

**SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY**

**SAULT STE. MARIE, ONTARIO**



Sault College

**COURSE OUTLINE**

<b>COURSE TITLE:</b>	Electrical Theory: Level II		
<b>CODE NO. :</b>	ELR 713	<b>SEMESTER:</b>	N/A
<b>PROGRAM:</b>	Construction and Maintenance Electrician Apprenticeship		
<b>AUTHOR:</b>	R. McTaggart		
<b>DATE:</b>	December 2003	<b>PREVIOUS OUTLINE DATED:</b>	N/A
<b>APPROVED:</b>	<hr/>		
	<b>DEAN</b>	<b>DATE</b>	
<b>TOTAL CREDITS:</b>	8		
<b>PREREQUISITE(S):</b>	Level I		
<b>HOURS/WEEK:</b>	6		

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*For additional information, please contact Colin Kirkwood, Dean  
School of Technology, Skilled Trades & Natural Resources*

*(705) 759-2554, Ext. 688*

**I. COURSE DESCRIPTION:**

This course introduces the student to fundamentals of magnetism and its relationship to electricity. This is followed by rotating machines (electric motors and generators) and alternating current circuit analysis.

**II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:**

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

**1. Solve problems associated with electro-magnetic circuits.****Potential Elements of the Performance:**

- Describe magnetic flux and flux density.
- Solve problems associated with magnetic energy, including magnetic potential difference, flux density, reluctance, permeance, and permeability.
- Explain Ohm's Law as applied to magnetic circuits.
- List and explain the factors that affect the magnitude and direction of induced EMF in single conductors and in coils.
- Describe factors which affect inductance and perform related calculations
- State and apply Fleming's hand rules.
- State and apply Lenz's law.
- Describe the creation and effects of eddy currents.

**2. Analyze and test direct current (DC) motors and generators.****Potential Elements of the Performance:**

- Describe the construction, operation and characteristics of permanent magnet, separately excited, shunt, series and compound (cumulative and differential) DC motors and generators.
- Draw connection diagrams for all types of DC motors and generators.

3. Analyze and test single and three phase ac induction motors.  
Potential Elements of the Performance:
  - Describe the construction of single and three-phase AC induction motors.
  - Describe the operating characteristics of single and three-phase AC induction motors.
  - Describe troubleshooting procedures for single and three-phase induction motors.
  
4. Perform calculations involving alternating current circuits with resistor, inductor and capacitor circuit elements.  
Potential Elements of the Performance:
  - Describe a sine wave, calculate RMS, average, maximum, and instantaneous values.
  - Explain and calculate frequency, electrical and mechanical degrees.
  - Interpret and calculate phasors, vectors and vector diagrams.
  - Describe the effects of alternating voltage and current in a resistive device.
  - Describe inductance, self inductance and characteristics of a coil connected to a DC source.
  - Describe the characteristics of a coil connected to an AC source.
  - Calculate inductive reactance, voltage, current, and power of an inductive circuit.
  - Describe capacitance, and characteristics of a capacitor connected to a DC source.
  - Describe the characteristics of a capacitor connected to an AC source.
  - Calculate capacitive reactance, voltage, current, power and phase relationships of a capacitive circuit.

- Calculate values for RL/RC/RLC series circuits.
  - Describe and calculate resonant circuits.
  - Describe and calculate resonant circuits and phase relations.
  - Explain and calculate RL/RC parallel circuits.
  - Label, describe and calculate values for RLC parallel circuit.
  - Describe the method for testing RLC parallel circuits.
  - Explain and calculate RLC parallel resonant circuits.
  - Explain and calculate the efficiency of AC loads as related to power factor correction.
  - Explain the effects of power factor correction.
  - Calculate power factor correction for single-phase loads.
5. Analyze simple relay logic motor control circuits.  
Potential Elements of the Performance:
- Design and draw control circuits using mechanical pilot devices for starting, stopping and reversing AC motors.

### III. TOPICS:

1. Magnetism and Induced EMF
2. DC Machines
3. AC Motors
4. AC Circuit Theory
5. AC Motor Control

**IV. REQUIRED RESOURCES/TEXTS/MATERIALS:**

Delmar's Standard Textbook of Electricity, Third Edition  
By Stephen L. Herman ISBN 1-4018-2565-6

**V. EVALUATION PROCESS/GRADING SYSTEM:**

Course grade will be based on four or five equally weighted tests.  
See special notes.

The following semester grades will be assigned to students:

<b>Grade</b>	<b><u>Definition</u></b>	<i>Grade Point Equivalent</i>
A+	90 – 100%	
A	80 – 89%	4.00
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.	

**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 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/program, as may be decided by the professor/dean. 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.

Course outline amendments:

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 professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

**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.