SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE OUTLINE:	ELECTRICAL MACHINES
CODE NO.:	ELR 232-6
PROGRAM:	ELECTRICAL TECHNICIAN/TECHNOLOGY
SEMESTER:	THREE
DATE:	MAY 1991
PREVIOUS OUTLINE DATED:	MAY 1990
AUTHOR:	R. MCTAGGART

NEW:_____ REV.: X

APPROVED:

W Filipowich — COORDINATOR — June 1/91 — DATE

L P Arguette — DEAN — 91/06/03 — DATE

ELECTRICAL MACHINES	ELR 232
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TOTAL CREDIT HOURS: 96

PREREQUISITE(S): ELR 109

PHILOSOPHY/GOALS:

THIS COURSE IS AN ANALYTICAL STUDY OF CHARACTERISTICS, PERFORMANCE AND CONTROL OF DC GENERATORS AND MOTORS, SINGLE AND POLYPHASE INDUCTION MOTORS, POLYPHASE SYNCHRONOUS MACHINES AND TRANSFORMERS, SUPPORTED BY AN INTEGRATED LABORATORY PROGRAM.

STUDENT PERFORMANCE OBJECTIVES:

UPON SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENT WILL:

1. HAVE A WORKING KNOWLEDGE OF DC MACHINES;
2. HAVE A WORKING KNOWLEDGE OF AC MACHINES;
3. UNDERSTAND AND BE ABLE TO DESIGN BASIC MOTOR CONTROL CIRCUITS.

TOPICS TO BE COVERED:

1. CONSTRUCTION OF DC MACHINES;
2. DC GENERATORS;
3. DC MOTORS;
4. INTRODUCTION TO MOTOR CONTROL CIRCUITS;
5. STARTING AND CONTROL OF DC MOTORS;
6. TRANSFORMERS;
7. AC GENERATORS;
8. POLYPHASE INDUCTION MOTORS;
9. SINGLE - PHASE MOTORS;
10. SYNCHRONOUS MOTORS;
11. STARTING AND CONTROL OF AC MOTORS;
12. SPECIAL-PURPOSE MOTORS AND DEVICES.

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LEARNING ACTIVITIES	REQUIRED RESOURCES
	TEXT: ELECTRICAL MACHINES AND TRANSFORMERS. RYFF, PLATNICK, KARNAS
1. CONSTRUCTION OF DC MACHINES - REVIEW OF DC MACHINE PRINCIPLES - COMPONENTS OF DC MACHINES - COMMUTATORS AND BRUSHES - ARMATURE WINDINGS - ARMATURE REACTION - INTERPOLES - COMPENSATING WINDINGS	CH.2
2. DC GENERATORS - TYPES OF DC GENERATORS - GENERATOR EQUIVALENT CIRCUITS - SATURATION - ANALYSIS OF GENERATOR OPERATION - VOLTAGE CONTROL - EFFICIENCY	CH.3
3. DC MOTORS - TYPES OF DC MOTORS - MOTOR EQUIVALENT CIRCUITS - SPEED REGULATION - TORQUE - SPEED RELATIONSHIPS - STARTING AND OPERATING CURRENT CHARACTERISTICS - SPEED CONTROL - RATING AND EFFICIENCY - APPLICATIONS	CH.4
4. INTRODUCTION TO MOTOR CONTROL CIRCUITS - A NEED FOR MOTOR STARTING EQUIPMENT - CONTROL OF STARTING EQUIPMENT - LADDER/RELAY LOGIC - SOLID STATE AND ELECTROMECHANICAL CONTROLS - PROGRAMMABLE CONTROLLERS AND RELAY LOGIC	

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LEARNING ACTIVITIES	REQUIRED RESOURCES
5. STARTING AND CONTROL OF DC MOTORS - VARIABLE RESISTOR STARTING - MOTOR CONTROL - ELECTRONIC CONTROLLERS - POWER SWITCHING PRINCIPLES - FOUR QUADRANT OPERATION	CH.5
6. TRANSFORMERS - REVIEW PRINCIPLES OF OPERATION - EQUIVALENT CIRCUITS AND PHASOR DIAGRAMS - TYPES, CONSTRUCTION AND RATING - PHASING AND POLARITIES - THREE PHASE CONNECTIONS - PARALLEL OPERATION	CH.8,9
7. AC GENERATORS - REVIEW AC MACHINE PRINCIPLES - CONSTRUCTION OF AC SYNCHRONOUS GENERATORS - ARMATURE WINDINGS - VOLTAGE REGULATION - ARMATURE REACTION - ANALYSIS OF GENERATOR OPERATION USING EQUIVALENT CIRCUITS AND PHASOR DIAGRAMS	CH.6,7
8. POLYPHASE INDUCTION MOTORS - GENERAL DESIGN FEATURES - ROTATING FIELD - EQUIVALENT CIRCUITS - TORQUE - SPEED CHARACTERISTICS - APPLICATIONS	CH.10
9. SINGLE - PHASE MOTORS - PRINCIPLE OF OPERATION - TYPES AND CONSTRUCTION	CH.11

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LEARNING ACTIVITIES	REQUIRED RESOURCES
10. THREE PHASE SYNCHRONOUS MOTORS - CONSTRUCTION - PRINCIPLE OF OPERATION - ANALYSIS OF OPERATING CHARACTERISTICS USING EQUIVALENT CIRCUITS AND PHASOR DIAGRAMS - EFFICIENCY - APPLICATIONS	CH.12
11. STARTING AND CONTROL OF AC MOTORS - AUTOMATIC STARTERS FOR SYNCHRONOUS MOTORS - DYNAMIC BRAKING OF SYNCHRONOUS MOTORS - EXCITATION SYSTEMS FOR SYNCHRONOUS MOTORS - INDUCTION MOTOR STARTING METHODS - INDUCTION MOTOR SPEED CONTROL - INTRODUCTION TO SOLID STATE DRIVES - VARIABLE FREQUENCY INDUCTION MOTOR DRIVE	CH.13
12. SPECIAL-PURPOSE MOTORS AND DEVICES - PERMANENT-MAGNET DC MOTORS - DC SERVOMOTORS - MOVING COIL ARMATURE MOTORS - BRUSHLESS DC MOTORS - DC TACHOMETERS - STEPPER MOTORS - LINEAR INDUCTION MOTORS - AC SERVOMOTORS - AC TACHOMETER GENERATORS - ELECTROMAGNETIC CLUTCHES	CH.14

ADDITIONAL RESOURCE MATERIALS:

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METHOD(S) OF EVALUATION

TESTS	70%
LAB EXERCISES	30%
TOTAL	100%

THE GRADING SYSTEM USED WILL BE AS FOLLOWS:

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

NOTES: IN ORDER TO OBTAIN A PASSING GRADE THE STUDENT MUST HAVE AN OVERALL TEST AVERAGE OF AT LEAST 50% AS WELL AS A COMBINED TEST/LAB AVERAGE OF AT LEAST 55%.

IF A STUDENT MISSES A TEST HE/SHE MUST HAVE A VALID REASON (ie. MEDICAL OR FAMILY EMERGENCY). IN ADDITION THE SCHOOL MUST BE NOTIFIED BEFORE THE SCHEDULED TEST SITTING. THE STUDENT SHOULD CONTACT THE INSTRUCTOR INVOLVED. IF THE INSTRUCTOR CANNOT BE REACHED LEAVE A MESSAGE WITH THE DEAN'S OFFICE OR THE COLLEGE SWITCHBOARD. IF THIS PROCEDURE IS NOT FOLLOWED THE STUDENT WILL RECEIVE A MARK OF ZERO ON THE TEST WITH NO REWRITE OPTION.

REQUIRED STUDENT RESOURCES:

TEXT BOOKS: 1. ELECTRICAL MACHINES AND TRANSFORMERS. PRINCIPLES AND APPLICATIONS. P. F. RYFF, D. PLATNICK, J. A. KARNAS

ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY BOOK SECTION:

KAISER, J. L. ELECTRICAL POWER: MOTORS, CONTROLS, GENERATORS, TRANSFORMERS. THE GOODHEART-WILLCOX CO., INC., 1982. TK 2000.K33
NASAR, S. A. ELECTRIC ENERGY CONVERSION AND TRANSMISSION. MACMILLAN PUBLISHING CO., 1985. TK 1001.N37
WILDI, T. ELECTRICAL POWER TECHNOLOGY. JOHN WILEY & SONS, 1981. TK 145.W489

SPECIAL NOTES: THERE ARE MANY BOOKS IN THE LIBRARY THAT ARE RELEVANT TO THIS COURSE. USUALLY THEY WILL BE FOUND IN THE SECTION BETWEEN TK 1000 AND TK 3000.