SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

SAULT
COLLEGE

COURSE OUTLINE

COURSE TITLE:	Instrumentation- Process Control		
CODE NO. :	ELN229	**SEMESTER:**	THREE
PROGRAM:	Electrical Engineering Technician Programs and Instrumentation Technician Program		
AUTHOR:	Frank Musso		
DATE:	September 2011	**PREVIOUS OUTLINE DATED:**	September 2010
APPROVED:	" Corey Meunier"		
	CHAIR		**DATE**
TOTAL CREDITS:	FIVE		
PREREQUISITE(S):	ELR100 and ELN100		
HOURS/WEEK:	FIVE		

For additional information, please contact Corey Meunier, Chair
School of Technology & Skilled Trades
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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 term density, weight 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

- Describe the behaviour of fluids at rest
- 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 device

5. Understand flow measurement, devices and applications

- 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
- 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

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

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 application
6. Control loop characteristics, modes of control and tuning procedures

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Lab Volt Process Control Training Manuals

V. EVALUATION PROCESS/GRADING SYSTEM:

The final grade will be derived as follows:

3 Tests	50%
Assignments and quizzes	10%
Lab Reports	20%
Practical Tests	20%
TOTAL	100%

*** Refer to SPECIAL NOTES and LAB REQUIREMENTS ***

The following semester grades will be assigned to students:

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:

Attendance:
Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

Use of cell phones/PDAs for any form of communication (voice, text…) during class or lab time is strictly prohibited. Cell phones/PDAs must be silenced during regular class and lab times and *must be turned off and kept out of sight during test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 being assigned.*

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.

Labs Requirements

1. Attendance to scheduled lab activities is compulsory, unless permission has been granted by the instructor.

2. Lab attendance and final grade are directly related. If a student arrives late for, or is not continuously present and actively participating at (scheduled breaks excepted), a scheduled lab class he/she will be considered absent for the entire class and will not be permitted to submit the associated lab report.

3. Students must continuously wear all Sault College required personal protective equipment (PPE) during lab activities. Failure to do this will result in expulsion from the lab activity and a grade of zero being assigned. All instrumentation labs required safety glasses and safety boots. (hard toes and shank with ohms tag)

4. If a student repeatedly neglects to wear PPE as required he/she will be considered to be in violation of the Sault College Academic Code of Conduct and may be sanctioned accordingly (see Student Code of Conduct & Appeal Guidelines) - first violation, verbal warning; second violation, written warning; and third violation suspension from lab activities.

5. Students must complete a lab safety orientation prior to participating in lab activities.

6. Successful completion of this orientation will be demonstrated by the student completing a quiz with a minimum grade of 100%.

7. All labs must be demonstrated to the instructor and signed off by the instructor before they are dismantled.

8. All lab reports are to be computer generated. Hand written reports will not be accepted.

9. All lab reports are to include a title page with the following information in the following sequence:

    - Lab title, name and number
    - Due date
    - Date submitted
    - Course number
    - Names of group members
    - Instructor's name

10. Lab reports are to include all procedures, observations and questions listed in the order they appear in the lab handout and numbered to match the lab handout

11. Maximum 2 members per group unless approved by the instructor. One lab report per group will be accepted.

Lab Reports

Lab reports are due at the beginning of class, 1 week after the scheduled period in which it was done. A ***penalty of 10% per day*** will be assessed for late submissions. It is recommended students submit lab reports prior to the deadline to avoid late submissions due to unforeseen circumstances (i.e. bad weather, transportation problems…).

Students are not permitted to work on live equipment outside of regular class time and may not work in the lab without faculty permission. This permission will not be considered outside of the regular 8:30am to 4:30pm, Monday – Friday time period.

Students must supply their own personal protective equipment (PPE). Students will not be permitted in the lab if not wearing required PPE. Students must never work alone in the lab. Unsafe work habits will not be tolerated.

Students are expected to maintain a clean and organized work area. Failure to put away equipment (in assigned location) and to clean up after a lab activity will result in a ***penalty of 10%***.

Final Marks

The student must maintain a minimum 50% average in **both** the **theory** portion **and lab** portion of the class in order to receive a passing grade.

If a student misses a test/lab he/she must have a valid reason (i.e. medical or family emergency – documentation may be required). In addition, the instructor **must** be notified **prior** to the test or lab sitting. If this procedure is not followed the student will receive a mark of zero on the test/lab with no make-up option. Students may not submit lab reports for labs in which they were not in continuous attendance.