Module Code	EEEP55C33/EEU44C33
Module Name	Power System Analysis
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Jin Zhao
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Describe, in terms of clean energy goals, the functioning of the smart grids. LO2. Explain the composition of the power systems. LO3. Analysis of power flow in power systems LO4. Design the deep learning techniques to realize model-free power flow analysis. LO5. Explain the low inertia features in highly renewable penetrated power grids. LO6. Evaluate the roles/features of renewable energy in electricity delivery. LO7. Assess and explore low-carbon supporting smart grid techniques through relevant literature in the domain. **Graduate Attributes: levels of attainment** To act responsibly - Attained To think independently - Attained To develop continuously - Attained To communicate effectively - Enhanced
Module Content	In line with the EU's ambition to become climate-neutral by 2050, renewable energy resources (RESs) will provide 75% to 100% of the electricity in the whole EU energy system. In Ireland, the net-zero goal has been brought forward to 2040 and there will be 80% renewable-based electricity by 2030. Power systems play a key role in the worldwide energy transition. With the concept of the smart grid, the power system is able to support the energy goals by providing sustainable and resilient electricity delivery. This module introduces the basic functions of power systems, the underlying principles of energy management in the power grid, and the technical updates for power delivery in the 'AI era'. In particular, the four aspects will be covered

[1] TEP Glossary

to develop the student's comprehension of power supply and system operation with highly renewable energy resources, the four aspects will be cover:

1) Smart grid and the key techniques for power transmission.
2) Power system steady-state analysis.
3) Opportunities and challenges brought by the integration of renewable energies.
4) Advanced AI application in power systems and energy management.

Teaching and Learning Methods

For 2025/26, the taught component of this module uses a mixture of theoretical elements, simulations, advanced research panels, and guest lectures from industrial practice. The students are expected to extensively read both course texts, relevant books, and literature. The students will have access to online resources.

Assessment Details[2]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
CA1	Power flow (PF) simulation	LO2,3	15	Around week 4
CA2	deep learning-based PF	LO3,4	15	Around week 8
CA3	Overview of potential implementation	LO2-6	10	Around week 10
Exam	End of year	All	60	As per the exam timetable

Reassessment Requirements

Exam based

Contact Hours and Indicative Student Workload[2]

Contact hours:
22 hours lectures + 11 hours tutorial + 8hours lab. Approx 33 hours Timetable hours: 22 lectures + 11tutorial + 8 lab = 41 hours
Independent Study (preparation for course and review of materials):

[2] TEP Guidelines on Workload and Assessment

	Approx 66 hours of self-guided study through the Semester. **Independent Study (preparation for assessment, incl. completion of assessment):** Approx 60 hours for assignments. Approx 60 hours of focused study for the exam
Recommended Reading List	**Textbooks:** *Power system analysis & design* J. Duncan Glover, Thomas J. Overbye, Mulukutla S. Sarma *Power system stability and control* Prabha Kundur **YouTube videos:** Electric Power Grid: On the relationship between power flows and bus voltages https://www.youtube.com/watch?v=gxZ3wschRpA Introduction to Power World https://www.youtube.com/watch?v=kDfRc_QV9uo Introduction to DC-OPF and AC-OPF https://www.youtube.com/watch?v=f92h6LL4ao8 https://www.youtube.com/watch?v=uWoFY045F1g **Other refs** will be given as assigned reading during the course.
Module Pre-requisite	Note that EE5C16 or a deep learning-related module is suggested before a student can start this course. Basic knowledge of deep neural networks is suggested.
Module Co-requisite	
Module Website	On Blackboard
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	
Module Approval Date	

Approved by	Prof. Naomi Harte
Academic Start Year	September 2025
Academic Year of Date	2025/2026