SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE OUTLINE: NETWORK ANALYSIS

CODE NO.: ELR 309 -5

PROGRAM: ELECTRICAL/ELECTRONIC TECHNOLOGY

SEMESTER: FIVE

DATE: SEPTEMBER 1996

PREVIOUS OUTLINE DATED: SEPTEMBER 1993

AUTHOR: DOUG FAGGETTER

APPROVED:

Sept 4/96

DEAN **DATE**

W.S.A.

NETWORK ANALYSIS — COURSE NAME

ELR 309 — CODE NUMBER

TOTAL CREDIT HOURS: 75

PREREQUISITE(S): MTH 577

PHILOSOPHY/GOALS:

THE STUDENT WILL STUDY AC & DC CIRCUITS IN-DEPTH USING NETWORK THEOREMS, DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS, FOURIER ANALYSIS USING TRADITIONAL SOLUTION TECHNIQUES AS WELL AS THE APPLICATION OF COMPUTER SOLUTION TECHNIQUES .

STUDENT PERFORMANCE OBJECTIVES:

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

1) DEFINE AND DISCUSS BASIC CIRCUIT LAWS AND ANALYSIS METHODS.

2) SOLVE INITIAL, FINAL AND FIRST-ORDER CAPACITIVE AND INDUCTIVE CIRCUITS.

3) ANALYZE CIRCUITS WITH LAPLACE TRANSFORMS.

4) PERFORM CIRCUIT ANALYSIS USING SPICE.

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TOPICS TO BE COVERED:

1) OVERVIEW OF BASIC CIRCUIT LAWS.

2) INTRODUCTION TO CIRCUIT ANALYSIS METHODS.

3) APPLICATION OF CIRCUIT ANALYSIS TO CAPACITIVE AND

INDUCTIVE CIRCUITS.

4) SOLVING FIRST ORDER DIFFERENTIAL CIRCUITS.

5) CIRCUIT ANALYSIS WITH LAPLACE TRANSFORMS.

REQUIRED STUDENT RESOURCES
(INCLUDING TEXTBOOKS & WORKBOOKS)

L.P. HUELSMAN, BASIC CIRCUIT THEORY
TORONTO, PRENTICE-HALL, 1991 (THIRD EDITION)

ADDITIONAL RESOURCES

P.W.TUINENGA, SPICE A GUIDE TO CIRCUIT SIMULATION
AND ANALYSIS USING PSPICE, TORONTO, PRENTICE HALL, 1988

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METHOD(S) OF EVALUATION

THE FINAL GRADE FOR THE COURSE WILL BE DERIVED FROM THE RESULTS OF FOUR TEACHER ASSIGNED TESTS.

FOUR TESTS	100% (25% PER TEST)
TOTAL	100%

THE GRADING SYSTEM USED WILL BE AS FOLLOWS:

A+	>= 90%	CONSISTENTLY OUTSTANDING ACHIEVEMENT
A	80-89%	EXCELLENT ACHIEVEMENT
B	70-79%	ABOVE AVERAGE ACHIEVEMENT
C	55-69%	SATISFACTORY ACHIEVEMENT
R		REPEAT

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LEARNING ACTIVITIES **REQUIRED RESOURCES**

1.0 BASIC CIRCUIT LAWS

1.1) DEFINE THE BASIC CIRCUIT QUANTITIES AND STATE THE SYMBOLS & UNITS USED TO REPRESENT THEM. TEXT: CHAPTER #2

1.2) DEFINE THE BASIC ACTIVE AND PASSIVE MODELS AND SKETCH THEIR SCHEMATIC FORMS.

1.3) EXPLAIN CLASSIFICATIONS OF NETWORK ELEMENTS.

1.4) STATE AND APPLY NETWORK TOPOLOGY LAW: 1) OHM'S LAW
2) KIRCHHOFF'S CURRENT LAW
3) KIRCHHOFF'S VOLTAGE LAW

1.5) DEFINE NETWORK ELEMENTS:
1) RESISTOR
2) SOURCE
3) NON-IDEAL SOURCE

1.6) DETERMINE THE EQUIVALENT RESISTANCE OF RESISTIVE NETWORKS IN SERIES AND PARALLEL CONNECTIONS.

1.7) STATE AND APPLY THE VOLTAGE AND CURRENT DIVIDER RULES TO COMPLEX RESISTIVE NETWORKS.

1.8) DEFINE THE FORM TYPES OF CONTROLLED (OR DEPENDANT) SOURCES AND DISCUSS THEIR SIGNIFICANCE IN CIRCUIT MODELLING.

2.0) CIRCUIT ANALYSIS METHODS TEXT: CHAPTER #3

2.1) DETERMINE THE CURRENT, VOLTAGE AND POWER IN A CIRCUIT USING MESH ANALYSIS.

2.2) DETERMINE THE CURRENT, VOLTAGE AND POWER IN A CIRCUIT USING NODAL ANALYSIS.

2.3) APPLY SOURCE TRANSFORMATIONS TO SIMPLIFY INDEPENDENT SOURCE MODELS.

2.4) APPLY SOURCE TRANSFORMATIONS TO SIMPLIFY DEPENDENT SOURCE MODELS.

2.5) DETERMINE THE THEVENIN AND NORTON EQUIVALENT CIRCUITS FOR A GIVEN CIRCUIT.

LEARNING ACTIVITIES **REQUIRED RESOURCES**

3.0 CAPACITIVE AND INDUCTIVE TRANSIENTS AND EQUIVALENT CIRCUITS TEXT: CHAPTER #4

3.1) DEFINE THE BASIC CAPACITIVE INTEGRO -DIFFERENTIAL EQUATIONS & WAVEFORMS

3.2) DEFINE THE COMMONLY USED TIME FUNCTIONS USED IN NETWORK ANALYSIS.

3.3) DEFINE THE BASIC INDUCTIVE INTEGRO-DIFFERENTIAL EQUATIONS & WAVEFORMS.

3.4) DETERMINE SERIES AND PARALLEL COMBINATIONS OF CAPACITORS AND INDUCTORS.

3.5) STATE AND APPLY THE VOLTAGE-CURRENT RELATIONSHIPS FOR MUTUAL INDUCTANCE

4.0) FIRST ORDER DIFFERENTIAL CIRCUITS TEXT: CHAPTER #5

4.1) SOLVING FIRST ORDER DIFFERENTIAL CIRCUITS EXCITED BY INITIAL CONDITIONS.

4.2) SOLVING FIRST ORDER DIFFERENTIAL CIRCUITS EXCITED BY SOURCES.

4.3) SOLVING FIRST ORDER DIFFERENTIAL CIRCUITS EXCITED BY INITIAL CONDITIONS AND SOURCES.

4.4) SOLVING FIRST ORDER DIFFERENTIAL CIRCUITS EXCITED BY CERTAIN RESPONSES AND INITIAL CONDITIONS.

5.0) SECOND ORDER DIFFERENTIAL CIRCUITS TEXT: CHAPTER #6

5.1) SOLVING SECOND ORDER DIFFERENTIAL CIRCUITS EXITED BY INITIAL CONDITIONS - CASE 1 & 11.

5.2) SOLVING SECOND ORDER DIFFERENTIAL CIRCUITS EXITED BY INITIAL CONDITIONS - CASE 111

5.3) SOLVING SECOND ORDER DIFFERENTIAL CIRCUITS EXITED BY INITIAL CONDITIONS AND SOURCES.

5.4) SOLVING HIGHER ORDER DIFFERENTIAL CIRCUITS EXITED BY CERTAIN RESPONSES AND INITIAL CONDITIONS.

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LEARNING ACTIVITIES **REQUIRED RESOURCES**

6.0 CIRCUIT ANALYSIS WITH LAPLACE TRANSFORMS — TEXT: CHAPTER #9

6.1) DEFINE AND EXPLAIN THE PURPOSE OF THE LAPLACE TRANSFORMS AS APPLIED TO CIRCUIT ANALYSIS.
6.2) STATE THE LAPLACE TRANSFORMS FOR THE MOST COMMON FUNCTIONS ENCOUNTERED IN CIRCUIT ANALYSIS.
6.3) STATE THE FORMS OF THE MOST COMMON LAPLACE TRANSFORM OPERATIONS.
6.4) DETERMINE THE LAPLACE TRANSFORM OF A GIVEN TIME FUNCTION.
6.5) DETERMINE THE INVERSE TRANSFORM OF OF A GIVEN S-DOMAIN FUNCTION.

7.0 CIRCUIT ANALYSIS USING PSPICE

USE PSPICE CIRCUIT SIMULATION PROGRAM TO ANALYZE AND SIMULATE CIRCUITS