ELEC 9711 - Advanced Power Electronics

Course Outline

Lecturer: Dr. W. Keerthipala       Tel 0415432917   w.keerthipala@ieee.org
Location: Room EE121
Tutors: Dr. W. Keerthipala
Course Authority: Prof. Faz Rahman   Ext: 54893 /  f.rahman@unsw.edu.au

Design Laboratory: Room 130 / PG Computer lab

Course Objective:

This course is designed, in conjunction with the co-requisites, to enable the design of power electronic converter circuits and systems. The design will include modeling of power electronics switches, their drive circuits, representation of the steady-state and dynamic characteristic of converters and their control system design.

Co- requisites: ELEC4614 – Power Electronics

As a postgraduate course an element of learning through IEEE Transactions and similar sources is expected from students in order to cover advanced and/or specific material. This subject may introduce some paths for industry applications as well as advanced research within the scope of Power Electronics and its applications.

Opportunities:

The subject is intended for those who may want to work in environments where all aspects of the design, application and maintenance of power electronics apparatus, circuits and systems may have to be undertaken. The emphasis of the course will be specific understanding of selected power electronic converters and circuits in the industrial applications. This course may use industry standard software such as PSCAD/EMTDC and/or Matlab / Simulink for modeling, designing, and dynamic studies.
Assessment:

: Assignment (10%),
Mid-session Test (10%),
Project (20%),
Final examination (60%)

There will be a mid-session test for the course; in week 8, which will cover materials in sections of the course covered up to week 7 inclusive. Date and venue for the mid-session tests will be announced in class in due course. Note that the final examination will cover ALL sections of lecture and other material covered during the entire semester including co-requisite.

Topics covered and schedule:
Lectures for the course will follow the following schedule approximately:

Mode: Lectures/design sessions in Lecture theatre / computer labs

The topics to be covered in this course will include: resonant converters, converter circuit characteristic and system modeling, device selection and their modeling, thermal design, gate drive design, magnetic core selection and design, dynamic representation of DC-DC and DC-AC converters, design of controllers for converters, case studies of converter system designs. Some system level design issues for example, grid connection of PV and wind energy systems, power factor control, front-end converters for power quality and bidirectional power flow may also be included.

Section Topic Hours
1. Overview of rectifiers, phase controlled converters, dc / dc converters - 6
2. HF dc / dc converters, VF dc / ac converters - 3
3. Resonant Converters - 4
4. AC /AC Converters - 5
5. Dynamics and control - 4
6. State-space models, Linear piece-wise models - 4
7. Feedback control design, Variable speed drives - 4
8. IM slip recovery, IM with VSI, IM with CSI - 6

Total hours 36

Course Webpage:
All lecture material, tutorial and design sheets for this subject can be found on the school webpage, via Current Students → Study Notes → Lecture Notes → ELEC9711. You may have to supply username: your student #, e.g., s1234567
and password: ee&tview, in order access these pages. Students will be expected to bring the printed lecture notes, tutorial sheets and design sheets into the lecture/tutorial/simulation classes as appropriate. Lecture Notes on ELEC9711.

Textbooks:

1. Text books on Power Electronics by
   N. Mohan et al
   J. Kassakian and
   Herbert Fredericksen

Further Reading:
The followings may be consulted for further reading

2. IEEE Transactions and other Journals on Power Electronics topics.
3. Power Electronics by Daniel W. Hart

Design / Tutorials:

Computer labs (Room 130 or PG computer lab) may be used for Design / tutorial and simulation work with PSCAD and/or Simulink.

Continuous Assessment:

Assignment – Week 4 Thursday
Mid-session Test – Week 8 Thursday
Project report – Week 12 Thursday