EE432/537 Power Electronics-(3 credits)

College of Engineering
Klipsch School of Electrical and Computer Engineering
New Mexico State University

Date and Time: Fall 2004:	Class	M W F 10:30 AM-11:20 AM T&B 303
	Lab	Open Lab Monday, Tuesday and Friday
Room:	Class: T&B303 Lab: Rm. T&B 100B	
Instructor:	Satish J. Ranade T&B112	
Office Hours:	T-TH 2PM-3PM or by appointment	
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e-mail:	sranade@nmsu.edu . Start subject line with EE432 please	
Instructor Web site	http://www.ece.nmsu.edu/~sranade/	
Course Web site:	http://www.ece.nmsu.edu/~sranade/	

Course Description from the Undergraduate Course Catalog –

EE432/537 Power Electronics-(3 credits)

Basic principles of power electronics and its application to power supplies, electric machines and power systems.

Prerequisite: c or better in EE321, EE332 Coerequisite:EE311, EE341

Textbook and other Required Materials:

Text: Batarseh "Power Electronic Circuits", Wiley, Hoboken, NJ, 2004

Course Objectives:

- To introduce students to electronic power control
- To develop an understanding of the basic structure and analysis of power electronic systems
- To explore and illustrate design and application.
- Writing laboratory reports and project documentation
- Presenting a team laboratory project in front of peers

Contribution of EE 432 to Meeting the Professional Component:

As an elective in the energy systems area and a depth course in the electronics area, Power Electronics challenges students to learn the principles of power electronics and to apply these to the design of practical power electronic systems. Students develop skills gained in previous courses: circuit theory; power systems, electronics, signals; controls and computers. Students completing this course are ready for employment as power or power electronics engineers. This course provides 1.5 credits of engineering science and 1.5 credits of engineering design.

Relationship of the Course to Program Objectives:

Through reading, homework problems, circuit simulations and layouts, exams, laboratory experience, and team projects students demonstrate an ability to

- apply knowledge of mathematics science and engineering [I.(a)]
- design a system to meet desired needs [I.(c)]
- formulate, and solve engineering problems [I.(e)]
- communicate effectively [I.(g)]
- engage in lifelong learning [I.(i)]
- use techniques, skills, and tools of practicing electrical engineers [I.(k)]
- deeply understand analog VLSI design [II.(a) and III.(c)]
- analyze and design complex electronic systems containing hardware [II. (g)]
- use computers to solve engineering problems [III. (a)]
- apply critical thinking skills to solve problems [III. (b)]
- obtain meaningful employment or continue with graduate education [III.(e)]

Students with Disabilities:

If you have or believe you have a disability, you may wish to self-identify. You can do so by providing documentation to the Office for Services for Students with Disabilities, located at Garcia annex (phone 646-6840). Appropriate accommodations may then be provided for you. If you have a condition which may affect your ability to exit safely from the premises in an emergency or which may cause an emergency during class, you are encouraged to discuss this in confidence with the instructor and/or the director of Disabled Student Programs. If you have general questions about the Americans with Disabilities Act (ADA), call 646-3635.

Prepared by: Satish J. Ranade, August 2, 2004

Schedule

Week	Topic	Section	Homework
1 (8/25)	Introduction to Power Electronics Applications; General structure of power electronic systems; Use of electronic devices as switches	Ch. 1	
2-5(8/30))	Basic Concepts/Circuit Analysis Analysis of RLC circuits with switches; Analytical solutions and simulation; Periodic Steady state solutions Power calculations; Fourier Series;	Ch.2,3; Appendix A, B	
6(9/27)	Rectifiers (ac-dc) Single and three-phase rectifiers; capacitive filters;		
7-9(10/4)	dc-dc Converters Linear regulators and switch mode conversion (Pulse width modulation) Buck, Boost, Buck-Boost and related converters; Isolated converters Design Considerations-simple dc power supply.	Ch.4-5	
10-11(10/25)	Converters Single and three-phase rectifiers; capacitive filters; Controlled rectifier/inverter. HVDC transmission; dc motor control Ac voltage controllers	Ch. 7-8	
12-14(11/8)	Inverters Basic principles; sinusoidal PWM. Applications	Ch. 9	
15(12/1)	Other topics. Project Presentations		

LABORATORY

You will be required to complete five laboratory experiments(tentative) as listed below

1. Circuit principles: RLC-Diode Voltage doubler
2. Rectifier and Controlled Rectifier
3. dc-dc converter
4. dc-ac converter
5. dc motor control

Friday's lecture hour will often be used to introduce laboratory experiments or to release time for laboratory work. The laboratory will be available Mondays, Tuesdays and Fridays. The instructor will be available by appointment.

PROJECT

A formal design project is required. The project can be extended for a Capstone Design class.

Sample Projects:

1. ac-dc power supply for something
2. dc-ac power supply for something
3. dc motor controller
4. static transfer switch
5. dc transmission line

The tentative schedule for the project is as follows

1. September 15: Select project; Submit two-page proposal
2. September 30: First milestone: Develop conceptual design, submit detailed specifications and time table.
3. October 15: Preliminary design; order parts if needed.
4. October 30: Second milestone. Detailed Design report; Prototype demo if appropriate.
5. Week of November 29: Final report and presentation

Each step counts towards 20 % of project grade.

GRADING

Homework	15%
Tests (3)	40%
Quizzes (?)	5%
Laboratory(5)	20%
Project	20%

Course grade: A >= 90%, B>=80%, C>=70%; D>=60%; F < 60%

Extra Credit: 1/2 point will be added to your semester total for any of the following activities:

A. *Active* participation in professional societies; give me a one page report describing your role
B. Attend seminars related to electrical engineering and write a one-page report summarizing the seminar.

Maximum extra credit is 2 points.

POLICIES

1. Feel free to collaborate on homework. No late homework.
2. Tests will focus on the material studied in each preceding period.
3. All work on tests and quizzes must be your own. You are allowed two-sides of a 8.5x11 cheat sheet for formulas for tests and quizzes. Do not put solved examples on the cheat sheet. If you do, you will receive a zero on the test. Turn cheat sheet in with test.
4. There will be no makeup quizzes.
5. Makeup tests can be given if you have a medical excuse, or if you need to miss class for good reason and make arrangements ahead of time
6. Arrangements can be made for makeup laboratory sessions if you have a valid reason(medical, family, out-of-town).
7. Incomplete grades will be assigned only under exceptional circumstances (e.g., medical, family), with proper and timely documentation, and only if you have a passing grade at mid-semester. Per NMSU rules an Incomplete cannot be given to avoid a bad or failing grade.
8. **Failure to follow safety and other specified procedures in laboratory will result in an F grade for the course**