ELEC 410 Power Electronics
May-August 2014

1. Objectives:

To introduce students to the basic principles of solid state power conversion and power semiconductor circuits.

2. Syllabus

Hours (Approx)

Introduction: Power Electronics and its scope..... 1.0

Circuits with Switches and Diodes 4.0
Switched DC source with R, RL, RC, and L loads, recovery of trapped energy,
review of DC and AC sources with RLC circuit.
Half-wave rectifier analysis with R, RC, RL load circuits (including EMF in the load circuit)

Power Semiconductor Switches 5.0
Thyristors, power transistors (Bipolar, MOSFET, IGBT), GTOs — their operation,
and characteristics, heat sink calculations, protection.

Controlled Half-wave Rectifier 1.5
Operation and analysis with RL, R, L and EMF load circuits

AC Voltage Controllers 4.0
Methods of AC voltage control - zero voltage switching and phase control.
Single-phase full-wave controller - analysis, gating signals. Three-phase full-wave
Wye and Delta connected controllers.

Full-Wave Controlled Rectifiers and Power Factor Correction 5.5
Single-phase full-wave controlled rectifiers - RL load circuit with EMF.
Three-phase controlled rectifiers. Basic principles of power factor correction.

DC-to-DC Converters - 1 (Choppers) 4.5
Types of chopper circuits, Type A chopper circuit and its analysis.
Type B chopper, four quadrant chopper.

Switching Regulators (DC-to-DC Converters – 2) 4.0
Buck, Boost, Buck-Boost, and Cuk converters. Isolated converter examples: Flyback and
Forward converters.

Inverters 5.5
Half-bridge inverter- load commutation.
Single-phase bridge inverter. Voltage control of single-phase inverters— single-pulse,
multiple-pulse and sinusoidal modulation. Basic operation of resonant inverters.Three-phase inverters.

Current Source Inverters..... 1.0

Application Examples..... 1.0
Uninterruptible power supplies, dc and ac motor drives, Photovoltaic energy converters

Sub Total.....	37.0
Midterm Test.....	01.0
Review (in class).....	01.0
Total	**39. 0**

3. Laboratory Experiments (Each experiment is of 3 hours duration)**:**

Experiment 1. Single-Phase AC Voltage Controller
Experiment 2. Single-Phase Full-Wave Controlled Rectifier
Experiment 3. One-Quadrant Chopper or DC-to-DC Converter
Experiment 4. Single-Phase Voltage-Source Inverter

4. Learning Outcomes :

Students are expected to learn:

- The basic operation of power devices SCR, MOSFET and IGBT; their basic characteristics and Limitations; and their use in power converters together with losses and heat sink calculations.
- Basic operating principles of controlled rectifiers, dc-to-dc converters and dc-to-ac inverters, and how to analyze these converters and some application examples.

5. Texts :

Required:

1. A.K.S. Bhat, ELEC410 Course Notes: http://www.ece.uvic.ca/~elec410
2. A.K.S. Bhat, "Laboratory Manual for ELEC410 - Power Electronics", University of Victoria, 2012: http://www.ece.uvic.ca/~elec410
3. Issa Batarseh, "Power Electronic Circuits", John Wiley and Sons, 2004.

Supplementary:

1. S.B. Dewan and A. Straughen, "Power semiconductor circuits", John Wiley, 1975.
2. M.H. Rashid, "Power Electronics - Circuits, Devices, and Applications", Prentice-Hall, 2004.
3. N. Mohan, T.M. Undeland and W.P. Robbins, "Power Electronics - Converters, Applications, and Design", John Wiley and Sons, 2003.

6. Evaluation Method :

Assignments (3 to 4 no.)	5%
Laboratory	25%
Mid-Term Exam	25%
Final Exam	45%

	100%

Note: Failure to complete all the laboratory requirements will result in a grade of N being awarded for the course.

7. Instructor : Mr. Nagendrappa Harischandrappa
Office: Room # ELW - B306,
E-mail: nagendra@ece.uvic.ca

8. Lectures:

Section(s): A01 and A02
Days: Tuesday, Wednesday, Friday
Time: 11:30 - 12:20 PM.
Location: CLE-A202

9. Mid-Term Exam : 24 June 2014 (Tuesday)

ELEC 410 Power Electronics
May -- August 2014
Laboratory Component

I. LABORATORY:

1. Days: Tuesdays and Wednesdays, Starting May 27 (Tuesday, B01), June 3 (Tuesday, B02) , May 28 (Wednesday, B03) and June 4 (Wednesday, B04)
(Note: Timing for all sections : 2.30 -5.20 PM). **Alternate Weeks.** Room No. ELW - B303. Exact time table will be announced as soon as full details are available.

2. Marks Distribution for each Experiment

i. ***Preparation***..... 10 Marks
(Circuit diagrams showing meters, etc. for each part of the experiment; calculations required in preparation and prediction of experimental results; tables for observations, answers to any questions)
ii. ***Report*** ..... 13 Marks
(Experimental results, conclusions, comparison with theory)
iii. ***Performance and Understanding*** .....02 Marks

TOTAL (For the laboratory work) **25 Marks**

Note: Each **student** must submit a separate lab preparation for evaluation. However, one report from each **group** needs to be submitted for each experiment.

3. **Laboratory Instructors**: (to be announced)
B01 -- Mr. B02 – Mr. B03 -- Mr. B04 – Mr.

4. Lab. reports are required to be submitted after one week of performing the experiment.

II. Contact (office) hours:

Fridays: 2.30 -3:30 P.M.
Room # EOW- 419.

The final grade obtained from the above marking scheme will be based on the following percentage-to-grade point conversion:

Passing Grades	**Grade Point Value**	**Percentage for Instructor Use Only**	
A+	9	90 – 100	
A	8	85 – 89	
A-	7	80 – 84	
B+	6	77 – 79	
B	5	73 – 76	
B-	4	70 – 72	
C+	3	65 – 69	
C	2	60 – 64	
D	1	50 – 59	
Failing Grades	**Grade Point Value**	**Percentage for Instructor Use Only**	**Description**
E	0	35 - 49	Fail, conditional supplemental exam. (For undergraduate courses only)
F	0	0 – 49	Fail, no supplemental.
N	0	0 – 49	Did not write examination, Lab or otherwise complete course requirements by the end of term or session; no supplemental exam.

The rules for supplemental examinations are found on page 80 of the current 2013/14 Undergraduate Calendar.

Term in which E Grade Was Obtained	Application Deadline for Supplemental Exam	Supplemental Exam Date
First term of Winter Session (Sept – Dec)	February 28 in the following term	First week of following May
Second term of Winter Session (Jan – Apr)	June 30 in the following term	First week of following September
Summer Session (May – Aug)	October 31 in the following term	First week of following January

Deferred exams will normally be written at the start of the student's next academic term; i.e., approximately 4 months following the deferral of the exam.

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the ECE Chair by email or the ECE Chair's secretary to set up an appointment.

Accommodation of Religious Observance
See http://web.uvic.ca/calendar2014/GI/GUPo.html

Policy on Inclusivity and Diversity
See http://web.uvic.ca/calendar2014/GI/GUPo.html

Standards of Professional Behaviour

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour at http://www.uvic.ca/engineering/current/undergrad/index.php#section0-25 which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult

http://web.uvic.ca/calendar2014/FACS/UnIn/UARe/PoAcI.html for the UVic policy on academic integrity.

Plagiarism detection software may be used to aid the instructor and/or TA's in the review and grading of some or all of the work you submit.

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