-	Draw response curves of the action of the controlled variable as various modes of control correct for a system disturbance.
Final Control Elements	-	Discuss and explain the purpose of control valves actuators and positioners.
Valves	-	Define "rangeability" and "turndown ratio".
	-	Know the meaning of and be able to use valve coefficients.
	-	List the factors influencing the dynamic behaviour of control valves and be able to explain why each is a factor.
Process Dynamics & Characteristics	-	Describe the general response characteristics of a first-order lag component which has been subjected to a step change.
	-	Determine graphically, a time constant for a first order lag system, that has been driven by a step input.
	-	Identify process dead time on a process response curve.
	-	Understand and be able to explain the effects of process lags and dead times on loop process dynamics.
Control System	-	Develop insight into the fundamental concepts of tuning feedback controllers.
	-	Calculate the tuning parameters using the ultimate tuning method.
	-	Calculate the tuning parameters using the process reaction curve method.
Advanced Concepts	-	List basic concepts of some more of the advanced control strategies such as cascade, ratio, dead time, feed forward, multi-variable control and digital control.
Digital Control	-	Have an understanding and be able to explain the role of digital computers in automatic process control systems.
	-	Understand the meaning of direct digital control and supervisory control, and be able to differentiate between them.
	-	Know and be able to explain the concept of distributed control.
Practical Skills	-	Identify the components in the four laboratory systems available, and select the proper components to set up control loops for process control of level, flow, temperature and pressure.
	-	Use standard process instrumentation determine characteristics of the four lab processes available.

- Use standard process instrumentation to determine the operational characteristics of controlling a temperature process with a two-position controller.
- Use standard process instrumentation to determine the operational characteristics of controlling a level process with a two-position controller.
- Use standard process instrumentation to observe and analyze the effects of demand and set point disturbances on an integral controller.
- Use standard process instrumentation to observe and analyze the effects of demand and set point changes on a proportional-only controller.
- Use standard process instrumentation to observe and analyze the effects of demand and set point changes on a "proportional plus integral" controller.
- Use standard process instrumentation to observe and analyze the effects of demand and set point changes on a "proportional plus derivative" controller.
- Use standard process instrumentation to observe and analyze the effects of demand and set point changes on a "proportional plus integral plus derivative" controller.
- Perform a series of steps to check out a controller for proper operation.
- Use standard process instrumentation to observe and analyze the effects of set point and gain changes on a controller and from gained information, make the calculations for optimum settings for controller tuning.
- Use standard process instrumentation to observe and analyze the effects of demand and set point changes on a process and determine the optimum tuning settings for the controller.