

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



Sault College

COURSE OUTLINE

COURSE TITLE: ELECTRICAL POWER SYSTEMS

CODE NO. : ELR 215-3 **SEMESTER:** THREE

PROGRAM: ELECTRICAL ENGINEERING
TECHNICIAN/TECHNOLOGY

AUTHOR: R. MCTAGGART

DATE: 08/2000 **PREVIOUS OUTLINE DATED:** 08/1999

APPROVED:

| | | |
|--|-------------|-------------|
| | _____ | _____ |
| | DEAN | DATE |

TOTAL CREDITS: 3

PREREQUISITE(S): ELR 109

HOURS/WEEK: 3

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For additional information, please contact Kitty DeRosario, Dean,
School of Trades & Technology Studies,
(705) 759-2554, Ext. 642

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Code No.**I. COURSE DESCRIPTION:**

This course is a study of the production, delivery and utilization of electrical power. Transmission and distribution equipment, system configurations, protection and control, and electrical load fundamentals will be discussed and analyzed. The student will also be introduced to the Canadian Electrical Code Part 1.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Perform basic calculations for three phase alternating current systems.

Potential Elements of the Performance:

- Convert actual power, voltage, current and impedance values to per unit values.
- Convert per unit electrical values to actual values.
- Reduce series/parallel networks to a single source/single impedance network.
- Solve a network using per unit and/or actual values for power, voltage and current levels throughout (balanced conditions).
- State the advantages and disadvantages of using the per unit method for calculating electrical parameters of power systems.
- Describe how real power flow is controlled in a power system and state the corresponding system indicators.
- Describe how reactive power flow is controlled in a power system and state the corresponding system indicators.

2. Describe various options presently available for bulk generation of electrical power as well as those under consideration for future use.

Potential Elements of the Performance:

- Describe the history of bulk electrical power generation in North America.
- State the three major categories of bulk electrical power generating stations in use today.
- State and briefly describe alternative sources of power generation that are presently being utilized.
- State and briefly describe potential future sources of electrical

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- energy that are presently in the design or test stage.
 - Identify all major mechanical and electrical components of a typical hydro generating station.
 - Identify all major mechanical and electrical components of a typical thermal generating station.
 - State the common types of nuclear generating stations.
 - Identify all major mechanical and electrical components of common nuclear generating stations.
 - Discuss components common to thermal and nuclear generating stations.
 - Discuss energy conversion processes in hydro, thermal and nuclear generating stations.
3. Describe alternating current (ac) and direct current (dc) transmission systems and their components.

Potential Elements of the Performance:

- Identify, state the purpose of, and describe each major component of an overhead transmission line.
 - Describe corona and associated problems.
 - Describe how lightning is created and its potential effects on a transmission line.
 - Describe and draw equivalent circuits for short, medium length and long ac transmission lines.
 - State how line impedance effects maximum power transfer of an ac transmission line.
 - List and comment on the advantages and disadvantages of dc power transmission.
 - Describe the various types of high voltage dc converter stations.
4. Describe transmission and distribution substations and their functions.

Potential Elements of the Performance:

- State the difference between transmission and distribution and describe how their definitions may vary to match given situations.
- List and describe the major components of a substation.
- List and describe the major categories of circuit breakers.
- Describe the operation and applications of various types of circuit breakers.
- Describe various 'name plate' parameters used to identify ratings and capacities of substation equipment.
- Describe various types of fuses and their operation.

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5. Describe the purpose of protective relays and how they interface with the power system.

Potential Elements of the Performance:

- List common electrical and mechanical faults that may occur in a power system.
- State the primary functions of protective equipment.
- Define protective relay.
- List various types of protective relays and describe their operation.
- Analyze time – current characteristic curves for various protective relays.
- Discuss the concepts of coordinated fault protection and zone coverage of power systems.
- Define symmetrical components using the alpha operator.

6. Interpret the Canadian Electrical Code Part 1 (CSA Standard C22.1).

Potential Elements of the Performance:

- Describe the purpose of the Canadian Electrical Code Part 1 (CEC).
- Describe how the CEC may become a legal document.
- Describe the relationship between the CEC and the Ontario Hydro Electrical Code.
- Describe the different parts of the CEC and their applications.
- Utilize the CEC to determine appropriate installation requirements for specific residential, commercial and industrial applications.
- List other codes associated with the CEC and describe their applications.

III. TOPICS:

1. Power System Analysis
2. Power Generation
3. Power Transmission
4. Substations

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5. Protective Relays
6. The Canadian Electrical Code Part 1

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Resource materials are available in the Sault College Library, from the instructor and on the Internet. No text purchase is required.

V. EVALUATION PROCESS/GRADING SYSTEM:

Three tests (equally weighted)* 100%

*Refer to SPECIAL NOTES items 4 and 6.

The following semester grades will be assigned to students in postsecondary courses:

| <u>Grade</u> | <u>Definition</u> | <u>Grade Point Equivalent</u> |
|--------------|---|-------------------------------|
| A+ | 90 - 100% | 4.00 |
| A | 80 - 89% | 3.75 |
| B | 70 - 79% | 3.00 |
| C | 60 - 69% | 2.00 |
| R (Repeat) | 59% or below | 0.00 |
| CR (Credit) | Credit for diploma requirements has been awarded. | |
| S | Satisfactory achievement in field placement or non-graded subject areas. | |
| X | A temporary grade. This is used in limited situations with extenuating circumstances giving a student additional time to complete the requirements for a course (see <i>Policies & Procedures Manual – Deferred Grades and Make-up</i>). | |
| NR | Grade not reported to Registrar's office. This is used to facilitate transcript preparation when, for extenuating circumstances, it has been impossible for the faculty member to report grades. | |

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Code No.**VI. SPECIAL NOTES:**Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Plagiarism

Students should refer to the definition of “academic dishonesty” in *Student Rights and Responsibilities*. Students who engage in “academic dishonesty” will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course, as may be decided by the professor. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

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 rewrite option.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following:

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VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.