



**COURSE OUTLINE: ELN229 - INST/PROCESS CONTROL**

Prepared: Frank Musso

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	ELN229: INSTRUMENTATION/PROCESS CONTROL
<b>Program Number: Name</b>	4026: ELECTRICAL TN-PROC 4029: ELECTRICAL TY-PROCES 4127: ELECTRICAL TN-TRADES
<b>Department:</b>	ELECT./INSTRUMENTATION PS
<b>Semesters/Terms:</b>	19F
<b>Course Description:</b>	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.
<b>Total Credits:</b>	4
<b>Hours/Week:</b>	5
<b>Total Hours:</b>	75
<b>Prerequisites:</b>	ELN100, ELR109
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>This course is a pre-requisite for:</b>	ELR212, ELR320
<b>Vocational Learning Outcomes (VLO's) addressed in this course:</b>  Please refer to program web page for a complete listing of program outcomes where applicable.	<b>4026 - ELECTRICAL TN-PROC</b> 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



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	specifications under the supervision of a qualified person.				
	VLO 17 Apply project management principles to assist in the implementation of projects.				
<b>Essential Employability Skills (EES) addressed in this course:</b>	<p>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.</p> <p>EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication.</p> <p>EES 3 Execute mathematical operations accurately.</p> <p>EES 4 Apply a systematic approach to solve problems.</p> <p>EES 5 Use a variety of thinking skills to anticipate and solve problems.</p> <p>EES 6 Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>EES 7 Analyze, evaluate, and apply relevant information from a variety of sources.</p> <p>EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others.</p> <p>EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</p> <p>EES 10 Manage the use of time and other resources to complete projects.</p> <p>EES 11 Take responsibility for ones own actions, decisions, and consequences.</p>				
<b>Course Evaluation:</b>	Passing Grade: 50%, D				
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<p>Must pass both written tests and practical tests to pass course. Smart watches and similar devices are not allowed during tests and quizzes.</p> <p>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</p> <p>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.</p>				
<b>Books and Required Resources:</b>	Lab Volt by Sault College Publisher: AK Graphics				
<b>Course Outcomes and Learning Objectives:</b>	<table border="1"> <thead> <tr> <th>Course Outcome 1</th><th>Learning Objectives for Course Outcome 1</th></tr> </thead> <tbody> <tr> <td>1. Describe Instrumentation and Process Control and understand related terminology</td><td>           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.         </td></tr> </tbody> </table>	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.
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	1.5 Understand instrumentation units, symbols and terminology.(I.S.A.)
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
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
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
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
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
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
<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
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
<b>Course Outcome 6</b>	<b>Learning Objectives for Course Outcome 6</b>
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										
<b>Evaluation Process and Grading System:</b>	<table> <tr> <th>Evaluation Type</th><th>Evaluation Weight</th></tr> <tr> <td>Assignments and quizzes</td><td>10%</td></tr> <tr> <td>Labs</td><td>20%</td></tr> <tr> <td>Practical tests</td><td>20%</td></tr> <tr> <td>Written tests</td><td>50%</td></tr> </table>	Evaluation Type	Evaluation Weight	Assignments and quizzes	10%	Labs	20%	Practical tests	20%	Written tests	50%
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<b>Date:</b>	August 27, 2019										
<b>Addendum:</b>	Please refer to the course outline addendum on the Learning Management System for further information.										