SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: ELECTRICAL FUNDAMENTALS

CODE NO.: ELR 206 **SEMESTER: 4**

PROGRAM: MECHANICAL

AUTHOR: A. GOODERHAM

DATE: DEC. 94 **PREVIOUS OUTLINE DATED:**

APPROVED: L.P. Chapleau 95-08-15

DEAN **DATE**

ELECTRICAL FUNDAMENTALS — COURSE NAME

ELR 206 — CODE NO.

TOTAL CREDITS

PREREQUISITE(S): PHYSICS

I.PHILOSOPHY/GOALS:

This course will develop the students' ability to understand and apply the basic concepts of electricity to the solution of direct current electrical circuit problems and analysis. An approach to the fundamentals of electricity will be presented with heavy emphasis on the solution of circuit problems using basic laws only. Practical skills and understanding of procedures dealing with electricity in the workplace, as well as reinforcement of basic theoretical circuit operation will be done in the lab setting.

II. STUDENT PERFORMANCE OBJECTIVES (OUTCOMES):

Upon successful completion of this course the student will:

1) Have a fundamental knowledge of DC circuit theory
2) Be able to simplify and analyze basic DC circuits comprised of resistors
3) Understand basic magnetic and electromagnetic principles
4) Be able to apply magnetic principles to the workings of DC and AC machines

III. TOPICS TO BE COVERED:

1) Electrical units
2) Ohm's Law
3) Series circuits
4) Parallel circuits
5) Magnetism
6) Force and Torque
7) DC Generators
8) DC Motors
9) AC Introduction
10) Transformers
11) Three Phase Induction Motor
12) Basic Motor Control
13) Digital Definitions
14) Logic Circuits / Logical Thinking

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IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Topic/Unit - Electrical Units

Learning Activities:

Listen to presentation of the principles of electrification by friction, planetary atom, potential difference, current and resistance. Discuss the electric lamp, simple circuit, some analogies, and the difference between ac and dc current. Draw circuit diagrams and practice scientific notation, metric prefixes and engineering notation numbering system conversions. Identify the difference between resistance and conductance.

Resources:

overheads, board work, Chapter 1 - text

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Topic/Unit: Series Circuits

Learning Activities:

Listen to the presentation on resistors in series, polarities of voltage drops and Kirchhoff's voltage law. Practice these concepts by applying them to the solution of series circuit problems involving resistance, voltage and current. Specific attention will be placed on open and short circuits, and circuit operation. Practice Ohm's Law problems following its introduction.

Resources:

overheads, board work, Chapter 2 - text

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Topic/Unit : Power and Work, AWG Wire Gauge

Learning Activities:

Listen to the presentation on the difference between energy and work. Practice the calculation for power, voltage, current and energy using the appropriate units of measure. Practice using the wire tables and become aware of the information available.

Resources:

overheads, board work, Chapters 3 & 4 - text

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Topic/Unit: Parallel Circuits

Learning Activities:

Listen to the presentation on resistors in parallel, current flow in parallel circuits and the concept of solving for equivalent total resistance. Apply Kirchhoff's current law to aide in the understanding of parallel circuit characteristics, and Ohm's law in the solution of parallel circuit problems. Specific attention will be placed on open and short circuits, and circuit operation.

Resources:

overheads, board work, Chapter 2 - text

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Topic/Unit: Magnetism and Magnetic Circuits

Learning Activities:

Listen to the presentation on magnetic fields, electromagnetism, magnetic flux and the correlation to electrical quantities. Become aware of the concepts of magnetomotive force, forces on current-carrying conductors in a magnetic field and then the application to the motor principle. Become familiar with the terms reluctance and permeability, relative permeability, hysteresis and eddy currents. Utilize magnetization curves to aide in problem solving.

Resources:

overheads, board work, Chapter 6 - text

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Topic/Unit: Inductance

Learning Activities:

Listen to the presentation on electromagnetic induction, Faraday's and Lenz's laws and self-induction. Become familiar with types of inductors and their uses, as well as self-inductance.

Resources:

overheads, board work, Chapter 7 - text

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Topic/Unit: DC Generators

Learning Activities:

Listen to the presentation on DC Generator characteristics and the application of magnetic principles involved. Understand the differences between types of generators and their unique characteristics.

Resources:

overheads, board work, Chapter 8 - text

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Topic/Unit: Safety

Learning Activities:

Listen to the presentation on high power switching, switchgear, lockout procedure and measuring high power. The use of gloves and goggles, the WHIMIS system and Occupational Health and Safety.

Resources:

overheads, board work, hand-outs

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Topic/Unit: DC Motors and Control

Learning Activities:

Listen to the presentation on DC motor characteristics and the application of magnetic principles involved. Understand the differences between types of motors, their unique characteristics , back EMF and connection conventions. Be able to recognize the type and characteristics of basic control circuitry.

Resources:

overheads, board work, Chapter 15 - Text

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Topic/Unit: Alternating Current

Learning Activities:

Listen to the presentation on the generation of alternating voltage, the sine wave, frequency, phase angle, and the radian. Become familiar with and practice using instantaneous, peak, average and RMS values in the analysis of sine waves.

Resources:

overheads, board work, Chapter 14 - text

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Topic/Unit: Transformers

Learning Activities:

Listen to the presentation on the application of basic magnetism laws and back EMF as they pertain to transformer operation. Be able to recognize the different types of transformers using the transformation ratio principle.

Resources:

overheads, board work, Chapter 12 - text

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Topic/Unit: Three Phase AC Induction Motors and Control

Learning Activities:

Listen to the presentation on AC motor characteristics and the concept of three phase. Understand the differences between types of motors, their unique characteristics , and connection conventions. Be able to recognize the type and characteristics of basic AC control circuitry.

Resources:

overheads, board work, Chapter 16 - Text

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Topic/Unit: Digital Fundamentals

Learning Activities:

Listen to the presentation on the differences between analog and digital quantities, logic tables, basic gates and boolean algebra example. Be able to understand the operation of basic gates and recognize symbols.

Resources:

overheads, board work, hand-outs

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Topic/Unit : Digital Circuits, Logical Thinking

Learning Activities:

Listen to the presentation on the combination of basic gates to perform logical sequences and industrial circuits.

Resources:

overheads, board work, hand-outs

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NOTE: All units covered have a strong reinforcement of hands-on application in the lab setting. Each student will be exposed to the theoretical analysis and must be able to apply these rules in the simulated industrial environment. Proficiency in the lab will be a large portion of the student work evaluation.

V. EVALUATION METHODS: (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS, ETC.)

Three (3) tests worth 20% each	60%
Quizzes, Homework and Lab Assignments	40%
Total	100%

The grading system to be used will be as follows:

A+= 90-100% A= 80-89% B= 70-79% C= 55-69%
R= Repeat

medical or family emergency) . In addition the school must be notified before the scheduled test sitting. The student should contact the instructor involved and/or leave a message on the electronic voice mail. If this is not followed, the student will receive a mark of zero on the test with no rewrite option.

Students will be given advance notice of a test date (1 week minimum) . Quizzes (worth a maximum of 5%) may be given without notice. There will be no rewrites for students missing quizzes without prior notice and valid reasons as stated above.

LAB ATTENDANCE IS MANDATORY. ALL LABS MUST BE COMPLETED AND SUBMITTED OR AN X GRADE WILL BE ISSUED UNTIL THE OUTSTANDING LAB(S) AND REPORT(S) ARE COMPLETED.

LAB REPORTS WHICH ARE UP TO ONE WEEK LATE WILL PENALIZED A FULL GRADE. ANY LABS MORE THAN A WEEK LATE WILL RECEIVE A MARK OF ZERO BUT MUST BE COMPLETED TO A SATISFACTORY DEGREE (55% MIN.) OR AN X GRADE WILL RESULT. THOSE STUDENTS COMPLETING AND SUBMITTING A LAB ON-TIME MAY BE REQUIRED TO REDO THE LAB IF AN UNSATISFACTORY GRADE IS RECEIVED.

VI. 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:
A four (4) hour comprehensive written exam.
A proficiency exam in the lab setting (2 hrs.)

VII. REQUIRED STUDENT RESOURCES

Electric Circuits and Machines, 7th edition,
by Lister and Rusch

VIII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY:

IX. SPECIAL NOTES

Students with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.