SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE OUTLINE: AUTOMATIC CONTROL SYSTEMS

CODE NO.: ELN 219-5

PROGRAM: INSTRUMENTATION TECHNICIAN

SEMESTER: FOUR

DATE: JANUARY 1994

PREVIOUS OUTLINE DATED: NONE

AUTHOR: ENO LUDAVICIUS

NEW:__X_ REV.:_____

APPROVED:

_____ _____
COORDINATOR **DATE**

L V Chouinard 95-05-23
DEAN **DATE**

AUTOMATIC CONTROL SYSTEMS — **COURSE NAME**

ELN 219 - 5 — **CODE NO.**

TOTAL CREDIT HOURS: 90

PREREQUISITE(S): ELN208

PHILOSOPHY/GOALS:

IN THIS COURSE THE STUDENT WILL DEVELOP THE UNDERSTANDING OF AUTOMATED CONTROL SYSTEMS WITH RATIO , CASCADE, ADAPTIVE AND FEEDBACK CONTROLS. THE STUDENT WILL OVERVIEW THE BASIC HARDWARE COMPONENTS OF CONTROL SYSTEMS. (ie. I/O, CONTROLLERS, ACTUATORS, SENSORS) THE LABWORK WILL INCLUDE INTERFACING WITH ANALOG DEVICES TO PLC'S PROGRAMMED BY IPC'S, UTILIZING SERVO, HYDRAULIC AND PNEUMATIC ACTUATORS, INTERFACING ROBOTS TO THEIR WORKCELLS.

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STUDENT PERFORMANCE OBJECTIVES (OUTCOMES):

UPON SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENT WILL BE ABLE TO:

1. PROGRAM AND TROUBLESHOOT THE AB 5 PLC FAMILY.

2. CONNECT SIMPLE PNEUMATIC ACTUATION.

3. PROGRAM HYDRAULIC ROBOTIC ACTUATION

4. PROGRAM SERVO ELECTRICAL ROBOTIC ACTUATION.

5. CONTROL A PROCESS WITH A PID LOOP CONTROLLER.

TOPICS TO BE COVERED:

1. OVERVIEW OF FEEDBACK CONTROL SYSTEMS.

2. COMPUTER-CONTROLLED INDUSTRIAL MACHINES, PROCESSES AND ROBOTS.

3. INTRODUCTION TO MODERN HYDRAULICS AND PNEUMATICS.

4. INTERFACING WITH ANALOG DEVICES.

AUTOMATIC CONTROL SYSTEMS **COURSE NAME**	ELR 219- 5 **CODE NO.**
LEARNING ACTIVITIES	RESOURCE MATERIAL
CLASSICAL CONTROL THEORY -DESCRIBE WHAT CONTROL SYSTEMS ARE AND THE WAY WE USE THEM. -DEFINE THE TERMINOLOGY NECESSARY TO DESCRIBE CONTROL SYSTEMS. (ie.plant,process,system,feedback,...) -DEFINE THE DIFFERENCE BETWEEN OPEN AND CLOSED LOOP CONTROL SYSTEMS. -D ISCUSS THE CONTROL SYSTEM CHARACTERISTICS. ie.accuracy,stability,sensitivity,noise,cost) -DISCUSS THE CONTROL STRATEGY STAGES OF M ANUFACTURING PROCESSING. -IILUSTRATE EXAMPLES OF CONTROL SYSTEMS. (ie.pressure,speed,numerical,computer,...)	RESOURCE MATERIAL - REQUIRED TEXTBOOK - HANDOUTS - MANUALS FROM THE AUTOMATION LIBRARY
OVERVIEW OF AUTOMATED CONTROL SYSTEMS - DEFINE THE PURPOSE OF AUTOMATIC CONTROL SYSTEMS - DESCRIBE THE IMPLEMENTATION OF INDUSTRIAL CONTROL SYSTEMS - DESCRIBE THE TYPES OF MANUFACTURING PROCESSES THAT USE CONTROLLERS - DESCRIBE THE TWO TYPES OF CONTROLLERS USED IN INDUSTRY - DESCRIBE THE METHODOLGY OF CHOOSING THE CORRECT CONTROLLER FOR THE INTENDED APPLICATION	RESOURCE MATERIAL
INDUSTRIAL SERVO CONTROL SYSTEMS -DISCUSS THE MEANING OF A FEEDBACK CONTROL SYSTEM. -DISCUSS THE EVALUATION OF PERFORMANCE OF FEEDBACK SYSTEMS (ie.error,setpoint,dynamic response,...) -DRAW A BLOCK DIAGRAM OF A CLOSED-LOOP FEEDBACK SYSTEM WITH A ROBOT IN THE SYSTEM	

LEARNING ACTIVITIES

-DESCRIBE SIMPLE SPEED CONTROL
PROPORTIONAL - P + INTEGRAL
- P + I + DERIVATIVE
- DISCUSS A SERVOMOTOR CONTROL SYSTEM.

THE ACTUATORS OF A INDUSTRIAL CONTROLS

-DESCRIBE THE ADVANTAGES & DISADVANTAGES OF THE THREE TYPES OF ACTUATORS USED IN INDUSTRY.
-DESCRIBE THE FACTORS WHICH INFLUENCE THE CHOICE OF A AN ACTUATOR FOR GIVEN APPLICATION.
-DISCUSS ELECTRICAL ACTUATION
- -SOLENOIDS
- RELAYS
- AC SERVOMOTOR
- STEPPER MOTORS
- DISCUSS HYDRAULIC ACTUATION
- LINEAR
- ROTARY
- DISCUSS PNEUMATIC ACTUATION
- LINEAR
- ROTARY

INDUSTRIAL SENSORS & TRANSDUCERS

-DEFINE THE MAJOR DIFFERENCE BETWEEN THE TERMS SENSOR AND TRANSDUCER.
-DESCRIBE THE CATEGORIZATION OF SENSORS:
- MECHANICAL
- FLUID
- THERMAL
- OPTICAL
-DISCUSS THE DIFFERENT TYPES OF MECHANICAL TRANSDUCERS:
- DISPLACEMENT
- STRAIN
- MOTION
- DISCUSS THE DIFFERENT TYPES OF FLUID TRANSDUCERS:
- PRESSURE
- FLOW
-DISCUSS THE DIFFERENT TYPES OF TEMPERATURE TRANSDUCERS:
- RTD
- THERMOCOUPLES

- REQUIRED TEXTBOOK
- HANDOUTS
- MANUALS FROM THE AUTOMATION LIBRARY

RESOURCE MATERIAL

-REQUIRED TEXTBOOK
- HANDOUTS
- MANUALS FROM THE AUTOMATION LIBRARY

LEARNING ACTIVITIES

- THERMISTORS
- IC SENSORS

-DISCUSS THE DIFFERENT TYPES OF OPTICAL TRANSDUCERS:

- OPTICAL ENCODERS
- VISION SYSTEMS - CAMERAS
- LASER SCANNERS
- X-RAYS
- INFRARED CAMERAS
- 3D CAMERAS

OVERVIEW OF PID CONTROL

-DISCUSS PROPORTIONAL PLUS INTEGRAL PLUS DERIVATIVE CONTROL

-DESCRIBE THE RELATIONSHIP BETWEEN PROCESS CHARACTERISTICS AND PROPER MODE OF CONTROL

-UTILIZE PID WITH PLC FUNCTION BLOCKS

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METHOD(S) OF EVALUATION

TESTS - THREE WRITTEN TESTS TOTALLING 50%.
(MINIMUM AVERAGE OF 55% MUST BE MAINTAINED FOR A PASSING GRADE IN ALL THREE TESTS.)

PROJECTS - FOUR PROJECTS TOTALLING 50%.
(MINIMUM AVERAGE OF 55% MUST BE MAINTAINED FOR A PASSING GRADE IN ALL FIVE PROJECTS.)

TOTAL 100%

THE GRADING SYSTEM USED WILL BE AS FOLLOWS:

A+ = 90 - 100% A = 80 - 89% B = 70 - 79% C = 55 - 69%

R REPEAT

REQUIRED STUDENT RESOURCES:

TEXT BOOKS: AUTOMATED PROCESS CONTROL SYSTEMS
CONCEPTS AND HARDWARE
RONALD P. HUNTER
PRENTICE HALL

ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY BOOK SECTION:

1) MODERN INDUSTRIAL ELECTRONICS
SCHULER - McNAMEE
GLENCOE

2) FEEDBACK CONTROL SYSTEMS FOR ATECHNICIANS
ROBERT T. PICKETT
PRINTICE HALL

3) AUTOMATED CONTROL SYSTEMS AND COMPONENTS
JAMES R. CASRTENS
PRINTICE HALL

SPECIAL NOTES:

COURSE ANALYSIS FORM

AUTOMATIC CONTROL SYSTEMS - ELN219-5

LEARNING OUTCOMES	BROAD AREAS OF CONTENT	INDICATION OF SUCCESS
1) Program and Troubleshoot The AB PLC 5 Family.	- Create and Edit a PLC program in Offline programming mode. - Download and Upload programs in Online programming mode. - Manipulation of I/O Data Tables	In the challenge process to write a program and then download to PLC 5, and then run the program.
2) Connect Simple Pneumatic Actuation	- Understand Pneumatic Symbols and read the connecting schematics.	In the challenge process to plum a pneumatic circuit from the schematic.
3) Program Hydraulic Robotic Actuation.	- Understand Hydraulic Symbols and read the connecting schematics. - Correlate Hydraulic actuation with Electrical PLC control.	In the challenge process to plum a hydraulic circuit from the schematic with electrical controls.
4) Program Servo Electrical Robotic Actuation.	- Understand Servo Electrical Symbols and read the connecting schematics. - Correlate servo Electrical actuation with Mechanical linkages.	In the challenge process to connect a servo system to be controlled by a PLC 5.
5) Control a process with a PID loop controller.	- Describe a simple Proportional, Integral, Derivative servo control systems.	In the challenge process to draw a process flow diagram (ie. Loop Diagram) depicting PID control.

COURSE ANALYSIS FORM

AUTOMATIC CONTROL SYSTEMS - ELN219-5

ASSESSMENT PROCESS

- Register at Prior Learning Assessment Office - E1935
- Pay fee at Registrar's Office (For September 1994 this fee is $55.00)
- Retain receipt
- Prepare for exam
- Present photo ID at exam location
- 4 hour evaluation process

ASSESSMENT TOOLS

- Written Theriacal Test on Automated Control Systems
- Hands On Practical Test with PLC control of automated equipment.

SUPPORTS

- Automated Process Control Systems Concepts And Hardware - R.P. Hunter
- Automated Control Systems and Components - J.R. Casrtens

REQUIREMENTS FOR SUCCESSFUL COMPLETION OF CHALLENGE PROCESS

- 65% on the written and practical tests combined.

A challenge process for this course can be available to learners within a reasonable period of time following a learner's request.
SIGNATURE:

Eno Ludavicius
PROFESSOR

MAY 1995
DATE

L C Forsyth
PROGRAM COORDINATOR OR DEAN

95-05-23
DATE