ELEC9715

Electricity Industry
Operation and
Control

COURSE OUTLINE - Session 2, 2010

1. Course Personnel

The course coordinator and lecturer is:

Dr. Iain MacGill,
Joint Director (Engineering), UNSW Centre for Energy and Environmental Markets (CEEM)
Senior Lecturer, School of Electrical Engineering and Telecommunications.
Room EE124B, i.macgill@unsw.edu.au

A number of guest lectures may be arranged with research and industry experts during the session.

2. Course Details

Availability: The course is available in the following programs: Master of Engineering Science; PhD in Electrical Engineering; Bachelor of Engineering (4th Year Elective substitution). Students undertaking other courses may also be permitted subject to agreement with the School of Electrical Engineering and Telecommunications, and the Course Coordinator.

Credits: This is a 6 UOC post-graduate course.

Lectures: There is one three hour lecture every week from week 2 to week 11 of semester, Tuesday 6-9pm in Pioneer International Theatre (K-G27-G04). Weeks 12 and 13 will involve student seminar presentations in the same room. There are no tutorials or laboratories. The last hour of some lectures may be run in a tutorial format to assist with the assignments – further details will be provided over the semester. The provisional syllabus of these weekly lectures is outlined below.

Prerequisite: Although this subject has no formal prerequisites, it is assumed that each student has a basic working knowledge of power systems. A number of texts are available for students whose undergraduate training did not include this type of material, or who feel that they require revision. Please contact the lecturer to discuss if you have questions regarding this matter.

Old courses: This course replaces ELEC9202 Power System Operation and Control

Consultations: Dr MacGill will be available for consultation before (5:30pm onwards), during and after lectures, or by appointment (arranged at lectures or by email). Please note that he is unlikely to be available for consultations without an appointment.
3. Aims and scope

The purpose of this course is to introduce students to the main issues involved in electricity industry operation and control – that is, decision making approaches and methods to meet industry objectives through appropriate operation of existing, in place, power system equipment. Industry operation and control will be discussed in the context of both traditional monopoly utility run power systems and the restructured market-based industries now becoming more common worldwide. Thus the course will explore the broader issue of electricity industry operation and control rather than the narrower traditional power system focus.

Considerable attention is given to practical implementation and experience to date in Australia, with comments on other countries when appropriate. Students taking this course will therefore gain a critical appreciation of the operation of Australia’s restructured industry.

The companion course, ELEC9714 Electricity Industry Planning and Economics explores issues of electricity industry structure, market design and technical, economic and environmental regulation with a particular focus on the investment decision making timescale. These courses can be taken separately or in either sequence.

4. Learning outcomes

After the successful completion of the course, the student will be able to:

- appreciate how electricity industry restructuring, technology development and environmental concerns are changing the way in which power system operation and control is defined and undertaken.
- apply basic conventional economic dispatch, unit commitment, hydro-scheduling, production costing, reliability assessment and operation planning techniques to simple electricity industry problems
- describe the implementation of power system operation and control in a restructured industry context including ancillary services, and energy spot and derivative markets.

Graduate attributes are the skills, qualities, understandings and attitudes a university agrees its students will develop during their program of study. Some faculties including Engineering have contextualised agreed UNSW-wide Graduate Attributes according to their disciplines and professional areas. The course delivery methods and course content address a number of core UNSW graduate attributes; these include:

- The skills involved in scholarly enquiry, in particular, the appreciation of and ability to indulge in research.
- An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context
- Development of analytical and critical thinking.
- Ability to engage in independent learning.
- Information literacy - skills to appropriately locate, evaluate and use relevant information
- Development of effective communication skills
- The skills required for collaborative and multidisciplinary work
- An appreciation of and responsiveness to change

Please refer to http://www.ltu.unsw.edu.au/content/userDocs/GradAttrEng.pdf for more information about graduate attributes.
5. Teaching method

Lectures will make extensive use of PowerPoint slides and white board work. PowerPoint printouts will be provided at the start of lectures and placed on the course Blackboard website. Additional information and reading materials will also be progressively made available on this site, but they are no substitute for accurate notes, and active student participation through questions and informal exercises during the lectures.

Students are expected and will benefit from attendance at every lecture. The course will cover a diverse range of material with an approach that is not readily found in textbooks or the literature. Note that UNSW policy is that you are expected to be regular and punctual in attendance at all classes in the course. See https://my.unsw.edu.au/student/atoz/AttendanceAbsence.html for details. Class rolls may be taken.

6. Assessment details

Assessment will consist of a group report on an agreed topic related to material covered in the course; a group oral presentation to the class of the major points in the report, class assignments taken individually, and the final exam. Satisfactory performance in both the class based assessment and examination is required to pass this course. The assigned marks for each assessment component are as follows:

<table>
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<tr>
<th>Assessment activity</th>
<th>Assessment (%)</th>
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<tbody>
<tr>
<td>Group student project reports on a topic agreed with the course coordinator by week 6 lecture (submission prior to the end of week 13)</td>
<td>20</td>
</tr>
<tr>
<td>Group student presentations on their report topics (over weeks 12-13 in a student order determined by the course coordinator)</td>
<td>10</td>
</tr>
<tr>
<td>Individual student assignments during the semester (number and submission dates to be confirmed within the course lectures).</td>
<td>20</td>
</tr>
<tr>
<td>Final exam</td>
<td>50</td>
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</tbody>
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The assignments will reinforce the material discussed in lectures. These must be undertaken by students individually. It is expected that there will be four such assignments during the semester. Provisional dates for assignment distribution and submission are provided in the course syllabus. The project will involve students in an activity suited to their interests and skills in the area of electricity industry operation and control. Groups of two students are preferred although individual or three student groups may be permitted under special circumstances. Projects will either focus on:

- development and testing of a simple software, spreadsheet or Matlab power system modelling and optimisation tool, or
- an in-depth literature survey of some aspect of electricity industry operation and control (2500-3000 words plus tables, diagrams, references etc.)

More information on these projects and suitable topics will be distributed in week 4 and project topics are to be negotiated and finalised by week 6. Details on the formal requirements for the project reports will also be provided at this time. It should contain a significant review of the
literature relevant to the topic and a comprehensive bibliography. All source material must be adequately referenced in the body of the report and it is expected that there will be 15 or more scholarly references in a literature survey.

The group oral presentation will take place during class time in weeks 12 and 13. Presentations will be 10 minutes with 5 minutes for questions and should make extensive use of visual aids. A computer and projector for PowerPoint presentations will be available. You will also be able to run the presentation from your own laptop if that is preferred. A one-page summary should be provided to all members of the class. Assessment will be based on the content and clarity of the presentation and the quality of the one-page summary. Note that students will participate in the assessment through a peer review process. More details will be provided during classes closer to the time of the seminar presentations.

The final exam will cover the lecture material and will be designed to assess comprehension and critical analysis of the material covered during the semester.

For all of the non-exam assessment tasks in this course, it is essential that you have a complete understanding of the UNSW official position on ‘In-class assessment and plagiarism’ as outlined below. Please note that there are severe penalties associated with plagiarism offences.

7. Resources for Students

There is no assigned textbook for this subject. The following book is a useful reference on the traditional, monopoly utility, approach to many of the topics covered in this course:


The UNSW library has a number of copies at PJ621.31. It is also available online via the UNSW library – search for ‘knovel wood wollenberg’ to find the online resource.

More recent concepts relevant to electricity industry operation and control in restructured industries are not easily found in textbooks. Instead, regular updates and course materials will be added to the course Blackboard website. You should check this site frequently. Materials will include pdf versions of the lecture PowerPoints (also provided as printouts prior to each lecture). A range of reports, papers and websites will be uploaded throughout the semester to provide more background on electricity industry operation and control within the restructured Australian electricity industry, as well as internationally.

Another useful website is that of the UNSW Centre for Energy and Environmental Markets (CEEM) found at [www.ceem.unsw.edu.au](http://www.ceem.unsw.edu.au). It contains useful papers and presentations covering many of the topics that are explored during the course.

8. Other Matters

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people’s work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a serious offence by the University and severe penalties may apply.

All submitted reports and assignments must have an attached cover-sheet that declares that the work detailed in the report/assignment is entirely that of the named student(s) only. The form is available from the EE&T School web site.

Some guidance on plagiarism is provided here. For more information about plagiarism, please refer to [http://www lc.unsw.edu.au/plagiarism](http://www.lc.unsw.edu.au/plagiarism).
What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one’s own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, website, Internet, other electronic resource, or another person’s assignment without appropriate acknowledgement;
- paraphrasing another person’s work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.

Continual Course Improvement

Students are advised that the course is under constant revision in order to improve the learning outcomes of its students. Please forward any feedback (positive or negative) on the course to the course coordinator or via the Course and Teaching Evaluation and Improvement Process (CATEI).

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School policies, see http://scoff.ee.unsw.edu.au/
9. Course Schedule

Note that this schedule is provisional at this stage and may be updated during the session. You should attend lectures and regularly check the course Blackboard website for possible updates.

Provisional Schedule, this version dated 11 July 2010.

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<thead>
<tr>
<th>WEEK</th>
<th>LECTURE</th>
<th>Class tasks</th>
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<tbody>
<tr>
<td>2</td>
<td>Introduction: important features and attributes of the electricity industry; definition of the key problems and challenges of industry operation and control</td>
<td>Introductions</td>
</tr>
<tr>
<td>3</td>
<td>Key technologies for generation, networks, loads and their control capabilities; decision-making tools</td>
<td>[out] Assignment 1</td>
</tr>
<tr>
<td>4</td>
<td>Economic dispatch (utilisation of operating generators &amp; loads)</td>
<td>[in] Assignment 1&lt;br&gt;[out] Assignment 2&lt;br&gt;[out] information on group projects and possible topics</td>
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<tr>
<td>5</td>
<td>Continuous voltage and frequency control</td>
<td>[in] preliminary group topic preferences</td>
</tr>
<tr>
<td>6</td>
<td>Contingencies and their management</td>
<td>[in] Assignment 2&lt;br&gt;group project topics finalized by end week 6</td>
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<tr>
<td>7</td>
<td>Unit commitment (selection of generators &amp; loads to operate)</td>
<td>[out] Assignment 3</td>
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<tr>
<td>8</td>
<td>Energy constraints: hydro, fuel management and maintenance scheduling</td>
<td>Project progress reviews</td>
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<tr>
<td>9</td>
<td>The operational challenges of distributed energy resources</td>
<td>[in] Assignment 3&lt;br&gt;[out] Assignment 4</td>
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<tr>
<td>10</td>
<td>Operation and control issues associated with intermittent generation</td>
<td></td>
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<tr>
<td>11</td>
<td>Electricity industry operation in a carbon constrained and 'smart grid' future</td>
<td>[in] Assignment 4</td>
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<tr>
<td>12</td>
<td>Student group presentations</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Student group presentations</td>
<td>Group reports due end week 13</td>
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