SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: ELECTRONIC CIRCUIT ANALYSIS and DESIGN

CODE NO.: ELN 320-7 **SEMESTER:** FIFTH

PROGRAM: ELECTRONIC ENGINEERING TECHNOLOGY (4023)

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APPROVED: _____ 94-08-29
DEAN DATE

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III. TOPICS TO BE COVERED: **Approximate time frame** Theory/Laboratory hours

Block 1:	Schematic capture and PCB design.	2/3
Block 2:	Heatsink design.	3/6
Block 3:	Two port parameters.	3/0
Block 4:	Linear Voltage and Current Regulator design.	9/9
Block 5:	Switched Mode Power Supply design.	15/9
Block 6:	Pulse and clock generator design.	3/3
Project1	Design and build a Step-down Switched Mode Power Supply.	1/9
Project 2	Design and build a Flyback Transformer. . . .	1/3
Testing		6/3

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Block 1: Schematic capture and PCB design.

Topic description:

- Load the Equation Keyboard in Word Perfect and assign mathematical and scientific characters to keys on your keyboard.
- Generate ASCII characters from 1 to 255 and include them in your document.
- Use ctrV to generate Math/Scientific characters in Word Perfect.
- Set up a pen plotter and a laser printer for printing from Hiwire, Smartwork and MathCad.
- Create HPGL graphic plot files and import them into Word Perfect. Edit a graphic file in Word Perfect.
- Generate a HIWIRE symbols library for MOSFETs, PWMs and other analog and digital ICs.
- Printed circuit board layout concepts, for testability and manufacturability.

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Block 3: Two port parameters applied to BJTs.

Topic description:

- Black box theory.
- The hybrid defining equations.
- Two port, hybrid equivalent network.
- The definition of the short circuit output and the open circuit input hybrid parameters.
- Two port device connected to source and load.
- Hybrid parameters applied to BJT's.
- The meaning of h_{11} , h_{12} , h_{21} and h_{22} .
- CE, CB, and CC hybrid equivalent circuits.
- Input and output impedance, voltage gain and current gain of a transistor amplifier, based on hybrid parameters.
- How to read h parameters from the data book.

Learning activities:

Manufacturers data books specify the hybrid transistor parameters. Participants will learn how to interpret and use hybrid parameters in amplifier design.

Required resources:

Overheads, handouts, MathCad software and access to the computers available in the laboratory.

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Block 4: Power MOSFET transistors.

Topic description:

- MOSFET structure, operation and physics.
- Advantages of power MOSFETs.
- Basic characteristics of power MOSFETs.
- Safe operating areas.
- Gate drive requirements.
- Gate drivers for power MOSFETs.

Learning activities:

Listen to lectures on MOSFET theory and applications. Learn how to test a MOSFET in the laboratory.

Required resources:

Overheads and handouts. A relevant book by Motorola is available in the college library. (Power MOSFET transistor data.)

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Topic description:

- Classes of Switched Mode voltage regulators.
- Buck, Boost, and Buck-Boost Converters.
- BJT and MOSFET switches.
- Continuous Current Mode (CCM) and Discontinuous Current Mode (DCM) of operation.
- Voltage Mode and Current Mode topologies.
- Switched mode voltage regulators in a closed loop.
- Hysteretic control, variable frequency, variable pulse width, constant on-time, constant off-time controls.
- Isolated switched mode power supplies.
- The DC to DC transformer concept.
- The Forward Converter.
- The Flyback Converter.
- Switched mode constant current source.

Learning activities:

Lectures will cover the classification, functioning and design of switched mode power supplies. Different model switchers will be built in the laboratory.

Required resources:

Theory class and laboratory handouts will be supplied. A number of relevant reference books are available in the college library:

1. Rudolf P. Severns and Gordon Bloom, Modern DC-to-DC Switchmode Power Converter Circuits.

2. Eugene R. Hnatek, Design of Solid State Power Supplies.

3. Keith H. Billings, Switchmode Power Supply Handbook.

4. Abraham I. Pressman, Switching Power Supply Design.

5. George Chryssis, High Frequency Switching Power Supplies: Theory and design.

6. Motorola, Practical Switched Mode Power Supply design.

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V. EVALUATION METHODS:

Four written tests will be conducted. Quizzes may be given without prior notice. Design assignments and hardware projects will carry the same weight as theory tests.

Grading:

Grading is done using the following definitions:

- Consistently outstanding performance.....A+ (90-100)%
- Outstanding performance.....A (80- 90)%
- Above average performance.....B (70- 80)%
- Satisfactory performance.....C (55- 70)%
- Unsatisfactory performance.....R (< 55)%