SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: ELECTRICAL CIRCUITS AND DEVICES

Code No.: ELR 307

Program: ELECTRICAL/ELECTRONIC TECHNOLOGY

Semester: V

Date: JUNE 1983

Author: R. A. PEARMAN

New: ______ Revision: X

APPROVED: ______________________ Chairperson ______________________ Date

ELECTRICAL CIRCUITS & DEVICES	ELR 307
Course Name	Course Number

PHILOSOPHY/GOALS:

To develop the ability to analyze complex electrical circuits.

METHOD OF ASSESSMENT (GRADING METHOD):

1. Written tests will be conducted at regular intervals.

2. Grading:

A - 76 - 100%
B - 66 - 75%
C - 55 - 65%
X - 50 - 55%
R - Less than 50%

TEXTBOOK(S):

Network Analysis, 3rd Edition - M.E. Van Valkenburg

ELR 307-6

<u>ELECTRICAL CIRCUITS & DEVICES I</u>

Objectives:

BLOCK 1 - Describing electrical circuits

At the end of this block, the student shall be able to:

1. Define, discuss and solve qualitative and quantitative problems associated with the following electrical concepts and elements:
   a) CHARGE
   b) ENERGY
   c) CURRENT
   d) VOLTAGE
   e) POWER
   f) ELECTRIC FIELD
   g) CAPACITANCE
   h) MAGNETIC FIELD
   i) INDUCTANCE
   j) FLUX
   k) RESISTANCE

2. Define and discuss voltage and current sources, and the difference between dependent and independent sources.

3. Define and apply the dot convention to magnetically coupled circuits.

4. Constant graphs corresponding to network schematics, and define the following terms:
   a) BRANCH
   b) MODE (VERTEX)
   c) TOPOLOGY
   d) PLANAR
   e) CHORDS
   f) TREE
   g) SUBGRAPH

5. Define Kirchhoff's voltage and current laws.

6. Apply Kirchhoff's laws to the determination of circuits equations.

7. Transform current and voltage sources from one type to the other and from one position in a network to another.

8. Describe networks using loop, nodal and state-variable techniques.

BLOCK 1 - Describing electrical circuits con't

9. Find the dual of a network.

10. Solve resistive and complex networks using loop and nodal analysis.

BLOCK 2 - Differential Equations and Laplace Transforms

At the end of this block the student shall be able to:

1. Write and solve first order differential equations of electrical circuits.

2. Discuss the implications and evaluation of initial conditions in electrical circuits.

3. Write and solve second order differential equations of electrical circuits.

4. Discuss the response of second order systems with respect to the S plane location of the roots.

5. Utilize Laplace transform techniques to solve electrical circuits and to describe signal waveforms.

BLOCK 3 - Network Functions, Theorems & Parameters

At the end of this block the student shall be able to:

1. Define complex frequency and use the concept in the solution of electrical circuits.

2. Define and utilize the following theorems:
   a) SUPERPOSITION
   b) RECIPROCITY
   c) THEVENIN'S
   d) NORTON'S

3. Define one and two-part networks and their transfer functions.

4. Apply pole-zero analysis to the determination of the time domain behaviour of systems.

5. Discuss the necessary conditions for stability of active networks, and utilize the Routh-Hurwitz criteria for determining stability.

BLOCK 3 - Network Functions, Theorems & Parameters con't

6. Define, determine and use the following two-part network parameters:
   a) IMPEDANCE
   b) ADMITTANCE
   c) TRANSMISSION
   d) INVERSE TRANSMISSION
   e) HYBRID
   f) INVERSE HYBRID

BLOCK 5 - Power & Fourier Analysis

At the end of this block the student shall be able to:

1. Discuss energy and power concepts in electrical circuits.
2. Calculate average and complex power in systems.
3. Solve problems relating to power factor correction and impedance matching.
4. Solve problems related to insertion loss.
5. Define, discuss and use Tellegen's Theorem.
6. Define and evaluate the Fourier Co-efficients of complex waveforms.