

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

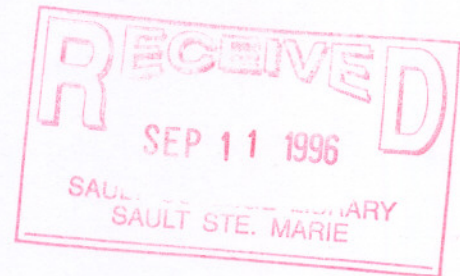
APPROVED:

 *Sept 4/96*

DEAN

DATE

W.S.A.



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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 ACTIVITIESREQUIRED 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 EXCITED BY INITIAL CONDITIONS - CASE 1 & 11.
 - 5.2) SOLVING SECOND ORDER DIFFERENTIAL CIRCUITS EXCITED BY INITIAL CONDITIONS - CASE 111
 - 5.3) SOLVING SECOND ORDER DIFFERENTIAL CIRCUITS EXCITED BY INITIAL CONDITIONS AND SOURCES.
 - 5.4) SOLVING HIGHER ORDER DIFFERENTIAL CIRCUITS EXCITED 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