SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY
SAULT STE MARIE, ON

COURSE OUTLINE

Course Title: Circuit Analysis and Design

Code No.: ELN-300 **Semester:** 5

Program: ELECTRICAL/ELECTRONICS ENG. TECHNOLOGY

Author: Peter Szilagyi

Date: Sept 9 1998 **Previous Outline Date:** Sept. 1997

Approved: K. DeRosario — Dean; Sept 10/98 — Date

Total Credits: 7 **Prerequisite(s):** MTH- 551

Length of Course: 16 **Total Credit Hours:** 96

I. COURSE DESCRIPTION:

This project oriented course is intended to develop the students ability to apply design and analysis techniques and reporting skills to project oriented tasks.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course the student will demonstrate the ability to:

1) Understand the principles and characteristics of solid state semiconductor switches.

Potential elements of the performance:
- Sketch the current, voltage and power waveforms of a generic switch
- Classify semiconductor switches as minority, majority and mixed carrier devices
- Draw the output characteristics of MOSFETs, IGBTs and Schottky diodes
- Design, operate and test generic solid state switches with inductive load

2) Use Hybrid parameters for BJTs

Potential Elements of the Performance:
- Write the hybrid defining equations
- Convert common emitter hybrid parameters to CC and CB parameters
- Calculate input and output impedance and gain based on hybrid parameters
- Use MathCad, a computer method for gain and impedance calculations

3) Specify heat sinks for semiconductors

Potential Elements of the Performance:
- Measure the thermal resistance of a heat sink in the laboratory
- Calculate the dissipated power for a given semiconductor
- Calculate the required thermal resistance for a given amount of dissipated power
- Determine the static and transient temperature rise for a semiconductor switch

4) Design Printed Circuit Boards

Potential elements of the performance:
- Produce a PCB layout for manufacturability

5) Design Linear Voltage Regulators

Potential elements of the performance:
- Be familiar with Shunt and Series voltage regulators
- Use simple and fold back short circuit protection circuits
- Design digitally controlled voltage regulators

6) Understand and design DC to DC converters

Potential elements of the performance:
- Sketch the schematics of Buck, Boost , Flyback and Cuk converters
- Draw the typical waveforms for Back, Boost , Flyback and Cuk converters
- Analyze the circuit diagrams of each of the above converters

7) Design isolated switched mode power supplies (SMPS)

Potential elements of the performance:
- Sketch the schematics of Flyback and Forward converters
- Use a computer method to design flyback converters
- Test an existing flyback converter, using a digital storage oscilloscope and current probes

8) Perform Fourier analysis

Potential elements of the performance:
- Write the mathematical equation of a waveform viewed on the CRT of an oscilloscope
- Solve integrals with MathCad
- Operate a Spectrum Analyzer
- Work out the amplitudes and the phase of each spectral component for a given waveform.

III. TOPICS:

1) Review and classification of power electronic components

2) Characteristics and construction of solid state switches

3) Hybrid parameters

4) Heat sink design

5) Printed circuit board design

6) Linear voltage regulators

7) Switched mode voltage regulators

8) Fourier analysis

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Study material notes and laboratory handouts will be provided by the teacher.
Hiwire, Smartwork, and PSPICE software is available in the computer room (B105) and also in B102 and B104.
It is recommended, that the student purchases a student version of Mathcad
One copy of the Motorola Linear and Interface components data book is available in B102

V. EVALUATION PROCESS/GRADING SYSTEM

The grading weight will be:
Theory 50%
Lab 25%
Hardware project 25%

The grading system will be as follows:

A+	90% - 100%	Outstanding Achievement
A	80% - 89%	Above Average Achievement
B	70% - 79%	Average Achievement
C	55% - 69%	Satisfactory Achievement
R	below 55%	Repeat

VI. SPECIAL NOTES:

- Special Needs

  If you are a student with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities), you are encouraged to discuss required accommodations with the instructor and/or contact the Special Needs Office, Room E1204, Ext. 493, 717, 491 so that support services can be arranged for you.

- Retention of Course Outlines

  It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other post-secondary institutions.

VII. PRIOR LEARNING ASSESSMENT

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following: