

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



Sault College

COURSE OUTLINE

COURSE TITLE: Instrumentation - Process Control

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

PROGRAM: Electrical/Electronics/Instrumentation
Technician/Technology

AUTHOR: Frank Musso

DATE: Aug. 2009 **PREVIOUS OUTLINE DATED:** Aug.
2008

APPROVED:

“Corey Meunier”
CHAIR

DATE

TOTAL CREDITS: 5

PREREQUISITE(S): n/a

HOURS/WEEK: 5

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For additional information, please contact Corey Meunier, Chair
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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.

2. 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 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 device
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

III TOPICS:

- Introduction and overview
- Temperature measurement and applications
- Pressure measurement and applications
- Level measurement and applications
- Flow measurement and applications
- Control loop characteristics, modes of control and tuning procedures

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Lab Volt Process Control Training Manuals
 Fundamentals of Industrial Instrumentation and Control/ William C. Dunn
 Safety Glasses

V. EVALUATION PROCESS/GRADING SYSTEM:

The final grade will be derived as follows:

| | |
|------------------------------------|-------------|
| Two theory tests and quizzes | 60% |
| One practical test and lab reports | 30% |
| Attendance and work ethics | <u>10%</u> |
| 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 | |
| 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:

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.

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.

Prior Learning Assessment:

Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question. Please refer to the Student Academic Calendar of Events for the deadline date by which application must be made for advance standing.

Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio.

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

Disability Services:

If you are a student with a disability (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Disability Services office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

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*. A professor/instructor may assign a sanction as defined below, or make recommendations to the Academic Chair for disposition of the matter. The professor/instructor may (i) issue a verbal reprimand, (ii) make an assignment of a lower grade with explanation, (iii) require additional academic assignments and issue a lower grade upon completion to the maximum grade “C”, (iv) make an automatic assignment of a failing grade, (v) recommend to the Chair dismissal from the course with the assignment of a failing grade. 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.

Student Portal:

The Sault College portal allows you to view all your student information in one place. **mysaultcollege** gives you personalized access to online resources seven days a week from your home or school computer. Single log-in access allows you to see your personal and financial information, timetable, grades, records of achievement, unofficial transcript, and outstanding obligations. Announcements, news, the academic calendar of events, class cancellations, your learning management system (LMS), and much more are also accessible through the student portal. Go to <https://my.saultcollege.ca>.

Electronic Devices in the Classroom:

Students who wish to use electronic devices in the classroom will seek permission of the faculty member before proceeding to record instruction. With the exception of issues related to accommodations of disability, the decision to approve or refuse the request is the responsibility of the faculty member. Recorded classroom instruction will be used only for personal use and will not be used for any other purpose. Recorded classroom instruction will be destroyed at the end of the course. To ensure this, the student is required to return all copies of recorded material to the faculty member by the last day of class in the semester. Where the use of an electronic device has been approved, the student agrees that materials recorded are for his/her use only, are not for distribution, and are the sole property of the College.

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.

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.

Labs

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

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. Students are expected to be wearing their required PPE prior to entering the lab.. Successful completion of this orientation will be demonstrated by the student completing a quiz with a minimum grade of 100%.

The instructor will advise what specific PPE is required. 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). For instance, first violation – verbal warning, second violation written warning, third violation suspension from lab activities. Students must complete a lab safety orientation prior to participating in lab activities

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

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

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

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. Maximum 2 members per group unless approved by the instructor. Each member must submit a lab report.

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.