



## COURSE OUTLINE: ELR215 - ELECTRIC POWER SYST

Prepared: Jon Pasiak

Approved: Corey Meunier, Chair, Technology and Skilled Trades

|   |  |
|---|--|
| <b>Course Code: Title</b>   | ELR215: ELECTRICAL POWER SYSTEMS   |
| <b>Program Number: Name</b>   | 4026: ELECTRICAL TN-PROC<br>4029: ELECTRICAL TY-PROCES<br>4127: ELECTRICAL TN-TRADES   |
| <b>Department:</b>  | ELECT./INSTRUMENTATION PS  |
| <b>Academic Year:</b>   | 2023-2024  |
| <b>Course Description:</b>  | This course is a study of the production and delivery of electrical power from the generating station to the consumer. Transmission and distribution equipment, system configurations, protection and control and electrical load fundamentals will be discussed and analyzed.   |
| <b>Total Credits:</b>   | 3  |
| <b>Hours/Week:</b>  | 3  |
| <b>Total Hours:</b>   | 42   |
| <b>Prerequisites:</b>   | ELR109   |
| <b>Corequisites:</b>  | There are no co-requisites for this course.  |
| <b>Substitutes:</b>   | ELN211   |
| <b>Vocational Learning Outcomes (VLO's) addressed in this course:</b> | <p><b>4026 - ELECTRICAL TN-PROC</b></p> <p>VLO 1 Interpret and produce electrical and electronics drawings including other related documents and graphics.</p> <p>VLO 2 Analyze and solve routine technical problems related to electrical systems by applying mathematics and science principles.</p> <p>VLO 9 Assist in creating and conducting quality assurance procedures under the supervision of a qualified person.</p> <p>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.</p> <p>VLO 15 Assist in commissioning, testing and troubleshooting electrical power systems under the supervision of a qualified person.</p> <p>VLO 16 Select electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.</p> <p><b>4029 - ELECTRICAL TY-PROCES</b></p> <p>VLO 1 Analyze, interpret, and produce electrical and electronics drawings, technical reports including other related documents and graphics.</p> <p>VLO 2 Analyze and solve complex technical problems related to electrical systems by applying mathematics and science principles.</p> |

Please refer to program web page for a complete listing of program outcomes where applicable.



- 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.

**4127 - ELECTRICAL TN-TRADES**

- VLO 1 Interpret and produce electrical and electronic 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 9 Assist in creating and conducting 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 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 specifications under the supervision of a qualified person.

**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.

**Course Evaluation:**

Passing Grade: 50%, D  
 A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.

**Other Course Evaluation & Assessment Requirements:**

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.

If a faculty member determines that a student is at risk of not being successful in their academic pursuits and has exhausted all strategies available to faculty, student contact information may be confidentially provided to Student Services in an effort to offer even more assistance with options for success. Any student wishing to restrict the sharing of such information should make their wishes known to the coordinator or faculty member.

Other course specific):

If a student misses a test he/she must have a valid reason (i.e. medical or family emergency documentation may be required). In addition, the instructor must be notified prior to the test sitting. If this procedure is not followed the student will receive a mark of zero on the test with no make-up option. Make-ups for missed tests (only with valid reason and documentation) will be written the week following the end of the semester. If this is not practical for the instructor an X grade may be issued.

If a student misses class time due to sickness, family emergency or other reason beyond his/her control the student must at his/her first opportunity meet with the course faculty to discuss if the missed time has placed the student at an increased risk of failing. The student must follow up the meeting by emailing the faculty with a summary of the meetings discussions. Documentation validating the missed time may be required.

Use of cell phones/PDAs for any form of communication (voice, text) during class or lab time is strictly prohibited. Cell phones/PDAs must be silenced during regular class and lab times and must be turned off and kept out of sight during test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 being assigned. Students may not wear earphones of any kind (i.e. for play back of recorded music/voice) during lab activities or test sittings. This does not include hearing aids required for hearing impaired.

Students are expected to maintain an active Sault College email account. They are required to check this email account daily. The instructor may announce details of lab and test requirements and scheduling through the Sault College email system (as well as sharing other important information).

**Books and Required Resources:**

No text book required.

**Course Outcomes and Learning Objectives:**

| Course Outcome 1  | Learning Objectives for Course Outcome 1  |
|---|---|
| 1. Perform basic per unit calculations for three phase alternating current systems. | 1.1 Convert actual power, voltage, current and impedance values to per unit values.<br>1.2 Convert per unit electrical values to actual values.<br>1.3 Reduce series/parallel networks to a single source/single impedance network.<br>1.4 Solve a network using per unit and/or actual values for power, voltage and current levels throughout (balanced conditions).<br>1.5 State the advantages and disadvantages of using the per |



|   |   |
|---|---|
|   | <p>unit method for calculating electrical parameters of power systems.</p> <p>1.6 Describe how real power flow is controlled in a power system and state the corresponding system indicators.</p> <p>1.7 Describe how reactive power flow is controlled in a power system and state the corresponding system indicators.</p>  |
| <b>Course Outcome 2</b>   | <b>Learning Objectives for Course Outcome 2</b>   |
| <p>2. Describe various options presently available for bulk generation of electrical power as well as those under consideration for future use.</p> | <p>2.1 Describe the history of bulk electrical power generation in North America.</p> <p>2.2 State the three major categories of bulk electrical power generating stations in use today.</p> <p>2.3 State and briefly describe alternative sources of power generation that are presently being utilized.</p> <p>2.4 State and briefly describe potential future sources of electrical energy that are presently in the design or test stage.</p> <p>2.5 Identify all major mechanical and electrical components of a typical hydro generating station.</p> <p>2.6 Identify all major mechanical and electrical components of a typical thermal generating station.</p> <p>2.7 State the common types of nuclear generating stations.</p> <p>2.8 Identify all major mechanical and electrical components of common nuclear generating stations.</p> <p>2.9 Discuss components common to thermal and nuclear generating stations</p> <p>2.10 Identify all major mechanical and electrical components of common wind power generating stations.</p> |
| <b>Course Outcome 3</b>   | <b>Learning Objectives for Course Outcome 3</b>   |
| <p>3. Describe alternating current (ac) and direct current (dc) transmission systems and their components.</p>                                      | <p>3.1 Identify, state the purpose of, and describe each major component of an overhead transmission line.</p> <p>3.2 Describe corona and associated problems.</p> <p>3.3 Describe how lightning is created and its potential effects on a transmission line.</p> <p>3.4 Describe and draw equivalent circuits for short, medium length and long ac transmission lines.</p> <p>3.5 State how line impedance affects maximum power transfer of an ac transmission line.</p> <p>3.6 List and comment on the advantages and disadvantages of dc power transmission.</p> <p>3.7 Describe the various types of high voltage dc converter stations.</p>   |
| <b>Course Outcome 4</b>   | <b>Learning Objectives for Course Outcome 4</b>   |
| <p>4. Describe transmission and distribution substations and their functions.</p>   | <p>4.1 State the difference between transmission and distribution and describe how their definitions may vary to match given situations.</p> <p>4.2 List and describe the major components of a substation.</p> <p>4.3 List and describe the major categories of circuit breakers.</p> <p>4.4 Describe the operation and applications of various types of circuit breakers.</p> <p>4.5 Describe various name plate parameters used to identify</p>  |



|  |  |  |
|--|--|--|
|  |  | ratings and capacities of substation equipment.<br>4.6 Describe the purpose of system grounding.<br>4.7 Describe basic substation grounding design.  |
|  | <b>Course Outcome 5</b>  | <b>Learning Objectives for Course Outcome 5</b>  |
|  | 5. Describe the purpose of 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.<br>5.2 State the primary functions of protective equipment.<br>5.3 Define protective relay.<br>5.4 List common types of protective relays and describe their operation.<br>5.5 Analyze time current characteristic curves for various protective relays.<br>5.6 Discuss the concepts of coordinated fault protection and zone coverage of power systems.<br>5.7 Define symmetrical components using the alpha operator. |
|  | <b>Course Outcome 6</b>  | <b>Learning Objectives for Course Outcome 6</b>  |
|  | 6. Describe the effects of harmonics on electrical power systems.                          | 6.1 Define harmonics.<br>6.2 List and describe terms used to quantify the effects of harmonics.<br>6.3 List components of a power system susceptible to damage from harmonics and describe what damage may occur and how to prevent or minimize it.  |
|  | <b>Course Outcome 7</b>  | <b>Learning Objectives for Course Outcome 7</b>  |
|  | 7. Interpret and apply the Canadian Electrical Code (CSA C22.1).                           | 7.1 Describe the purpose and layout of the Canadian Electrical Code.<br>7.2 Identify and apply appropriate Sections, Rules and Tables relating to electrical cabling and conductor ampacities.<br>7.3 Identify and apply appropriate Sections, Rules and Tables relating to grounding and bonding.<br>7.4 Identify and apply appropriate Sections, Rules and Tables relating to the installation of electrical equipment.  |

**Evaluation Process and Grading System:**

| Evaluation Type   | Evaluation Weight |
|-------------------|-------------------|
| Tests and Quizzes | 100%              |

**Date:**

July 14, 2023

**Addendum:**

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

