SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title:	PROCESS CONTROL
Code No.:	MCH 315-3 (ELN 229-4)
Program:	MECHANICAL TECHNOLOGY
Semester:	FIVE
Date:	SEPTEMBER 1987
Author:	WRITTEN by W. ADOLPH - 1986 REVISED by K. CHENG - 1987

New X Revision:

APPROVED:  Chairperson Date

PROCESS CONTROL FOR MECHANICAL TECHNOLOGY — COURSE NAME

MCH 315 — COURSE NUMBER

PHILOSOPHY/GOALS;

It is the intent of this course to familiarize the student of Mechanical Technology sufficiently in the basics of Process Control that in the general practice of Classical Mechanical Engineering, 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 follows:

A = 80 - 100%
B = 69 - 79%
C = 55 - 68%
R = less than 5 5% or

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

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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 LEARMING 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 Valves	Discuss and explain the purpose of control valves actuators and positioners. 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.
Advanced Concepts	Calculate the tuning parameters using the process reaction curve method. 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.