SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: ELECTRONIC CIRCUITS AND DEVICES

Code No.: ELN 306

Program: ELECTRONIC/ELECTRICAL TECHNOLOGY

Semester: FIVE

Date: JUNE, 1983

Author: T. BLACK

New: _____ Revision: X

APPROVED: L.P. Arazietti
Chairperson

JUNE 1983 83/06/06
Date

ELECTRONIC CIRCUITS AND DEVICES	ELN 306
Course Name	Course Number

PHILOSOPHY/GOALS:

This course addresses the need for a technologist to have a comprehensive understanding of the expanding applications of linear integrated circuits, especially operational amplifiers. In addition, digital design concepts are studied at a level commensurate with a technology-level course; specifically, combinational and sequential circuit design.

Associated lab projects are designed to reinforce the practical aspects of the theory.

METHOD OF ASSESSMENT (GRADING METHOD):

Written tests: 3 expected

Quiz (Unannounced)

Laboratory Reports

Seminar

TEXTBOOK(S):

1. "Op Amps and Linear Integrated Circuit Technology", by R.A. Gayakwad.
2. "An Engineering Approach to Digital Design", by William Fletcher.

Specific Objectives: Theory

Block 1 - Linear Integrated Circuits

Part A - IC Fabrication Techniques

1. Student should understand the basic processes of monolithic IC fabrication, including:

    a) photo resist techniques
    b) the planar process
    c) isolation techniques
    d) individual element formation
    e) state-of-the-art and future trends

Part B - Operational Amplifier Characteristics

Reference: "Op Amps and Linear IC Technology", by Gayakwad.

Students should be able to recall the following:

1. IC Identification Conventions (CH.2)

2. Interpretation of Op Amp Data Sheets, ratings and parameters. (CH.3)

3. Ideal op amp characteristics and equivalent circuit. (CH.4)

4. The application of op amps in the following modes:
    a) inverting amplifiers (voltage-shunt feedback)
    b) non-inverting amps--(voltage series feedback)

5. The effect of negative feedback on op amp characteristics.

6. Voltage followers.

7. Differential Amplifier Circuits.

8. Five basic feedback rules for op amp circuits.

9. Practical (non ideal) Op Amp characteristics: (CH.5)
    a) Input Offset Voltage
    b) Input bias current

c) Input Offset Currents
d) Output Offset voltage calculations
e) Thermal drift, noise
f) CMRR

10. Causes of destruction of op amps and protection methods.

11. Frequency response of op amps. (CH.6)
a) Frequency compensation techniques
b) Stability
c) Slew Rate

Part C - Op Amp Applications (CH.7 and 9)

Students should be able to analyze and design op amp circuits for the following applications:

1. Summing, scaling and averaging amplifiers

2. Instrumentation amps

3. V - to - I and I - to V converters

4. Differentiator

5. Integration

6. Comparators, Zero-Crossing Detectors, Schmitt triggers

7. Voltage limiters, window detectors, clippers, clampers

8. Precision rectifiers, peak detectors

9. Sample and hold circuits

10. Selected specialized op amp applications.

Part D - Active Filters and Oscillators (CH.8)

1. Students shall be able to identify the main characteristics of Butterworth, Chebychev, Bessel and Cauer active filters.

2. Students shall be able to design Butterworth low, high and bandpass active filters.

3. Students shall be able to design various signal generators including:
a) Phase-shift, Wien-Bridge and Quadrature Oscillators
b) Phase-wave, triangular wave and sawtooth Generators

Students shall recall the principles of operation and application techniques for the following special linear IC's:

Block 2 - Digital Integrated Circuits

Part A - Logic Family Characteristics

1. Comparison of DTL, TTL, Schottky, I^2L, ECL, NTL, CMDS, NMOS and PMOS Logic characteristics.

2. Detailed characteristics and application rules for TTL and CMOS logic.

Part B - Digital Circuit Design

Reference: Fletcher, "An Engineering Approach to Digital Design"

1. Codes (Chap. 1)

2. Combinational Logic Design (Chap. 2, 3)
   a) Function Minimization using Karnaugh Maps
   b) Variable-Entered-Mapping (VEM) Techniques for Logic Implementation

3. MSI and LSI Circuits and Applications (Chap. 4)
   a) Adders, Subtractors, Magnitude Comparators
   b) Multiplexers, Decoders, Encoders
   c) Wired Logic, Tri-state bus systems

4. Sequential Circuit Fundamentals (Chap. 5)
   a) Differences between Combinational and sequential machines
   b) Practical aspects of Flip-flops

5. Synchronous Sequential Curcuit Analysis and Design (Chap. 6)
   a) State Diagrams
   b) Analysis of synchronous sequential circuits
   c) Design of synchronous sequential circuits
   d) Counters, shift registers and RAM's

6. Introduction to System controller Design (Chap. 7)