

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



COURSE OUTLINE

COURSE TITLE: Process Control

CODE NO. : ELR212 **SEMESTER:** FOUR

PROGRAM: Electrical Technician – Power Generation and Instrumentation

AUTHOR: Frank Musso

DATE: January 2017 **PREVIOUS OUTLINE DATED:** January 2016

APPROVED: *“Corey Meunier”* Jan '17
CHAIR

TOTAL CREDITS: FIVE

PREREQUISITE(S): ELN229

HOURS/WEEK: FIVE hours per week

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For additional information, please contact Corey Meunier, Chair
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I. COURSE DESCRIPTION:

This course is a study of process control systems including; single loop, multi-loop, cascade, ratio, feed-forward and DCS control. The student will calibrate, adjust, tune, test and maintain these types of control systems.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. *Understand process control terminology and define common Instrumentation terms.***Potential Elements of the Performance:**

- List the classifications of industrial control systems.
- Identify open and closed loop systems.
- Recognize and describe controller modes.
- Recognize and describe single loop control dynamics.
- Explain SAMA and ISA symbols.
- Describe the use and list requirements for instrument air supply
- Identify pneumatic control systems
- Identify Hydraulic control systems
- Understand the workings of SLC (Single Loop Controller)

2. *Develop an insight into the concepts of tuning feedback controllers.***Potential Elements of the Performance:**

- Define the basis for tuning automatic controllers.
- Review $\frac{1}{4}$ wave amplitude decay.
- Describe the Trial and Error Method of controller tuning.
- Calculate and apply the tuning parameters for a feedback controller using the Ziegler-Nichols ultimate method.
- Calculate and apply the tuning parameters for a feedback controller using the Ziegler-Nichols process reaction method.
- Understand adaptive controller tuning.

3. Understand the basic concepts of cascaded control.Potential Elements of the Performance:

- Understand the basic concept of feedback control
- Understand the basic concept of feed-forward control
- Explain the general guidelines for cascade controller mode selection.
- Draw the block diagram of a cascade system
- Identify primary and secondary systems.
- Describe function of remote/local transfer.
- Configure and tune a cascade system.

4. Understand the basic concepts of ratio control.Potential Elements of the Performance:

- Identify a ratio control system.
- Draw the block diagram of a ratio control system.
- Describe wild and controlled variables.
- Calculate loop values for a common flow ratio system.
- Configure and tune a ratio control system.

5. Understand the basic concepts of feed-forward control.Potential Elements of the Performance:

- Analyse feed-forward control systems.
- Draw the general block diagram of a feed-forward control system.
- Identify limitations and problems of feed-forward control systems.
- Describe the reasons for feedback trim on a feed-forward system.
- Sketch a feed-forward control loop with feedback trim.

6. Understand DCS control systemsPotential Elements of the Performance:

- Describe the functions of a DSC system
- Analyze and troubleshoot PLC analog card
- Configure PLC Analog input and output interfacing modules
- Configure PLC, PID software advance instructions
- Program a PLC to control a single loop process

III. TOPICS:

1. *Basic Process Control Review*
2. *Controller Tuning*
3. *Cascaded control*
4. *Ratio Control*
5. *Feed-forward Control*
6. *DCS, PLC*

REQUIRED RESOURCES/TEXTS/MATERIALS:

- Lab Volt Process Control Training Manual
- Assorted handouts supplemented by the Instructor

IV. EVALUATION PROCESS/GRADING SYSTEM:

Grading -	Written Tests - 50%
	labs - 20%
	Practical Test - 20%
	Assignments – <u>10%</u>
	100%

Students who will be absent for a scheduled test must contact instructor in advance. Students absent without prior notification and a valid reason will be given a zero grade for the missed test.

Quizzes – quizzes can be held without notice, throughout the semester. Students who are absent, will receive a zero grade for that quiz

The following semester grades will be assigned to students:

Grade	<u>Definition</u>	<i>Grade Point Equivalent</i>
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.

VII. COURSE OUTLINE ADDENDUM:

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