

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE OUTLINE: POWER ELECTRONICS

CODE NO.: ELR 236 - 6

PROGRAM: ELECTRICAL TECHNICIAN/TECHNOLOGY

SEMESTER: FOUR

DATE: JANUARY 1992

PREVIOUS
OUTLINE DATED: JANUARY 1991

AUTHOR: R. MCTAGGART

NEW: _____ REV.: X

APPROVED:

W. Filipowich
COORDINATOR

Jan 6, 1992
DATE

L. Oguth
DEAN

92/01/06
DATE

DEC 17 1990

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TOTAL CREDIT HOURS: 96

PREREQUISITE(S): ELN 213, ELR 109

PHILOSOPHY/GOALS:

THE STUDENT WILL BE INTRODUCED TO POWER ELECTRONIC DEVICES AND SOLID STATE DRIVE PACKAGES. THE STUDENT WILL ALSO BE INTRODUCED TO CONVERTER AND INVERTER CIRCUITS WHICH COMPRISE THE POWER AND CONTROL FOR THESE DRIVE PACKAGES. HANDS ON EXPERIENCE OF OPERATION AND TROUBLESHOOTING OF TYPICAL COMMERCIAL AC AND DC DRIVE SYSTEMS WILL BE ACHIEVED THROUGH LAB EXERCISES.

STUDENT PERFORMANCE OBJECTIVES:

UPON SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENT WILL BE ABLE TO:

1. DESCRIBE THE OPERATING CHARACTERISTICS OF VARIOUS POWER ELECTRONIC DEVICES AND ASSOCIATED TRIGGERING DEVICES;
2. UNDERSTAND AND DESCRIBE THE OPERATION OF SINGLE AND POLYPHASE RECTIFIERS, CONVERTERS, AND INVERTERS;
3. UNDERSTAND AND DESCRIBE THE OPERATION OF DC CHOPPER CIRCUITS;
4. OPERATE AND TROUBLESHOOT POWER ELECTRONIC DRIVE PACKAGES;
5. UNDERSTAND MANUFACTURERS' DATA SHEETS AND BE ABLE TO SELECT APPROPRIATE DEVICES FOR SPECIFIC APPLICATIONS.

TOPICS TO BE COVERED:

1. INTRODUCTION TO POWER ELECTRONICS;
2. DIODE CIRCUITS AND RECTIFIERS;
3. THYRISTOR COMMUTATION TECHNIQUES;
4. CONTROLLED RECTIFIERS;
5. STATIC SWITCHES;
6. AC VOLTAGE CONTROLLERS;
7. DC CHOPPERS;
8. INVERTERS.

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| LEARNING ACTIVITIES | REQUIRED RESOURCES |
|--|---|
| 1. INTRODUCTION TO POWER ELECTRONICS - HISTORY OF POWER ELECTRONICS - APPLICATIONS - POWER ELECTRONIC DEVICES - TRIGGERING DEVICES - MANUFACTURERS' DATA SHEETS - DEVICE PROTECTION | TEXT: <u>POWER ELECTRONICS: CIRCUITS, DEVICES, AND APPLICATIONS, RASHID.</u> CH. 1, 12, 13, 14, 15 |
| 2. DIODE CIRCUITS AND RECTIFIERS - DIODES WITH RLC LOADS - FREEWHEELING DIODES - SINGLE PHASE RECTIFIERS - POLYPHASE RECTIFIERS | CH. 2 |
| 3. THYRISTOR COMMUTATION TECHNIQUES - NATURAL COMMUTATION - FORCED COMMUTATION - COMMUTATION CIRCUIT DESIGN | CH. 3 |
| 4. CONTROLLED RECTIFIERS - PHASE-CONTROLLED CONVERTER OPERATION - SEMICONVERTERS - FULL CONVERTERS - DUAL CONVERTERS - SERIES CONVERTERS - POWER FACTOR IMPROVEMENTS - DESIGN OF CONVERTER CIRCUITS - EFFECTS OF INDUCTANCES | CH. 4 |
| 5. STATIC SWITCHES - SINGLE PHASE AC SWITCHES - POLYPHASE AC SWITCHES - DC SWITCHES - DESIGN OF STATIC SWITCHES | CH. 5 |

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|---|--------------------|
| 6. AC VOLTAGE CONTROLLERS - SINGLE PHASE CONTROLLERS - POLYPHASE CONTROLLERS - TRANSFORMER TAP CHANGERS - CYCLOCONVERTERS - DESIGN OF AC VOLTAGE CONTROLLER CIRCUITS - EFFECTS OF INDUCTANCES | CH. 6 |
| 7. DC CHOPPERS - INTRODUCTION - STEP-DOWN AND STEP-UP CHOPPER OPERATION - SWITCHING-MODE REGULATORS - THYRISTOR CHOPPER CIRCUITS - CHOPPER CIRCUIT DESIGN | CH. 7 |
| 8. INVERTERS - PRINCIPLE OF OPERATION - SINGLE PHASE INVERTERS - POLYPHASE INVERTERS - VOLTAGE CONTROL OF INVERTERS - HARMONIC REDUCTIONS | CH. 8 |

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METHOD(S) OF EVALUATION

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|---------------|------|
| TESTS | 60% |
| LAB EXERCISES | 40% |
| 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 MAINTAIN A MINIMUM 55% AVERAGE IN BOTH TEST SCORES AND LAB EXERCISES.

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. POWER ELECTRONICS: CIRCUITS, DEVICES, AND APPLICATIONS BY M. H. RASHID.

ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY BOOK SECTION:

