SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE: INSTRUMENTATION – PROCESS CONTROL

CODE NO. : ELN 229 **SEMESTER:** 3

PROGRAM: ELECTRICAL/ELECTRONICS/INSTRUMENTATION TECHNICIAN/TECHNOLOGY

AUTHOR: BILL ARMSTRONG

DATE: Aug. 2004 **PREVIOUS OUTLINE DATED:** Aug. 2003

APPROVED:

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DEAN **DATE**

TOTAL CREDITS: 5

PREREQUISITE(S): N/A

HOURS PER WEEK 4

I. COURSE DESCRIPTION:

This course introduces the student to the principles of Instrumentation and Process Control. The measurement and control of process variables such as temperature, pressure, level and flow will be studied in detail and applied in the practical component of the course.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Describe Instrumentation and Process Control and understand Related terminology.

   Potential Elements of the Performance:

   - Explain what Instrumentation is.
   - Explain what Process Control is.
   - Describe the major components of a process control loop.
   - Draw the block diagram of a process control loop.
   - Understand instrumentation units, symbols and terminology.(I.S.A.)

2. Understand temperature measurement, devices and applications.

   Potential Elements of the Performance:

   - Understand the difference between temperature and heat.
   - Convert from one temperature scale to another.
   - Describe the physical and operating characteristics of filled system thermometers, thermocouples, resistance temperature detectors and thermistors.
   - Calibrate and explain the operation of thermocouple and RTD transmitters
   - Describe methods of measuring temperature.
   - Select, install and calibrate temperature measurement devices

3. Understand pressure measurement, devices and applications.

   Potential Elements of the Performance:

   - Define the term fluids and fluid mechanics
   - Derive units of force, energy and pressure in SI and English units
   - Perform unit conversions and calculations
   - Define the tem density, weight density and specific gravity
   - Derive the relationship between mass density and weight density
   - Express pressure as equivalent liquid column
   - Differentiate between gauge pressure and absolute pressure
   - Describe methods of measuring pressure
   - Select install and calibrate pressure measurement devices

4. Understand level measurement, devices and applications

   Potential Elements of the Performance:

   - Describe the behaviour of fluids at rest
   - Discuss the three forms of fluid energy
   - Express the fluid energy as head
   - Derive the relationships between pressure and elevation
   - Measure fluid pressure using manometers and gauges
   - Describe methods of measuring level (bubbler assembly)
   - Select, install and calibrate level measurement devices

5. Understand flow measurement, devices and applications

   Potential Elements of the Performance:

   - Derive and apply continuity equation to size the pipes
   - Apply the concept of energy conversation to write Bernoulli's equation
   - Recognize the limitations of Bernoulli"s equation
   - Define Toricelli's theorem
   - Describe the working principles of variable head meters
   - Describe general flow equation for variable head meters
   - Calculate the flow rate of various fluids
   - Describe methods of measuring flow
   - Select, install and calibrate flow measurement devices

6. Understand characteristics of common automatic control loops, control modes and loop tuning

   Potential Elements of the Performance:

   - Describe the difference between open and closed loop
   - Define and use process control terminology
   - Describe using diagrams and proper symbols open and closed loop control
   - Explain the criteria for feedback control
   - Explain the optimum criteria for feedback control
   - Apply pattern recognition to analyze process responses
   - Determine proper methods to stabilize various processes
   - Understand on-off, proportional, integral and derivative control modes
   - Tune pressure, flow, level and temperature loops for optimum performance using trial and error method.

III. TOPICS:

1. Introduction and overview
2. Temperature measurement and applications
3. Pressure measurement and applications
4. Level measurement and applications
5. Flow measurement and applications
6. Control loop characteristics, modes of control and tuning procedures

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

- Industrial Control Electronics Devices, Systems & Applications
- Instrumentation Practical Book 1 and 2

V. EVALUATION PROCESS/GRADING SYSTEM:

The following semester grades will be assigned to students in postsecondary courses:

	Grade	Definition	*Grade Point Equivalent*
	A+	90 – 100%	4.00
	A	80 – 89%	
	B	70 - 79%	3.00
	C	60 - 69%	2.00
	D	50 – 59%	1.00
	F (Fail)	49% and below	0.00
	CR (Credit)	Credit for diploma requirements has been awarded.	
	S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
	U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
	X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
	NR	Grade not reported to Registrar's office.	
	W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:

Special Needs:
If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

Retention of course outlines:
It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

VI. SPECIAL NOTES CONTINUED:

Plagiarism:
Students should refer to the definition of “academic dishonesty” in *Student Rights and Responsibilities*. Students who engage in “academic dishonesty” will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course, as may be decided by the professor. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

<*include any other special notes appropriate to your course*>

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following:

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean’s secretary. Students will be required to provide a transcript and course outline related to the course in question.