** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Provide information requested below that is not contained in the syllabus.
Please note the guidelines in the boxes.

** Number (if known): **
X Undergraduate  X Graduate  ___ Professional

** Title/subtitle: ** Power Electronics

** Effective: ** Winter 2015 (Quarter and Year)

** Offered: ** ___ Fall  ___ Winter  X Spring  ___ Summer  ___ Once Only  ___ Other ___

** Instructor(s): ** Roman Chomko

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** Hours per week per unit of credit may not be less than but may exceed those listed below.**

- One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
- One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems
- One unit for each two to three hours per week (1:2-3) of studio

** Units: ** 4

** Activities and hours per week:** Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Internship</th>
<th>Seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic</td>
<td>3 Laboratory</td>
<td>3 Studio</td>
</tr>
<tr>
<td>Colloquium</td>
<td>3 Lecture</td>
<td>3 Term Paper</td>
</tr>
<tr>
<td>Consultation</td>
<td>Practicum</td>
<td>3 Thesis</td>
</tr>
<tr>
<td>Discussion</td>
<td>Research (outside)</td>
<td>3 Tutorial</td>
</tr>
<tr>
<td>Extra Reading</td>
<td>Research (scheduled)</td>
<td>3 Workshop</td>
</tr>
<tr>
<td>Field</td>
<td>Screening (outside)</td>
<td>3 Written Work</td>
</tr>
<tr>
<td>Individual Study</td>
<td>Screening (scheduled)</td>
<td>Other: ____</td>
</tr>
</tbody>
</table>

** Prerequisite(s): ** EE 100B with a grade of "D-“ or better, or graduate standing
Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.

Examples:
Instead of "This course will introduce students to the history of . . .," use one of the following formats:
   Introduces the history of . . .
   An introduction to the history of . . .
   Introduction to the history of . . .

Instead of "Functions, equations, and graphs," use a format similar to one of the following examples:
   Explores functions, equations, and graphs . . .
   Topics include functions, equations, and graphs . . .
   A study of functions, equations, and graphs . . .

Catalog description: Covers the study of switch mode power supplies, power semiconductor devices, magnetics of inductors and transformers, and design of regulators. Laboratory experiments will include Spice-based computer modeling assignments.

Grading
   X Letter Grade or petition for Satisfactory/No Credit (S/NC)
   _ Letter Grade only
   _ In Progress (IP)
   _ Letter Grade or S/NC; no petition required
   _ S/NC only

The statements selected below will be added to the Catalog description by the Catalog office:

Grading statement (if required):
   _ Satisfactory (S) or No Credit (NC) grading is not available.
   _ Graded Satisfactory (S) or No Credit (NC).
   _ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
   X May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
   _ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
   _ Students who submit a term paper receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade.
   _ Students who present a seminar receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade.
   _ Students who present a seminar or submit a term paper receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade.
   _ Other:

Repeatability statement (if required):
   _ Course is repeatable.
   _ Course is repeatable to a maximum of ___ units.
   _ Course is repeatable as content changes.
   _ Course is repeatable as content changes to a maximum of ___ units.
   _ Course is repeatable as topics change.
   _ Course is repeatable as topics change to a maximum of ___ units.
   _ Other:

If the course is repeatable, may a student take more than one section of the course in a single quarter? _ Yes _ No

Cross-listing statement: Cross-listed with NA

Credit statement (to limit credit when course content overlaps):
Credit is awarded for only one of

Other

Breadth statement (for CPAC, ETST, FVC, HASS, or WMST courses only):
   _ Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
   _ Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
WORKSHEET - Request for a New Course

__ Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
__ See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences.
__ Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
__ Other: __

If the course content overlaps or duplicates the content of another course, describe the overlap or duplication: _NA_.

If the course affects degrees, minors, and/or programs, list the affected degrees, etc. and explain how they are affected: _

If the course affects the prerequisites and/or descriptions of other courses, list the affected courses and explain how they are affected: _NA_.

Justification for establishing the course (insert or attach):

There is an ever-growing, substantially renewed industrial interest in robotic and automation systems, renewable (green) energy electric systems, automotive electric vehicle systems, etc. It is the subject of power electronics and electric drives that addresses these issues. This course is needed because it will be used as part of the MSOL online degree program that the BCOE ECE department intends to offer. This V version of the course involves the following six components: a) a course management system, e.g., UCR's iLearn (BlackBoard) system, which UCR has been using for many years and with which most UCR faculty are already familiar; b) for online consultation with TAs and faculty, a web-based meeting system that includes shared desktop, audio, and possibly video communication. c) Remotely available online video recordings of classroom lectures (e.g., Flash 7.0+) with accompanying presentation graphics (e.g., PowerPoint slides). d) Remotely proctored exams, for which we will initially follow UCLA's policies and protocols. e) Lectures are online and would be a direct 1:1 "contact" as in a regular course. For the consultation, faculty members should be available for 1 hour/week to interact with the student via Skype (or other). f) In the evaluation, homework and other assignments are submitted via e-mail (or within iLearn). All exams are proctored. For remotely proctored exams, UCR intends to initially follow UCLA's policies and protocols.

Syllabus (insert or attach and include the information below): __Attached__

Course requirements: Midterm Exam, Final Exam, Homework, Laboratory Reports

If an activity selected above under "Activities and Hours" does not involve faculty contact (e.g., extra reading, individual study, and outside research), describe the activity and explain how it will be evaluated.

If one of the activities selected above is consultation hours, explain how these hours will be implemented and monitored.

For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at senate.ucr.edu/Committees/courses/guidelines.pdf
Roman Chomko, Ph.D.

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Department of Electrical Engineering
University of California, Riverside
Riverside, CA 92521-0429

Email: chomko@ee.ucr.edu

EE 123V
POWER ELECTRONICS
SYLLABUS

Quarter: Winter 2015
Room: MSE 003
Time: TR 3:40 p.m. - 5:00 p.m.
Office Hours: W 3:30 p.m. - 5:00 p.m. or by appointment
Final Exam: 03/18/2015, 7:00 p.m. - 10:00 p.m.

Laboratory: Sect. 021: M 11:10 a.m. - 2:00 p.m., Chung 125
Sect. 022: R 08:10 a.m. - 11:00 a.m., Chung 125

Course Website: http://ilearn.ucr.edu
Teaching Assistant: TBA

CATALOG DESCRIPTION

EE 100B (w/ grade D- or better), or graduate standing. Units: 4, Lecture: 3 hours;
Laboratory: 3 hours

Covers the study of switch mode power supplies, power semiconductor devices,
magnetics of inductors and transformers, and design of regulators. Laboratory
experiments will include Spice-based computer modeling assignments.
TOPICS

Power Quantities and Calculations

Transformers and Diode Rectifiers (Half-Wave and Full-Wave)

Power Semiconductor Devices
- Power Diodes: general, fast-recovery, Schottky;
- Power Switches: thyristors (SCR, GTO, MCT)
- Power Transistors: BJT, MOSFET, IGBT

Switching DC-DC Converters and DC Power Supplies
- CCM and DCM Switching Analysis
- Buck, Boost, Buck-Boost, Cuk
- Chopper Circuits Design
- Controlled Rectifiers (single-, three-phase and PWM)

DC-AC Inverters
- single phase bridge inverters
- three-phase inverters
- PWM voltage control
- Resonant pulse inverters

AC-DC Converters

AC-AC Converters

Resonant Converters

Snubber Circuits, Overvoltage (OVL) and Undervoltage (UVL) protection circuits

Introduction to Design of Feedback Controllers

HOMEWORK

Homework will be assigned every other week, and six in total are to be expected. Discussion of homework problems with the instructor, TAs, and/or classmates is highly encouraged. Nevertheless, all homework must be completed independently. Most homework assignments require LTspice programming.

No late homework will be accepted.
LABORATORY EXPERIMENTS

All labs will be held in Chung 128. Discussion of lab experiments with the instructor, TAs, and/or other students is encouraged. Lab work will be done in groups of two. It is allowed to submit a single lab report per group. Laboratories are based on LTspice software from Linear Technology, a free and very powerful Spice simulation environment, http://www.linear.com/designTools/software/. Additional LTspice power electronics library specifically designed for EE123 will be distributed on iLearn. Laboratories will cover majority of power electronic circuits discussed in class.

You are expected to read the lab descriptions, and complete the pre-lab before scheduled lab session.

Each lab report is due one week after each experiment, or per your TA requirements. Guidelines for the lab report must be followed.

EXAMS

Midterm: approximately the 5th week
Final: 03/18/2015, 7:00 p.m. – 10:00 p.m.

All exams are open book, open notes, closed friends. Communication gadgets must be off (including laptops), and lecture notes’ sharing is strongly prohibited. Make-up exams are possible only under circumstances of sickness or personal emergency.

GRADING POLICY

Letter grade (4 units) is required:
  Homework: 15%
  Experiments: 25%
  Midterm: 25%
  Final: 35%

COURSE TEXTBOOK AND REFERENCES


