COURSE OUTLINE

ELR236

Prepared: Robert Allen Approved: Corey Meunier

Course Code: Title	ELR236: POWER ELECTRONICS
Program Number: Name	4026: ELECTRICAL TN-PROC
Department:	ELECT./INSTRUMENTATION PS
Semester/Term:	18W
Course Description:	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.
Total Credits:	7
Hours/Week:	7
Total Hours:	105
Prerequisites:	ELN213, ELR232
This course is a pre-requisite for:	ELR320
Vocational Learning Outcomes (VLO's): **Please refer to program web page for a complete listing of program outcomes where applicable.**	**4026 - ELECTRICAL TN-PROC** #1. Interpret and produce electrical and electronics drawings including other related documents and graphics. #2. Analyze and solve routine technical problems related to electrical systems by applying mathematics and science principles. #4. Assemble, test, modify and maintain electrical circuits and equipment to fulfill requirements and specifications under the supervision of a qualified person. #5. Install and troubleshoot static and rotating electrical machines and associated control systems under the supervision of a qualified person. #6. Verify acceptable functionality and apply troubleshooting techniques for electrical and electronic circuits, components, equipment, and systems under the supervision of a qualified person. #7. Analyze, assemble and troubleshoot control systems under the supervision of a qualified person. #8. Use computer skills and tools to solve routine electrical related problems. #10. Prepare and maintain records and documentation systems.

	#12. Apply health and safety standards and best practices to workplaces. #13. Perform tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles. #14. Configure installation and apply electrical cabling requirements and system grounding and bonding requirements for a variety of applications under the supervision of a qualified person.
Essential Employability Skills (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. #2. Respond to written, spoken, or visual messages in a manner that ensures effective communication. #3. Execute mathematical operations accurately. #4. Apply a systematic approach to solve problems. #5. Use a variety of thinking skills to anticipate and solve problems. #6. Locate, select, organize, and document information using appropriate technology and information systems. #7. Analyze, evaluate, and apply relevant information from a variety of sources. #8. Show respect for the diverse opinions, values, belief systems, and contributions of others. #9. Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals. #10. Manage the use of time and other resources to complete projects. #11. Take responsibility for ones own actions, decisions, and consequences.
Course Evaluation:	Passing Grade: 50%, D
Other Course Evaluation & Assessment Requirements:	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. 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.
Evaluation Process and Grading System:	**Evaluation Type** / **Evaluation Weight** Laboratory Assignements. / 30% Tests and Quizes / 70%
Books and Required Resources:	Electrical Machines, Drives, and Power Systems by Theodore Wildi Publisher: Pearson Prentice Hall Edition: Sixth Edition ISBN: 0-13-177691-6
Course Outcomes and Learning Objectives:	**Course Outcome 1.** Analyze the operation of various types of diode and rectifier circuits

Learning Objectives 1.

- Describe energy transfer between inductors and capacitors in diode /RLC circuits
- state the various types of diode rectifier circuits and draw the associated circuit diagrams
- choose the correct type and rating of rectifier diode for a given application
- draw associated voltage and current waveforms for single phase, three phase and six phase diode rectifiers
- identify safety issues of non-isolated oscilloscopes if used to test power circuits
- set-up and use isolated oscilloscopes and oscilloscope isolators in the lab environment
- connect, test and troubleshoot diode rectifier circuits

Course Outcome 2.

Understand the operation characteristics of Thyristors and Power Transistors

Learning Objectives 2.

- state the five major categories of power electronic switching devices
- describe the operating characteristics of power SCR`s, BJT`s, MOSFETs and IGBTs
- connect and test simple power electronic switching circuits in the lab environment

Course Outcome 3.

Analyze various types of SCR commutation circuits

Learning Objectives 3.

- define natural and forced commutation
- draw and describe the operation of various forced commutation circuits

Course Outcome 4.

Analyze the operation of various types of single and polyphase controlled rectifiers.

Learning Objectives 4.

- describe the principal of phase controlled converter operation
- draw circuit diagrams for, and describe the operation of, single and three-phase semi-converters, full converters and dual converters
- describe the effects of an inductive load on various controlled rectifiers
- describe the effects of controlled rectifiers on system power factor and harmonic content
- draw voltage and current waveforms associated with the various converter circuits
- build and test a three phase controlled rectifier

Course Outcome 5.

Analyze the operation of various types of static switches

Learning Objectives 5.

- draw circuit diagrams for, and describe the operation of various AC and DC static switches
- describe common applications of static switches

Course Outcome 6.

Analyze the operation of various types of AC voltage controllers

Learning Objectives 6.

- draw circuit diagrams for, and describe the operation of, various AC voltage controllers
- draw voltage waveforms associated with various AC voltage controllers
- describe common applications of AC voltage controllers

Course Outcome 7.

Analyze the operation of various types of DC chopper circuits

Learning Objectives 7.

- describe the principle of operation of a step down (buck) chopper
- describe the operation of a step up (boost) chopper
- describe the operation of specific buck, boost and buck/boost chopper circuits

Course Outcome 8.

Analyze the operation of various types of inverter circuits

Learning Objectives 8.

- draw circuit diagrams for, and describe the operation of, common single and three phase inverters
- draw voltage waveforms associated with common inverters
- describe how pulse width modulation is used for wave shaping
- draw circuit diagrams for, and describe the operation of, various resonant pulse inverters
- draw voltage waveforms associated with various resonant pulse inverters

Course Outcome 9.

Analyze the operation of various types of DC motor drives.

Learning Objectives 9.

- describe the basic electrical and mechanical characteristics of DC motors
- describe how DC drives are used to control the operation of DC motors
- identify power and control sections of DC drive circuitry and produce simplified block diagrams of specific DC motor drives in the lab

	• connect and test DC drives in the lab **Course Outcome 10.** Analyze the operation of various types of AC motor drives. **Learning Objectives 10.** • describe the basic electrical and mechanical characteristics of AC motors • describe how AC drives are used to control the operation of AC motors • identify power and control sections of AC drive circuitry and produce simplified block diagrams of specific AC motor drives in the lab • connect and test AC drives in the lab **Course Outcome 11.** Analyze the operation of various types of industrial power supplies **Learning Objectives 11.** • state the general requirements for industrial power supplies • describe the operation of switched-mode, resonant and bi-directional DC power supplies • describe the components of a basic UPS system • state the purpose of multistage AC power supplies • describe the operation of various multistage AC power supplies
Date:	Monday, December 18, 2017
	Please refer to the course outline addendum on the Learning Management System for further information.