



## 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 how the working of the electricity market affects the operation of the power system.
2. Describe the working and interaction of the various components of a power system.
3. Develop network models and analyse power flows.
4. Analyse power system static behaviours and contingencies.
5. Make grid design decisions, based on stability and cost, with respect to new renewable energy integration.

## Course content

This course is a lab-based course. Labs and tests will require in-person attendance by students in the Wellington Region. There will be online options for students outside the Wellington region, but students will have to complete alternative substitutes to the physical lab requirements. The remote option for tests will use a Zoom-based system for online supervision of the tests.

Students taking this course remotely from outside the Wellington region must have access to a computer with camera and microphone and a reliable high speed internet connection that will support real-time video plus audio connections and screen sharing. Students must be able to use Zoom; other communication applications may also be used. A mobile phone connection only is not considered sufficient. The computer must be adequate to support the practical work required by the course: almost any modern windows, macintosh, or unix laptop or desktop computer will be sufficient, but an Android or IOS tablet will not.

## Withdrawal from Course

Withdrawal dates and process:

<https://www.wgtn.ac.nz/students/study/course-additions-withdrawals>

## Lecturers

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**Daniel Burmester (Coordinator)**

daniel.burmester@vuw.ac.nz 04 463 9998

AM 404 Alan Macdiarmid Building, Gate 7, Kelburn Parade, Kelburn

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## Prof Alan Brent

alan.brent@vuw.ac.nz 04 463 5960

AM 413 Alan Macdiarmid Building, Gate 7, Kelburn Parade, Kelburn

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## Dr Jim Hinkley

jim.hinkley@vuw.ac.nz 04 463 5515

AM 227 Alan Macdiarmid Building, Gate 7, Kelburn Parade, Kelburn

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## Dr Ramesh Rayudu

ramesh.rayudu@vuw.ac.nz 04 886 5332

AM 421 Alan Macdiarmid Building, Gate 7, Kelburn Parade, Kelburn

## Teaching Format

This course will be offered in-person and online. For students in Wellington, there will be a combination of in-person components and web/internet based resources. It will also be possible to take the course entirely online for those who cannot attend on campus, with all the components provided in-person also made available online.

During the trimester there are weekly contact lectures, tutorials, and laboratory sessions. In terms of the latter, the practical work involves simulations with PowerFactory ([www.digsilent.de](http://www.digsilent.de)). Two individual projects are undertaken, which entail the modelling of the power system at different levels. Additional information 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](http://www.cad.vuw.ac.nz/feedback/feedback_display.php)

## Dates (trimester, teaching & break dates)

- Teaching: 11 July 2022 - 14 October 2022
- Break: 22 August 2022 - 04 September 2022
- Study period: 17 October 2022 - 20 October 2022
- Exam period: 21 October 2022 - 12 November 2022

## Class Times and Room Numbers

### 11 July 2022 - 21 August 2022

- **Tuesday** 15:10 - 16:00 – 407, Alan MacDiarmid Building, Kelburn
- **Wednesday** 15:10 - 16:00 – 407, Alan MacDiarmid Building, Kelburn

### 05 September 2022 - 16 October 2022

- **Tuesday** 15:10 - 16:00 – 407, Alan MacDiarmid Building, Kelburn
- **Wednesday** 15:10 - 16:00 – 407, Alan MacDiarmid Building, Kelburn

## Set Texts and Recommended Readings

## Required

An e-book version of the recommended text 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. 6<sup>th</sup> 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.

*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 exercises and assignments, using the PowerFactory software. The fundamental, technical principles of the course material are assessed through one in-class test.

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Assignment 1 – electricity market analysis	Week 6	CLO: 1	25%
Assignment 2 – simulation model and report	Week 9	CLO: 2,3,4,5	25%
Assignment 3 – Protection and stability	Week 14	CLO: 2,4	25%
Five laboratory exercises	Week 2 to 10	CLO: 2,3	25%

## 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 via the ECS submission system, 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.

## 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 (2 hours); tutorials (1 hour); laboratories (2 hours); reading, review and online discussions (2 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:

- Power system introduction
- Powerfactory modelling
- Generators, and system loads/storage
- Transformers
- Introduction to power markets and analysis
- Power system control
- Transmission lines
- Power flow analysis
- System stability
- Contingency analysis
- Power system protection
- Industry guest lectures

## 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.wgtn.ac.nz/students/study/exams/integrity-plagiarism>
- Academic Progress: <https://www.wgtn.ac.nz/students/study/progress/academic-progress> (including restrictions and non-engagement)
- Dates and deadlines: <https://www.wgtn.ac.nz/students/study/dates>
- Grades: <https://www.wgtn.ac.nz/students/study/progress/grades>
- Special passes: Refer to the Assessment Handbook, at <https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf>
- Statutes and policies, e.g. Student Conduct Statute: <https://www.wgtn.ac.nz/about/governance/strategy>
- Student support: <https://www.wgtn.ac.nz/students/support>
- Students with disabilities: [https://www.wgtn.ac.nz/st\\_services/disability/](https://www.wgtn.ac.nz/st_services/disability/)
- Student Charter: <https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter>
- Terms and Conditions: <https://www.wgtn.ac.nz/study/apply-enrol/terms-conditions/student-contract>

- Turnitin: <http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin>
- University structure: <https://www.wgtn.ac.nz/about/governance/structure>
- VUWSA: <http://www.vuwsa.org.nz>

**Offering CRN: [31173](#)**

**Points:** 15

**Prerequisites:** EEEN 313

**Duration:** 11 July 2022 - 13 November 2022

**Starts:** Trimester 2

**Campus:** Kelburn