SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE OUTLINE: ROBOTIC & PLC CONTROL SYSTEMS

CODE NO.: ELR 223-7

PROGRAM: ELECTRICAL/ELECTRONIC TECHNICIAN

SEMESTER: FOUR

DATE: JANUARY 1993

PREVIOUS
OUTLINE DATED: NEW

AUTHOR: ENO LUDAVICIUS

NEW:__X__ REV.:

APPROVED: _W. Filipowich_ _Jan 7/93_
   COORDINATOR   DATE

              L.P. Clazutt _93·01·07_
   DEAN   DATE

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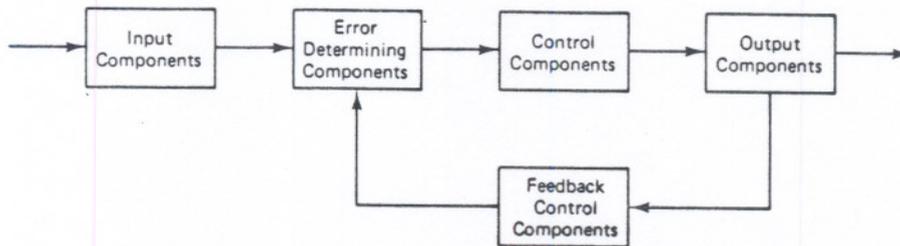COURSE NAME   CODE NO.

TOTAL CREDIT HOURS: 90

PREREQUISITE(S):   ELN 213-4

PHILOSOPHY/GOALS:

THE STUDENT WILL BE INTRODUCED TO AUTOMATIC CONTROL
SYSTEMS WITH INPUT/OUTPUT, ERROR DETERMINING AND
FEEDBACK CONTROL COMPONENTS.

THE STUDENT WILL ALSO BE INTRODUCED TO ROBOTICS
(TECHNOLOGY) AS A WORKING APPLICATION OF AUTOMATIC
CONTROL SYSTEMS. LABWORK WILL ILLUSTRATE THE THEORY
BY USING DC SERVO FEEDBACK SYSTEMS, THE THREE TYPE OF
ROBOTS IN LAB AND PROGRAMMABLE LOGIC CONTROL.
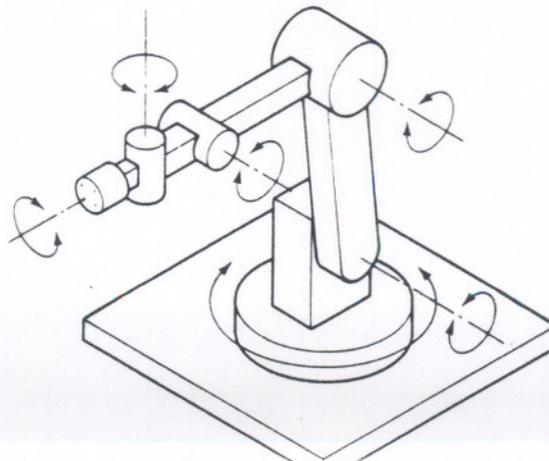
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STUDENT PERFORMANCE OBJECTIVES:

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

1. TROUBLESHOOT OPEN AND CLOSED LOOP FEEDBACK CONTROL
   SYSTEMS AND RECOGNIZING THE CONTROL SYSTEM COMPONENTS.

2. PROGRAM AND TROUBLESHOOT A ROBOTIC CONTROL SYSTEM.

3. CLASSIFY A ROBOT TO A PARTICULAR APPLICATION.

4. PROGRAM AND TROUBLESHOOT PROGRAMMABLE LOGIC CONTROLLER
   USING A MULTIFUNCTIONAL TERMINAL.

5. DESIGN, COMMISSION AND DOCUMENT A BASIC PLC APPLICATIONS.

TOPICS TO BE COVERED:

1. CONTROL THEORY BASICS.

2. TRANSDUCERS AND CONTROL SYSTEM COMPONENTS.

3. DESIGNING A CONTROL SYSTEM.

4. AUTOMATED CONTROL SYSTEMS.

5. INTRODUCTION TO ROBOTIC AND THEIR CHARACTERISTIC,
   COMPONENTS AND APPLICATIONS.

6. ROBOTIC ACTUATORS, SENSORS & INTERFACING.

7. ROBOTIC SAFETY & TESTING.

8. CLASSIFICATIONS OF PLC'S

9. HARDWARE AND SOFTWARE COMPONENTS OF PLC'S

10. PLC MEMORY ORGANIZATION AND ADDRESSING

11. PLC BASIC RELAY INSTRUCTIONS

12. PLC TIMERS AND COUNTERS

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LEARNING ACTIVITIES	REQUIRED RESOURCES
	TEXT: AUTOMATIC CONTROL SYSTEMS AND COMPONENTS BY: J.R. CARSTENS
1. REVIEW OF FUNDAMENTALS	CHAPTER ONE
- DC CIRCUITS	
- RESISTIVE CIRCUITS	
- KIRCHHOFF'S LAWS	
- POWER SUPPLY REGULATION	
- AC CIRCUITS	
- CAPACITORS	
- INDUCTORS	
- TRANSFORMERS	
- RC & RL CIRCUITS	
- REACTANCE & IMPEDANCE	
- POWER	
- RESONANT FREQUENCY	
- SOLID STATE DEVICES	
2. CONTROL THEORY BASICS	CHAPTER TWO
- CONTROL TERMINOLOGY	
- FREQUENCY RESPONSE	
- GAIN, BANDWIDTH	
- LINEARITY, PHASE	
- FEEDBACK	
- BLOCK DIAGRAMS	
3. TRANSDUCERS AND CONTROL SYSTEM COMPONENTS	CHAPTER FOUR
- TRANSDUCERS	
- POSITIONING SENSORS	
- VELOCITY SENSORS	
- PRESSURE SENSORS	
- SOUND SENSORS	
- FLOWRATE SENSORS	
- ELECTROMAGNETIC SENSORS	
- TEMPERATURE SENSORS	
- LIGHT SENSORS	
- SERVOMECHANISM	
-SERVOMOTOR	
-SYNCHROMECHANISMS	
-RESOLVERS	
-SERVO CIRCUITS	
-STEPPER MOTOR	

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LEARNING ACTIVITIES	REQUIRED RESOURCES
	TEXT: AUTOMATIC CONTROL SYSTEMS AND COMPONENTS BY: J.R. CARSTENS
4. DESIGNING A CONTROL SYSTEM	
- TRANSIENT RESPONSE ANALYSIS	CHAPTER EIGHT
- CONTROLLER TYPES	
- A DIGITAL CONTROLLER FOR A HYDRAULIC PRESS	CHAPTER NINE
- BANG-BANG SERVO SYSTEMS	
5. PROCESS CONTROL SYSTEMS	CHAPTER TEN
- ROBOTIC CONTROL SYSTEM	
- REMOTE CONTROL ANTENNA ROTATOR	
6. INTRODUCTION TO ROBOTICS AND THEIR CHARACTERISTICS, COMPONENTS AND APPLICATIONS	TEXT: ROBOT TECHNOLOGY BY: SPITERI
- INTRODUCTION	CHAPTER ONE
- CHARACTERISTICS & COMPONENTS	CHAPTER TWO
- APPLICATIONS	CHAPTER THREE
7. ROBOTIC ACTUATORS	
- MOTORS	CHAPTER SEVEN
- MECHANICAL LINKAGES	CHAPTER EIGHT
- PNEUMATICS & HYDRAULICS	CHAPTER NINE
8. ROBOTIC SENSORS & INTERFACING	
- SENSORS	CHAPTER TEN
- TEMPERATURE, PROXIMITY	
- PHOTOELECTRIC, ULTRASONIC	
- LVDT	
- VISION	CHAPTER ELEVEN
9. ROBOTIC SAFETY & TESTING	
- SAFEGUARDING	APPENDIX A
- TESTING	HANDOUTS

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LEARNING ACTIVITIES | **REQUIRED RESOURCES**

10) OVERVIEW OF ALLEN BRADLEY PLC CONTROLLERS

1.1) HARDWARE & SOFTWARE

1.1.1) INTRODUCTION TO PLC CONTROLLERS
      - HISTORY & DEFINITION
1.1.2) CLASSIFICATION OF PLC CONTROLLERS
      - MICROS, SMALL, MEDIUM, LARGE
1.1.3) I/O COMPONENTS
1.1.4) POWER SUPPLIES
1.1.5) PROGRAMMING DEVICES
1.1.6) DATA HIGHWAY & CONFIGURATION

2) OVERVIEW OF PLC-2/15 CONTROLLER

2.1) HARDWARE

2.1.1) INTRODUCTION TO PLC-5 CONTROLLER
2.1.2) PROCESSOR
2.1.3) I/O COMPONENTS
2.1.4) POWER SUPPLIES
2.1.5) DATA HIGHWAY & CONFIGURATION

2.2) SOFTWARE

TAYLOR PROGRAMMING SOFTWARE

2.2.1) INITIALIZATION
2.2.2) OFFLINE PROGRAMMING & DOCUMENTATION
2.2.3) ONLINE PROGRAMMING & DOCUMENTATION
2.2.4) REPORTING MENU
2.2.5) UTILITY MENU

3) OVERVIEW OF PLC-2 PROGRAMMING

3.1) MEMORY ORGANIZATION AND ADDRESSING

3.1.1) DATA TABLES FILES

3.2) PROGRAMMING INSTRUCTIONS

3.2.1) RELAY LOGIC INSTRUCTIONS
3.2.2) TIMER & COUNTER INSTRUCTIONS
3.2.3) ARITHMETIC & LOGICAL INSTRUCTIONS
3.2.4) COMPARISON INSTRUCTIONS
3.2.5) DATA MONITOR

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METHOD(S) OF EVALUATION

TESTS   - THREE WRITTEN TESTS WORTH 50% TOTAL AND A MINIMUM OF
          55% ON ALL THREE TESTS COMBINED MUST BE OBTAINED
          TO ACHIEVE A PASSING GRADE.

ASSIGNMENTS - CONTROL LAB SECTION IS WORTH 25%
    AND   - PLC LAB SECTION IS WORTH 25%.
LAB TESTS

TOTAL   100%

THE GRADING SYSTEM USED WILL BE AS FOLLOWS:

A+ = 90 - 100% A = 80 - 89% B = 70 - 79% C = 55 - 64%

R REPEAT

REQUIRED STUDENT RESOURCES:

TEXT BOOKS: 1.ROBOT TECHNOLOGY
               BY: SPITERI
            2.MINI PLC-2/02,2/16 AND 2/17
              PROCESSORS
              BY: ALLEN BRADLEY
ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE
LIBRARY BOOK SECTION:

SPECIAL NOTES: