SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	POWER ELECTRONICS
CODE NO.:	ELR236 - 6
PROGRAM:	ELECTRICAL TECHNICIAN
SEMESTER:	FOUR
DATE:	JANUARY 1991
AUTHOR:	ENO LUDAVICIUS

NEW: ____ REV.: X

APPROVED: L P Crozzetti (DEAN) 91/01/08 (DATE)

CALENDAR DESCRIPTION

POWER ELECTRONICS	ELR236 - 6
COURSE NAME	COURSE NUMBER

PHILOSOPHY/GOALS:

THE STUDENT WILL BE INTRODUCED TO POWER ELECTRONIC DEVICES WHICH POWER AC & DC DRIVE PACKAGES. THE STUDENT WILL ALSO BE INTRODUCED TO CONVERTER & INVERTER CIRCUITS WHICH COMPRISE THE POWER AND CONTROL FOR THESE DRIVE SYSTEMS. THE STUDENT WILL ACHIEVE HANDS-ON EXPERIENCE OF OPERATIONAL ADJUSTMENT AND TROUBLESHOOTING OF TYPICAL COMMERCIAL AC & DC DRIVE SYSTEMS THROUGH LABWORK.

METHOD OF ASSESSMENT (GRADING METHOD):

THE STUDENT WILL BE ASSESSED IN THE FOLLOWING MANNER:

1) THREE WRITTEN TESTS WORTH 20% EACH.

2) PROJECTS AND ASSIGNMENTS WORTH 40% IN TOTAL.

TEXTBOOK(S):

1) ELECTRICAL POWER TECHNOLOGY - T. WILDI
2) POWER ELECTRONICS & CONTROLS - S.K. DATTA
3) POWER CONTROL WITH SOLID-STATE DEVICES - I.M. GOTTLIEB
4) POWER ELECTRONICS - SOLID STATE MOTOR CONTROL - R.A. PEARMAN
5) POWER ELECTRONICS- CIRCUITS,DEVICES,APPLICATIONS- M.H.RASHID
6) ELECTRICAL TRANSFORMERS AND POWER EQUIPMENT - A.J. PANSINI
7) ELECTRICAL POWER SYSTEM TECHNOLOGY - S.W.FARDO & D.R.PATRICK

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POWER ELECTRONICS

GENERAL OBJECTIVES

1) BLOCK 1 - INTRODUCTION TO POWER ELECTRONICS

1.1) INTRODUCTION TO THE POWER ELECTRONICS INDUSTRY
1.2) POWER ELECTRONIC DEVICES: POWER SEMICONDUCTOR DIODES
1.3) POWER ELECTRONIC DEVICES: POWER TRANSISTORS
1.4) POWER ELECTRONIC DEVICES: THYRISTORS
1.5) POWER ELCETRONIC DEVICES: PROTECTION

2) BLOCK 2 -DIODE CIRCUITS & RECTIFIERS & CONTROLLED RECTIFIERS

2.1) THYRISTOR COMMUTATION TECHNIQUES
2.2) SINGLE & THREE PHASE DIODE CIRCUITS
2.3) PHASE CONTROLLED CONVERTERS
2.4) STATIC SWITCHES

3) BLOCK 3 - DC CHOPPERS & DC DRIVES

3.1) INTRODUCTION TO STEP-UP & STEP-DOWN CHOPPER OPERATION
3.2) THYRISTOR CHOPPER CIRCUITS
3.3) INTRODUCTION TO SINGLE & THREE PHASE DRIVES
3.4) INTRODUCTION TO CHOPPER DRIVES

4) BLOCK 4 - AC VOLTAGE CONTROLLERS & INVERTERS

4.1) INTRODUCTION TO SINGLE & THREE PHASE CONTROLLERS
4.2) INTRODUCTION TO CYCLOCONVERTERS
4.3) INTRODUCTION TO SINGLE & THREE PHASE INVERTERS
4.4) INTRODUCTION TO THE DIFFERENT TYPES OF INVERTER CONTROL

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POWER ELECTRONIC SYSTEMS

SPECIFIC OBJECTIVES

BLOCK 1 - INTRODUCTION TO POWER BLOCK

1.1) DEVICE CHARACTERISTICS

REVIEW OF THE CHARACTERISTICS OF SCR'S:

- PHASE CONTROLLED AND INVERTER GRADE
- AMPLIFYING GATE
- GATE TURN-OFF THYRISTORS (GTO)
- LIGHT ACTIVATED
- REVERSE CONDUCTING THYRISTORS (RCT)
- TRIACS
- NPN POWER TRANSISTORS
- POWER MOSFETS
- GENERAL PURPOSE & FAST ACTING RECTIFIER DIODES

1.2) DATA SHEETS

TO UNDERSTAND MANUFACTURES DATA SHEETS AND BE ABLE TO SELECT THE APPROPRIATE DEVICES FOR ANY SPECIFIC APPLICATION.

1.3) DEVICE PROTECTION

- JUNCTION TEMPERATURE; TURN-ON CONDUCTION AND TURN-OFF HEAT DISSIPATION COMPONENTS.
- EFFECTS OF SWITCHING RATES
- THERMAL IMPEDANCES & TRANSIENT THERMAL IMPEDANCE
- HEAT SINK CALCULATIONS
- SELECTION OF DEVICE PACKAGE AND TYPE OF HEAT SINK
- THERMOCAPACITY
- PULSE AND SURGE CURRENT CAPABILITIES
- CURRENT RATINGS
- TURN-ON di/dt
- TRANSIENT OVERVOLTAGE
- OFF-STATE dv/dt
- SERIES/PARALLEL ARRAYS FOR HIGH-POWER APPLICATIONS

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POWER ELECTRONIC SYSTEMS

SPECIFIC OBJECTIVES

BLOCK 2 -DIODE CIRCUITS & RECTIFIERS & CONTROLLED RECTIFIERS

2.1) PHASE-CONNECTED CONVERTERS

1) SINGLE-PHASE CONVERTERS: LOAD VOLTAGE AND HARMONICS, DISTORTION FACTOR, DISPLACEMENT FACTOR, POWER FACTOR, DISCONTINUOUS CONDUCTION.
2) THREE PHASE CONVERTERS: HARMONICS AND DISPLACEMENT FACTOR, COMMUTATION OVERLAP, SEMICONVERTER, DUAL CONVERTERS.
3) CONVERTER CONTROL: LINEAR FIRING ANGLE CONTROL, COSINE CROSSING CONTROL, DIGITAL FIRING CIRCUITS, PHASE-LOCKED-LOOP AND MICROPROCESSOR CONTROL.

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GENERAL INFORMATION

TIMETABLE

DAY	TIME	PLACE	ACTIVITY
MONDAY	2:30- 4:30	B104	LECTURE & LAB
WEDNESDAY	9:30-10:30	E313	LECTURE
THURSDAY	3:30- 4:30	E110	LECTURE
FRIDAY	8:30-10:30	B104	LAB

EVALUATION

ACTIVITY	DAY	TIME	PLACE	%
TEST #1 (BLOCK #1 MATERIAL)	FEB. 8/91 (FRIDAY)	8:30-10:30	B104	20
TEST #2 (BLOCK 2&3 MATERIAL)	MAR. 15/91 (FRIDAY)	8:30-10:30	B104	20
TEST #3 (BLOCK #4 MATERIAL)	APR. 19/91 (FRIDAY)	8:30-10:30	B104	20

ASSIGNMENT TOPICS	DUE DATE
1) INVESTIGATION OF GATE CHARACTERISTICS OF THYRISTORS	JAN. 14/91
2)	
3)	
4)	
5)	
6)	
7)	
8)	

GENERAL INFORMATION

SEMESTER-END REPORTING

A+	(Numerical Equivalent = 4.0)	-	Consistently Outstanding ≥ 90%
A	(Numerical Equivalent = 3.75)	-	Outstanding Achievement 80 to 100 %
B	(Numerical Equivalent = 3.0)	-	Consistently Above Average Achievement 70 to 79
C	(Numerical Equivalent = 2.0)	-	Satisfactory or Acceptable Achievement 55 to 69
R	(Numerical Equivalent = 0.0)	-	Repeat - Objectives of the course not achieved and course must be repeated

X A temporary grade that is limited in use to rare instances when no other grade will insure justice. The "X" (incomplete) grade may not be assigned unless accompanied by a written authorization from the Department Dean. Time allowed for completing course requirements will not exceed 120 calendar days beyond the end of the semester in which the grade was given. An "X" grade contract form must be completed and submitted for each "X" grade assigned. Please enter the date the "X" grade is expected to clear in the "Date Clearance" column of grade sheet.

If the final grade for the course is not received in the Registrar's Office by the date indicated on the authorization, the "X" will revert to an "R".