



## COURSE OUTLINE: ELR820 - ELECTRICAL THEORY 3

Prepared: A. Gooderham, J. Paloniemi

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	ELR820: ELECTRICAL THEORY - LEVEL 3
<b>Program Number: Name</b>	6522: CONST & MTCE ELE ADV
<b>Department:</b>	ELEC. APPRENTICES
<b>Semesters/Terms:</b>	21W, 20F
<b>Course Description:</b>	Students will explain principles of, and perform calculations relating to, three phase alternating current circuits, poly-phase transformers and AC motors and generators.
<b>Total Credits:</b>	6
<b>Hours/Week:</b>	6
<b>Total Hours:</b>	60
<b>Prerequisites:</b>	There are no pre-requisites for this course.
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>Essential Employability Skills (EES) addressed in this course:</b>	<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 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 11   Take responsibility for ones own actions, decisions, and consequences.</p>
<b>Course Evaluation:</b>	<p>Passing Grade: 50%, D</p> <p>A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.</p>
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<p>No Rewrites will be granted for tests attempted with unsuccessful results.</p> <p>There is no final exam. Block/section tests only.</p> <p>Quizzes and assignments worth a max 5% towards final grade can be given at any time, and each will be attributed toward the percentage of the next test.</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</p>

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2020-2021 academic year.



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	<p>F (Fail)49% and below 0.00</p> <p>CR (Credit) Credit for diploma requirements has been awarded.</p> <p>S Satisfactory achievement in field /clinical placement or non-graded subject area.</p> <p>U Unsatisfactory achievement in field/clinical placement or non-graded subject area.</p> <p>X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.</p> <p>NR Grade not reported to Registrar's office.</p> <p>W Student has withdrawn from the course without academic penalty.</p>												
<b>Books and Required Resources:</b>	<p>Delmars Standard Textbook of Electricity by Stephen L. Herman</p> <p>Publisher: Nelson Edition: 5</p> <p>ISBN: 978-0-17-665680-5</p>												
<b>Course Outcomes and Learning Objectives:</b>	<table> <tr> <th>Course Outcome 1</th><th>Learning Objectives for Course Outcome 1</th></tr> <tr> <td>1. Three-phase circuits</td><td> <p>1.1 Explain the advantages of three phase circuits over single phase circuits.</p> <p>1.2 Explain the advantages and disadvantages of Wye vs Delta three phase systems.</p> <p>1.3 Calculate voltage, current and power for three phase Wye and Delta systems with resistive loads.</p> <p>1.4 Calculate voltage, current and power for three phase Wye and Delta systems with series and parallel RLC loads.</p> <p>1.5 Calculate component values required for three phase power factor correction.</p> <p>1.6 Perform calculations for, and show connections of wattmeters for three phase systems.</p> <p>1.7 Explain the principles of, and show proper connections for power-factor and phase-angle meters.</p> </td></tr> <tr> <th>Course Outcome 2</th><th>Learning Objectives for Course Outcome 2</th></tr> <tr> <td>2. Explain principles of and perform calculations for Single-phase transformers</td><td> <p>2.1 Describe the various classifications of transformers and identify applications.</p> <p>2.2 Describe losses associated with transformers and methods to reduce them.</p> <p>2.3 Describe the methods employed to cool transformers.</p> <p>2.4 Describe safety concerns of transformer cooling mediums.</p> <p>2.5 Explain safety procedures for taking instrument transformers off line.</p> <p>2.6 Interpret transformer nameplate data.</p> </td></tr> <tr> <th>Course Outcome 3</th><th>Learning Objectives for Course Outcome 3</th></tr> <tr> <td>Three-phase transformers</td><td> <p>Calculate voltages and currents for three phase transformers.</p> <p>Calculate transformed and conducted power for autotransformers.</p> <p>Perform calculations for the determination of transformer impedances.</p> <p>Calculate maximum available fault currents at the secondary of a transformer.</p> </td></tr> </table>	Course Outcome 1	Learning Objectives for Course Outcome 1	1. Three-phase circuits	<p>1.1 Explain the advantages of three phase circuits over single phase circuits.</p> <p>1.2 Explain the advantages and disadvantages of Wye vs Delta three phase systems.</p> <p>1.3 Calculate voltage, current and power for three phase Wye and Delta systems with resistive loads.</p> <p>1.4 Calculate voltage, current and power for three phase Wye and Delta systems with series and parallel RLC loads.</p> <p>1.5 Calculate component values required for three phase power factor correction.</p> <p>1.6 Perform calculations for, and show connections of wattmeters for three phase systems.</p> <p>1.7 Explain the principles of, and show proper connections for power-factor and phase-angle meters.</p>	Course Outcome 2	Learning Objectives for Course Outcome 2	2. Explain principles of and perform calculations for Single-phase transformers	<p>2.1 Describe the various classifications of transformers and identify applications.</p> <p>2.2 Describe losses associated with transformers and methods to reduce them.</p> <p>2.3 Describe the methods employed to cool transformers.</p> <p>2.4 Describe safety concerns of transformer cooling mediums.</p> <p>2.5 Explain safety procedures for taking instrument transformers off line.</p> <p>2.6 Interpret transformer nameplate data.</p>	Course Outcome 3	Learning Objectives for Course Outcome 3	Three-phase transformers	<p>Calculate voltages and currents for three phase transformers.</p> <p>Calculate transformed and conducted power for autotransformers.</p> <p>Perform calculations for the determination of transformer impedances.</p> <p>Calculate maximum available fault currents at the secondary of a transformer.</p>
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	<p>Describe procedures for determining transformer polarity, terminal identification, winding ratio and insulation resistance.</p> <p>Describe procedures for paralleling transformers and taking one off line.</p> <p>Describe alternator and transformer connections for various 3 phase systems.</p> <p>Explain the principles of three phase open delta connections and perform related calculations.</p>
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
4. Explain principles of and perform calculations for Three-phase alternators	<p>4.1 Describe the theory of operation of alternators.</p> <p>4.2 Perform calculations to illustrate principles for single and 3-phase power conversion.</p> <p>4.3 Describe the methods of synchronizing alternators.</p>
<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
5. Explain principles of and perform calculations for Three-phase motors	<p>5.1 Explain the principle of operation of three phase squirrel cage induction motors.</p> <p>5.2 Describe the operating characteristics of three phase squirrel cage induction motors.</p> <p>5.3 Describe troubleshooting procedures for three phase squirrel cage induction motors.</p> <p>5.4 Identify AC motor connections and terminal markings for multiple voltage and speed applications.</p> <p>5.5 Describe the construction of single-phase induction motors.</p> <p>5.6 Explain the principle of operation of single-phase induction motors.</p> <p>5.7 Describe the operating characteristics of single-phase induction motors.</p> <p>5.8 Describe troubleshooting procedures for single-phase induction motors.</p> <p>5.9 Describe the construction of three-phase wound rotor induction motors.</p> <p>5.10 Explain the principle of operation of three-phase wound rotor induction motors.</p> <p>5.11 Describe the operating characteristics of three phase wound rotor induction motors.</p> <p>5.12 Describe trouble-shooting procedures for three-phase wound rotor induction motors.</p> <p>5.13 Describe the construction of three phase synchronous motors.</p> <p>5.14 Explain the principle of operation of three phase synchronous motors.</p> <p>5.15 Describe the operating characteristics of three phase synchronous motors.</p> <p>5.16 Describe troubleshooting procedures for three phase synchronous motors.</p> <p>5.17 Explain the operation of synchronous motors in power factor correction and constant speed applications.</p>

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	<p>5.18 Describe the insulation classifications used in AC motors, and applications of each.</p> <p>5.19 Explain: brush adjustments, brush selection for wound rotor motors, slip ring care, bearing specifications and types, bearing applications, bearing lubrication.</p> <p>5.20 Interpret motor name plate specification values.</p>								
<b>Evaluation Process and Grading System:</b>	<table> <tr> <th>Evaluation Type</th><th>Evaluation Weight</th></tr> <tr> <td>Test1</td><td>33%</td></tr> <tr> <td>Test2</td><td>33%</td></tr> <tr> <td>Test3</td><td>34%</td></tr> </table>	Evaluation Type	Evaluation Weight	Test1	33%	Test2	33%	Test3	34%
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<b>Date:</b>	August 18, 2020								
<b>Addendum:</b>	Please refer to the course outline addendum on the Learning Management System for further information.								

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