COURSE OUTLINE: ELR330 - ELECT POWER SYSTEM

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	ELR330: ELECTRICAL POWER SYSTEM ANALYSIS&DESIGN
Program Number: Name	4029: ELECTRICAL TY-PROCES
Department:	ELECT./INSTRUMENTATION PS
Semesters/Terms:	21W
Course Description:	Design and analysis of large and small scale electrical power systems will be studied. Topics include balanced and unbalanced faults, load flow, system stability (classical control theory utilizing Laplace Transform analysis) instrument and power transformers, protective relaying, alternative energy systems and Fourier series analysis. An integrated laboratory program supports the theory. Notes will be supplied by the instructor.
Total Credits:	6
Hours/Week:	5
Total Hours:	0
Prerequisites:	ELR232, MTH577
Corequisites:	There are no co-requisites for this course.
Vocational Learning Outcomes (VLO's) addressed in this course: **Please refer to program web page for a complete listing of program outcomes where applicable.**	**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 9 Create, conduct and recommend modifications to quality assurance procedures under the supervision of a qualified person. VLO 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. 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.

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Essential Employability Skills (EES) addressed in this course:	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 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: 0%, 50 A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.
Other Course Evaluation & Assessment Requirements:	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.

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
1. Perform fault calculations for balanced and unbalanced faults in a three phase AC system.	1.1 Convert actual power, voltage, current and impedance values to per unit values. 1.2 Convert per unit electrical values to actual values. 1.3 Solve a network using per unit and/or actual values for power, voltage and current levels throughout (balanced conditions). 1.4 Use symmetrical components to analyze unbalanced faults.
Course Outcome 2	**Learning Objectives for Course Outcome 2**
2. Analyze Basic AC Power Systems In Steady State.	2.1 Analyze real and reactive power flow in two and three bus systems. 2.2 Describe real and reactive power balances and indicators for each. 2.3 Derive and explain the static load flow equations.

Course Outcome 3	Learning Objectives for Course Outcome 3
3. Control Systems in the Power System.	3.1 Describe Voltage control methods. 3.2 Describe Power Factor control methods. 3.3 Describe Frequency control methods in a power system. 3.4 Describe Load control methods in a power system.
Course Outcome 4	**Learning Objectives for Course Outcome 4**
4. Assist in the design and installation of instrument and power transformers.	4.1 List and describe various types of large power transformers. 4.2 List and describe various cooling methods used with large power transformers. 4.3 List and describe name plate information provided with large power transformers. 4.4 List and describe various protection schemes used with large power transformers. 4.5 Describe the construction, operation and connection of instrument transformers. 4.6 Discuss safety concerns of instrument transformers.
Course Outcome 5	**Learning Objectives for Course Outcome 5**
5. Describe the purpose and operation of various protective relays and how they interface with the power system.	5.1 List common electrical and mechanical faults that may occur in a power system. 5.2 State the primary functions of protective equipment. 5.3 Define protective relay. 5.4 List various types of protective relays and describe their operation. 5.5 Analyze time - current characteristic curves for various protective relays. 5.6 Discuss the concepts of coordinated fault protection and zone coverage of power systems. 5.7 Connect and test various protective relays.
Course Outcome 6	**Learning Objectives for Course Outcome 6**
6. Analyze the viability and application of various alternative energy systems.	6.1 List various types of alternative energy systems. 6.2 Describe where and how commercially available alternative energy systems are currently being utilized. 6.3 Describe alternative energy systems proposed for future use (i.e. in prototype stage).
Course Outcome 7	**Learning Objectives for Course Outcome 7**
7. Analyze periodic, non-sinusoidal waveforms.	7.1 Define harmonics and describe their affect on electrical power systems. 7.2 Use Fourier series analysis to determine the harmonic content of various periodic, non-sinusoidal waveforms.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Laboratory/Reports	40%
Theory Tests	60%

Date: September 2, 2020

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

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