



## COURSE OUTLINE: ELR236 - POWER ELECTRONICS

Prepared: R. Allen

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	ELR236: POWER ELECTRONICS
<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>	20W
<b>Course Description:</b>	This course is an introductory analytical study of A.C. and D.C. motor control utilizing solid-state techniques. The topics include D.C. motor speed control utilizing phase-controlled and chopper converters, and polyphase A.C. motor speed control utilizing six-step and pulse-width modulated inverters and phase-controlled cycloconverters. This course is supported by a well equipped laboratory program.
<b>Total Credits:</b>	7
<b>Hours/Week:</b>	7
<b>Total Hours:</b>	105
<b>Prerequisites:</b>	ELN213, ELR232
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>This course is a pre-requisite for:</b>	ELR320
<b>Vocational Learning Outcomes (VLO's) addressed in this course:</b>	<b>4026 - ELECTRICAL TN-PROC</b>
<b>Please refer to program web page for a complete listing of program outcomes where applicable.</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 4 Assemble, test, modify and maintain electrical circuits and equipment to fulfill requirements and specifications under the supervision of a qualified person.
	VLO 5 Install and troubleshoot static and rotating electrical machines and associated control systems 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 10 Prepare and maintain records and documentation systems.
	VLO 12 Apply health and safety standards and best practices to workplaces.
	VLO 13 Perform tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.
	VLO 14 Configure installation and apply electrical cabling requirements and system



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	grounding and bonding requirements for a variety of applications under the supervision of a qualified person.
<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>Both the Theory Portion of the class and the Lab portion must be successfully passed in order to achieve a passing grade for the class.</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. Cell Phones turned off and put away during tests Smart Watched turned off and removed during tests If your Phone or Watch ring during a test, your test will be immediately collected and a score of 0 will be issued. Students texting or playing on their phones during class will be asked to leave the room and go elsewhere to play.</p>
<b>Books and Required Resources:</b>	<p>Electrical Machines, Drives, And Power Systems by Wildi Publisher: Pearson Prentice Hall Edition: 6th ISBN: 0-13-177691-6</p>

**Course Outcomes and Learning Objectives:**

<b>Course Outcome 1</b>	<b>Learning Objectives for Course Outcome 1</b>
1. Analyze the operation of various types of diode and rectifier circuits	1.1 Describe energy transfer between inductors and capacitors in diode /RLC circuits 1.2 State the various types of diode rectifier circuits and draw the associated circuit diagrams 1.3 Choose the correct type and rating of rectifier diode for a given application 1.4 Draw associated voltage and current waveforms for single phase, three phase and six phase diode rectifiers 1.5 Identify safety issues of non-isolated oscilloscopes if used to test power circuits 1.6 Set-up and use isolated oscilloscopes and oscilloscope isolators in the lab environment 1.7 Connect, test and troubleshoot diode rectifier circuits
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
2. Understand the operation characteristics of Thyristors and Power Transistors	2.1 State the five major categories of power electronic switching devices 2.2 Describe the operating characteristics of power SCRs, BJTs, MOSFETs and IGBTs 2.3 Connect and test simple power electronic switching circuits in the lab environment
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
3. Analyze various types of SCR commutation circuits	3.1 Define natural and forced commutation 3.2 Draw and describe the operation of various forced commutation circuits
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
4. Analyze the operation of various types of single and polyphase controlled rectifiers.	4.1 Describe the principal of phase controlled converter operation 4.2 Draw circuit diagrams for, and describe the operation of, single and three-phase semi-converters, full converters and dual converters 4.3 Describe the effects of an inductive load on various controlled rectifiers 4.4 Describe the effects of controlled rectifiers on system power factor and harmonic content 4.5 Draw voltage and current waveforms associated with the various converter circuits 4.6 Build and test a three phase controlled rectifier
<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
5. Analyze the operation of various types of static switches	5.1 Draw circuit diagrams for, and describe the operation of various AC and DC static switches 5.2 Describe common applications of static switches
<b>Course Outcome 6</b>	<b>Learning Objectives for Course Outcome 6</b>
6. Analyze the operation of various types of AC voltage controllers	6.1 Draw circuit diagrams for, and describe the operation of, various AC voltage controllers 6.2 Draw voltage waveforms associated with various AC voltage controllers 6.3 Describe common applications of AC voltage controllers



<b>Course Outcome 7</b>	<b>Learning Objectives for Course Outcome 7</b>
7. Analyze the operation of various types of DC chopper circuits	7.1 Describe the principle of operation of a step down (buck) chopper 7.2 Describe the operation of a step up (boost) chopper 7.3 Describe the operation of specific buck, boost and buck/boost chopper circuits
<b>Course Outcome 8</b>	<b>Learning Objectives for Course Outcome 8</b>
8. Analyze the operation of various types of inverter circuits	8.1 Draw circuit diagrams for, and describe the operation of, common single and three phase inverters 8.2 Draw voltage waveforms associated with common inverters 8.3 Describe how pulse width modulation is used for wave shaping 8.4 Draw circuit diagrams for, and describe the operation of, various resonant pulse inverters 8.5 Draw voltage waveforms associated with various resonant pulse inverters
<b>Course Outcome 9</b>	<b>Learning Objectives for Course Outcome 9</b>
9. Analyze the operation of various types of DC motor drives.	9.1 Describe the basic electrical and mechanical characteristics of DC motors 9.2 Describe how DC drives are used to control the operation of DC motors 9.3 Identify power and control sections of DC drive circuitry and produce simplified block diagrams of specific DC motor drives in the lab 9.4 Connect and test DC drives in the lab
<b>Course Outcome 10</b>	<b>Learning Objectives for Course Outcome 10</b>
10. Analyze the operation of various types of AC motor drives.	10.1 Describe the basic electrical and mechanical characteristics of AC motors 10.2 Describe how AC drives are used to control the operation of AC motors 10.3 Identify power and control sections of AC drive circuitry and produce simplified block diagrams of specific AC motor drives in the lab 10.4 Connect and test AC drives in the lab
<b>Course Outcome 11</b>	<b>Learning Objectives for Course Outcome 11</b>
11. Analyze the operation of various types of industrial power supplies	11.1 State the general requirements for industrial power supplies 11.2 Describe the operation of switched-mode, resonant and bi-directional DC power supplies 11.3 Describe the components of a basic UPS system 11.4 State the purpose of multistage AC power supplies 11.5 Describe the operation of various multistage AC power supplies

**Evaluation Process and Grading System:**

Evaluation Type	Evaluation Weight
Laboratory Assignments	30%
Tests and Quizzes	70%

**Date:**

August 27, 2019



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**Addendum:**

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

