

Course Description

4042 - Power Electronics & Drive Systems

Course Code:	4042
Course Title	Power Electronics & Drive Systems
Academic Year:	2008
Semester:	2
Lecturer:	Dr. N. Ertugrul
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Aim

The principal objective of Power Electronics is to use electrical energy more efficiently and effectively. The aim of this subject is to develop the knowledge of the fundamental principles of Power Electronics and drive systems, and to help the understanding the operation of various advanced motor drives and practical difficulties in implementing such drives in industrial systems.

Outcomes

This is a highly multidisciplinary subject, which is relevant to almost every appliance and devices available in industrial world. It is expected that students will be familiar and aware of how power electronic circuits fit in to the practical world, and they will be familiar with the distinguishing features of Power Electronic drive systems used in industry.

Assumed knowledge

ELEC ENG 1006 Electrical Engineering I or ELEC ENG 1005 Electrical Systems AM, ELEC ENG 2008 Electronics II, APPMTH 2000 Differential Equations and Fourier Series, or equivalent

Delivery Methods

24 hours of lectures and tutorials

Assessment

Written examination with quizzes and quizzes during semester

Quiz 1, 2 40%

Final Examination 60 %

COURSE OUTLINE

Part A. Introduction [6 lectures]

1. Overview : history, applications, converters
2. Basic Converter Operation : DC and AC choppers
3. Power Electronic Devices : principles, diodes, thyristors, transistors

Part B. Power Electronic Converters : topology, control, analysis [9 lectures]

4. AC-DC Converters (rectifier) : uncontrolled, controlled
5. AC-AC Converters : AC chopper, cycloconverter
6. DC-DC Converters : linear, buck, boost, supplies, soft-switching
7. DC-AC Converters (inverter) : square-wave, PWM, UPS
8. Practical Implementation : thermal, sensors, snubbers

Part C. Electric Motor Drives [5 lectures]

9. Motor Drive Principles : control, sensors, implementation
10. Advanced Motor Drives : brushless DC, IM, stepper, SR, IM

COURSE NOTES or TEXTBOOKS

The following books are recommended as reference. The primary source is the lecture notes that will be available beginning of the semester.

1. Mohan N., Undeland T.M. and Robbins W.P., Power Electronics, Converters, Applications and Design, John Wiley and Sons.
2. Rashid M.H., Power electronics, Circuits, Devices and Applications, Prentice-Hall.
3. N. Ertugrul, LabVIEW for Electric Circuits, Machines, Drives, and Laboratories, Prentice Hall, 2002.

Graduate Attributes

- GA1 An advanced level of knowledge and understanding of the theory and practice of Electrical and Electronic, Computer Systems or IT&T Engineering and the fundamentals of science and mathematics that underpin these disciplines.
- GA2 A commitment to maintain an advanced level of knowledge throughout a lifetime of engineering practice and the skills to do so
- GA3 The ability to apply knowledge in a systematic and creative fashion to the solution of practical problems
- GA4 A commitment to the ethical practice of engineering and the ability to practice in a responsible manner that is sensitive to social, cultural, global, legal, professional and environmental issues.
- GA7 An ability to identify, formalise, model and analyse problems.

- GA8 The capacity to design, optimise, implement, test and evaluate solutions.
 - GA10 Personal attributes including: perseverance in the face of difficulties; initiative in identifying problems or opportunities; resourcefulness in seeking solutions; and a capacity for critical thought.
 - GA11 Skills in the use of advanced technology, including an ability to build software to study and solve a range of problems.
 - GA13 An ability to utilise a systems approach to design and operational performance.
- GA14 Understanding of the principles of sustainable design and development.

These programs also foster the graduate attributes of the University of Adelaide and the Institution of Engineers Australia. These should be read in conjunction with the list above.

Assessment of Graduate Attributes

The above attributes will be assessed through two mid-term quizzes and one final examination. The mid-term quizzes are designed particularly to develop GA1, GA2, GA3 and GA7, but will also provide a background for the other attributes. The final year exam aims to strengthen GA7, GA8, GA10, G11, G13 and G14, and will develop and assess attribute GA2. Due to the multidisciplinary nature of the course, the lecture material will be supported by actual components and instrumentation relevant to the topics covered, and the delivery method will provide active participation from students. These will provide particular help for the attributes GA4, G10 and G14.

ne:clg:rev 23th February 2007