SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

Sault College

COURSE OUTLINE

COURSE TITLE:	Advanced Process Control

CODE NO. :	ELR212	**SEMESTER:**	F/W

PROGRAM:	ELECTRICAL/ELECTRONICS/INSTRUMENTATION TECHNICIAN/TECHNOLOGY
AUTHOR:	Bill Armstrong

DATE:	January 2008	**PREVIOUS OUTLINE DATED:**	January 2007

APPROVED:

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                           CHAIR   **DATE**

TOTAL CREDITS:	6
PREREQUISITE(S):	Eln 229
HOURS/WEEK:	5

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I.   COURSE DESCRIPTION:

 This course is a study of process control systems including; single loop,
 multi-loop, cascade, ratio, feedforward and DCS control. The student will
 calibrate, adjust, tune, test and maintain these type 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.
       - Understand the basic concept of feedback control.
       - Understand the basic concept of feedforward control.
       - Recognize and describe controller modes.
       - Recognize and describe single loop control dynamics.
       - Explain SAMA and ISA symbols.

2.   Develop an insight into the concepts of tuning
        feedback controllers.

       Potential Elements of the Performance:

       - Define the basis for tuning automatic controllers.
       - Review ¼ 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.
       - Understand how to verify controller settings.

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3.   Understand the basic principles of cascade control.

      Potential Elements of the Performance:

         • 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 feedforward control.

      Potential Elements of the Performance:

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

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      6.   Understand DCS control systems

           Potential Elements of the Performance:

- Develop advance PLC 5 programs to control various processes
- Analyze and troubleshoot PLC circuits that contain discrete logic, sequential logic and A to D and D to A conversion
- Apply logic family characteristics in PLC programming design
- Design and implement solutions to control problems using PLCs
- Program PLC 5, 500 & 5000 processors using RSlogix programming software
- Configure PLC Analog input and output interfacing modules
- Configure PLC, PID software advance instructions
- Program a PLC to control a single loop process
- Develop advance HMI programs for the PLC 5 to control various Processes.

III.   TOPICS:

      1.   Basic Process Control Review
      2.   Controller tuning
      3.   Cascade Control
      4.   Ratio Control
      5.   Feedforward Control
      6.   Dcs Control

IV.   REQUIRED RESOURCES/TEXTS/MATERIALS:
Lab Volt Process Control Training Manual
Industrial Control Electronicss Devices, Systems and applications
Terry Bartlett 2nd Edition 2002 Delmar Publishing.
Assorted handouts supplemented by the Instructor.

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V. EVALUATION PROCESS/GRADING SYSTEM:
The final grade will be derived as follows :
        Theory tests and Quizzes = 50%
        Practical tests and report = 50%
                  Total   = 100%

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:

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 professor and/or the Special Needs office. Visit Room E1101 or call Extension 703 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.

Communication:
The College considers **WebCT/LMS** as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the **Learning Management System** communication tool.

Plagiarism:
Students should refer to the definition of "academic dishonesty" in *Student Code of Conduct*. 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/program, as may be decided by the professor/dean. 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.

Course Outline Amendments:
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 professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

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.