COURSE OUTLINE: ELN229 - INST/PROCESS CONTROL

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Course Code: Title	ELN229: INSTRUMENTATION/PROCESS CONTROL
Program Number: Name	4026: ELECTRICAL TN-PROC 4029: ELECTRICAL TY-PROCES 4127: ELECTRICAL TN-TRADES
Department:	ELECT./INSTRUMENTATION PS
Academic Year:	2024-2025
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.
Total Credits:	4
Hours/Week:	5
Total Hours:	70
Prerequisites:	ELN100, ELR109
Corequisites:	There are no co-requisites for this course.
This course is a pre-requisite for:	ELR212, ELR320
Vocational Learning Outcomes (VLO's) addressed in this course: **Please refer to program web page for a complete listing of program outcomes where applicable.**	**4026 - ELECTRICAL TN-PROC** VLO 1 Interpret and produce electrical and electronics drawings including other related documents and graphics. VLO 2 Analyze and solve routine technical problems related to electrical systems by applying mathematics and science principles. VLO 3 Use, verify, and maintain instrumentation equipment and systems. VLO 4 Assemble, test, modify and maintain electrical circuits and equipment to fulfill requirements and specifications under the supervision of a qualified person. VLO 6 Verify acceptable functionality and apply troubleshooting techniques for electrical and electronic circuits, components, equipment, and systems under the supervision of a qualified person. VLO 7 Analyze, assemble and troubleshoot control systems under the supervision of a qualified person. VLO 8 Use computer skills and tools to solve routine electrical related problems. VLO 9 Assist in creating and conducting quality assurance procedures under the supervision of a qualified person. VLO 10 Prepare and maintain records and documentation systems. VLO 12 Apply health and safety standards and best practices to workplaces. VLO 15 Assist in commissioning, testing and troubleshooting electrical power systems under

the supervision of a qualified person.

VLO 16 Select electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.

VLO 17 Apply project management principles to assist in the implementation of projects.

4029 - ELECTRICAL TY-PROCES

VLO 1 Analyze, interpret, and produce electrical and electronics drawings, technical reports including other related documents and graphics.

VLO 2 Analyze and solve complex technical problems related to electrical systems by applying mathematics and science principles.

VLO 3 Design, use, verify, and maintain instrumentation equipment and systems.

VLO 4 Design, assemble, test, modify, maintain and commission electrical equipment and systems to fulfill requirements and specifications under the supervision of a qualified person.

VLO 6 Design, assemble, analyze, and troubleshoot electrical and electronic circuits, components, equipment and systems under the supervision of a qualified person.

VLO 7 Design, install, analyze, assemble and troubleshoot control systems under the supervision of a qualified person.

VLO 8 Use computer skills and tools to solve a range of electrical related problems.

VLO 9 Create, conduct and recommend modifications to quality assurance procedures under the supervision of a qualified person.

VLO 10 Prepare reports and maintain records and documentation systems.

VLO 12 Apply and monitor health and safety standards and best practices to workplaces.

VLO 15 Design, commission, test and troubleshoot electrical power systems under the supervision of a qualified person.

VLO 16 Select and recommend electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.

VLO 17 Apply project management principles to contribute to the planning, implementation, and evaluation of projects.

4127 - ELECTRICAL TN-TRADES

VLO 1 Interpret and produce electrical and electronic drawings including other related documents and graphics.

VLO 2 Analyze and solve routine technical problems related to electrical systems by applying mathematics and science principles.

VLO 3 Use, verify, and maintain instrumentation equipment and systems.

VLO 4 Assemble, test, modify and maintain electrical circuits and equipment to fulfill requirements and specifications under the supervision of a qualified person.

VLO 6 Verify acceptable functionality and apply troubleshooting techniques for electrical and electronic circuits, components, equipment, and systems under the supervision of a qualified person.

VLO 7 Analyze, assemble and troubleshoot control systems under the supervision of a qualified person.

VLO 8 Use computer skills and tools to solve routine electrical related problems.

	VLO 9	Assist in creating and conducting quality assurance procedures under the supervision of a qualified person.
	VLO 10	Prepare and maintain records and documentation systems.
	VLO 12	Apply health and safety standards and best practices to workplaces.
	VLO 15	Assist in commissioning, testing and troubleshooting electrical power systems under the supervision of a qualified person.
	VLO 16	Select electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.
	VLO 17	Apply project management principles to assist in the implementation of projects.
Essential Employability Skills (EES) addressed in this course:	EES 1	Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.
	EES 2	Respond to written, spoken, or visual messages in a manner that ensures effective communication.
	EES 3	Execute mathematical operations accurately.
	EES 4	Apply a systematic approach to solve problems.
	EES 5	Use a variety of thinking skills to anticipate and solve problems.
	EES 6	Locate, select, organize, and document information using appropriate technology and information systems.
	EES 7	Analyze, evaluate, and apply relevant information from a variety of sources.
	EES 8	Show respect for the diverse opinions, values, belief systems, and contributions of others.
	EES 9	Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.
	EES 10	Manage the use of time and other resources to complete projects.
	EES 11	Take responsibility for ones own actions, decisions, and consequences.
Course Evaluation:	Passing Grade: 50%, D A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.	
Other Course Evaluation & Assessment Requirements:	The student must pass both the theory portion and the lab portion to pass the course. Smart watches, smart phones and similar devices are not allowed during tests or quizzes and must be removed. Smart phones are not acceptable for use as a calculator during a test or quiz. 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.

Books and Required Resources:

Lab Volt Process Control Training Manual by Sault College
Publisher: AK Graphics
LABVOLT ELN229 (Sault Coll)

Course Outcomes and Learning Objectives:

Course Outcome 1	**Learning Objectives for Course Outcome 1**
1. Describe Instrumentation and Process Control and understand related terminology.	1.1 Explain what Instrumentation is. 1.2 Explain what Process Control is. 1.3 Describe the major components of a process control loop. 1.4 Draw the block diagram of a process control loop. 1.5 Understand instrumentation units, symbols, and terminology (I.S.A.).
Course Outcome 2	**Learning Objectives for Course Outcome 2**
2. Understand temperature measurement, devices, and applications.	2.1 Understand the difference between temperature and heat. 2.2 Convert from one temperature scale to another. 2.3 Describe the physical and operating characteristics of filled system thermometers, thermocouples, resistance temperature detectors and thermistors. 2.4 Calibrate and explain the operation of thermocouple and RTD transmitters. 2.5 Describe methods of measuring temperature. 2.6 Select, install, and calibrate temperature measurement devices.
Course Outcome 3	**Learning Objectives for Course Outcome 3**
3. Understand pressure measurement, devices, and applications.	3.1 Define the term fluids and fluid mechanics. 3.2 Derive units of force, energy and pressure in SI and English units. 3.3 Perform unit conversions and calculations. 3.4 Define the term density, weight, and specific gravity. 3.5 Derive the relationship between mass density and weight density. 3.6 Express pressure as equivalent liquid column. 3.7 Differentiate between gauge pressure and absolute pressure. 3.8 Describe methods of measuring pressure. 3.9 Select install and calibrate pressure measurement devices.
Course Outcome 4	**Learning Objectives for Course Outcome 4**
4. Understand level measurement, devices, and applications.	4.1 Describe the behaviour of fluids at rest. 4.2 Express the fluid energy as head. 4.3 Derive the relationships between pressure and elevation. 4.4 Measure fluid pressure using manometers and gauges.

	4.5 Describe methods of measuring level. 4.6 Select, install, and calibrate level measurement device.

Course Outcome 5	Learning Objectives for Course Outcome 5
5. Understand flow measurement, devices, and applications.	5.1 Derive and apply continuity equation to size the pipes. 5.2 Apply the concept of energy conversation to write Bernoulli`s equation. 5.3 Describe the working principles of variable head meters. 5.4 Describe general flow equation for variable head meters. 5.5 Calculate the flow rate of various fluids. 5.6 Describe methods of measuring flow. 5.7 Select, install, and calibrate flow measurement devices.

Course Outcome 6	Learning Objectives for Course Outcome 6
6. Understand characteristics of common automatic control loops.	6.1 Define and use process control terminology. 6.2 Describe using diagrams and proper symbols open and closed loop control. 6.3 Explain the criteria for feedback control. 6.4 Apply pattern recognition to analyze process responses. 6.5 Determine proper methods to stabilize various processes. 6.6 Understand on-off, proportional, integral, and derivative control modes. 6.7 Tune pressure, flow, level, and temperature loops for optimum performance.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assignments and Quizzes	10%
Labs	20%
Practical Tests	20%
Written Tests	50%

Date: August 9, 2024

Addendum: Please refer to the course outline addendum on the Learning Management System for further information.