School of
Engineering and Computer Science
Te Kura Mātai Pūkaha, Pūrorohiko

Prescription

This course introduces the electricity industry and its components along with techniques for modern electric power system modelling and analysis. Topics include transmission line models, transformers and per unit systems, generator models, network matrices, power flow analysis and computation, real and reactive power control, voltage control, and protection. The course incorporates lab and simulation based exercises, an industrial tour, and an industrial project.

Course learning objectives

Students who pass this course should be able to:

1. Describe the different mathematical models of power system components.
2. Develop network models and analyse power flows.
3. Analyse power system static behaviours and contingencies.
4. Make design decisions with respect to criteria such as production cost minimisation and emissions.
5. Describe how the working of the electricity market affects the operation of the power system.

Course content

The course comprises of seven components. First, it gives students with a good understanding of the basic principles of single- and three-phase power, power transfer, and power indices. Second, it provides a deeper understanding of the components of power systems, and how to conduct per unit calculations, as well as power flow analyses. The techniques are then utilised to analyse, and understand, power system stability, faults, and protection. The integration of solar and wind generation, and storage in various parts of power systems, is examined in all of these components. The students are also equipped to analyse microgrids, as well as the implications of their integration in the larger power system. Finally, the students are exposed to the working of the electricity market, in New Zealand and other parts of the world, and how the kind of market affects the technical power system.

Withdrawal from Course

Withdrawal dates and process:
https://www.victoria.ac.nz/students/study/course-additions-withdrawals

Lecturers

Alan Brent (Coordinator)

alan.brent@vuw.ac.nz 04 4635960

413 Alan MacDiarmid Building, Kelburn

Jim Hinkley

jim.hinkley@vuw.ac.nz 04 4635515

227 Alan MacDiarmid Building, Kelburn

A/Prof Ramesh Rayudu
Dr Jim Hinkley
Dr Daniel Burmester

Teaching Format

During the trimester there are weekly contact lectures, tutorials, and laboratory sessions. In terms of the latter, the practical work involves simulations with PowerWorld (powerworld.com). Two individual projects are undertaken, which entail the modelling of the power system at different levels. Virtual case study analyses and discussions are also facilitated online via Blackboard.

Student feedback

Student feedback on University courses may be found at:
www.cad.vuw.ac.nz/feedback/feedback_display.php. As 2019 is the first year this course has been offered there is no feedback on previous instances of the course.

Dates (trimester, teaching & break dates)

- Teaching: 04 March 2019 - 09 June 2019
- Break: 15 April 2019 - 28 April 2019
- Study period: 10 June 2019 - 13 June 2019
- Exam period: 14 June 2019 - 29 June 2019

Class Times and Room Numbers

Set Texts and Recommended Readings

Required

All students are required to obtain a copy of the prescribed textbook. An e-book version is available from the library.
Additional material is made available online, via Blackboard, to assist with understanding the various concepts and the current debate around the renewable energy technology systems, which include: webinars, explanation videos, and other resources. Journal papers are made available via Talis Aspire with specific case studies and academic literature that are discussed and/or from part of the tutorials. In some weeks students are required to identify relevant literature, as part of online discussions, through the University library.

- Glover JD, Overbye TJ, 2016. *Power System Analysis and Design* – SI Edition. 6th edition, Cengage Learning, Mason.

Mandatory Course Requirements

In addition to achieving an overall pass mark of at least 50%, students must:

- Achieve an average of at least 40% on the assignments.
- Participate in all of the laboratory exercises.
- Achieve at least 40% on the essay, and the two class tests.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

The assessment is largely based on the modelling excercises and assignments, using the PowerWorld software. The fundamental, technical principles of the course material are assessed through two small, in-class tests, and the overarching understanding is assessed through an essay.

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Assignment 1 – simulation model and report	29 April	CLO: 1,2,3	25%
Assignment 2 – simulation model and report	3 June	CLO: 1,2,3,4	25%
Three laboratory exercises with a one-page report/software output	12 April	CLO: 1,2	15%
Electricity market analysis assignment/essay	24 June	CLO: 5	25%
Two class tests	6 June	CLO: 1,2,3,4,5	10%

Penalties

Late assessment will be penalised at the rate of 10% for every working day the assessment is late. The lecturer may refuse to mark work that has been handed in over a week late, and may also refuse if the assessment has been marked and returned to the class. In such instances, a zero grade for that assessment shall result.

Extensions

Individual extensions will only be granted in exceptional personal circumstances, and should be negotiated with the course coordinator before the deadline whenever possible. Documentation (eg, medical certificate) may be required.

Submission & Return

All the assessment items are submitted on Blackboard, and feedback will be provided electronically and discussed in class as appropriate.

Marking Criteria

The modelling assignments will be marked according to the robustness of the developed simulation models.
The modelling exercises will be marked in terms of the accuracy of three modelling outputs.
The tests will be marked in terms of the accuracy of the provided solutions to technical problems.
The essay will be marked according to the in-depth understanding of the described context.

Workload

Although the workload varies from week to week, students are expected to spend approximately 10 hours per week on the course, to give a total of 150 hours study time over the trimester. A plausible breakdown

for these hours would be: lectures (1 hours); tutorials (2 hour); laboratories (2 hours); reading, review and online discussions (3 hours); and modelling and written assignments (3 hours).

Teaching Plan

The learning areas/lectures and other activities over the teaching period comprise of the following:

Week 1

Lecture	Overview of course and Chapter 2
Tutorial	Introduction to Blackboard and other learning infrastructure
Laboratory	Introduction to the PowerWorld modelling package and exercises

Week 2

Lecture	Overview of Chapters 3, 4, 8
Tutorial	Chapter 2 problems
Laboratory	PowerWorld modelling exercise

Week 3

Lecture	Overview of Chapter 6
Tutorial	Chapters 3, 4, 8 problems
Laboratory	PowerWorld modelling exercise

Week 4

Lecture	Overview of Chapter 14
Tutorial	Chapter 6 problems
Laboratory	Assignment 1 commencement

Week 5

Lecture	Overview of Chapter 5
Tutorial	Chapter 14 problems
Laboratory	Assignment 1 continuation

Week 6

Lecture	Overview of Chapter 13
Tutorial	Test 1
Laboratory	Assignment 1 continuation

Week 7

Lecture	Overview of Chapter 11
Tutorial	Chapters 5, 13 problems
Laboratory	Assignment 2 commencement

Week 8

Lecture	Overview of Chapter 7
Tutorial	Chapter 11 problems
Laboratory	Assignment 2 continuation

Week 9

Lecture	Overview of Chapter 9
Tutorial	Chapter 7 problems
Laboratory	Assignment 2 continuation

Week 10

Lecture	Overview of Chapter 10
Tutorial	Chapter 9 problems
Laboratory	Assignment 2 continuation

Week 11

Lecture	Overview of Chapter 12
Tutorial	Chapters 10, 12 problems
Laboratory	Electricity market analysis assignment

Week 12

Lecture	Ovierview of Chapter 1, and other reading material
Tutorial	Test 2
Laboratory	Electricity market analysis assignment

Communication of Additional Information

Any additional information regarding this course will be posted on Blackboard.

Links to General Course Information

- Academic Integrity and Plagiarism: https://www.victoria.ac.nz/students/study/exams/integrity-plagiarism
- Academic Progress: https://www.victoria.ac.nz/students/study/progress/academic-progess (including restrictions and non-engagement)
- Dates and deadlines: https://www.victoria.ac.nz/students/study/dates
- Grades: https://www.victoria.ac.nz/students/study/progress/grades
- Special passes: Refer to the Assessment Handbook, at https://www.victoria.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf
- Statutes and policies, e.g. Student Conduct Statute: https://www.victoria.ac.nz/about/governance/strategy
- Student support: https://www.victoria.ac.nz/students/support
- Students with disabilities: https://www.victoria.ac.nz/st_services/disability/
- Student Charter: https://www.victoria.ac.nz/learning-teaching/learning-partnerships/student-charter
- Terms and Conditions: https://www.victoria.ac.nz/study/apply-enrol/terms-conditions/student-contract
- Turnitin: http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin
- University structure: https://www.victoria.ac.nz/about/governance/structure
- VUWSA: http://www.vuwsa.org.nz

Offering CRN: 31173

Points: 15
Prerequisites: RESE 313; ECEN 202, 203
Duration: 04 March 2019 - 30 June 2019
Starts: Trimester 1
Campus: Kelburn