Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG6D8
Module Title	Smart Grids and Distributed Generation
Level	6
Credit value	20
Faculty	FACE
HECoS Code	100175
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Sustainable Energy Engineering BEng (Hons) Renewable Energy Engineering	Core

Breakdown of module hours

Learning and teaching hours	18 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	18 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**36 hrs**
Placement hours	0 hrs
Guided independent study hours	164 hrs
Module duration (Total hours)	**200 hrs**

Module aims

This module integrates advanced theoretical study with applied laboratory investigation. Students critically evaluate techniques, interpret data, and justify design or methodological decisions within a professional context. The combination of theory and practice cultivates independent learning, innovation, and readiness for individual project or dissertation work.

This module aims to equip students with advanced knowledge and skills in smart grid technologies and distributed generation, enabling them to analyse, design, and evaluate modern power systems. The module places particular emphasis on system efficiency, reliability, sustainability, and the integration of renewable energy sources within complex electrical networks.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Analyse the operation, control, and optimisation of smart grids and distributed generation systems, applying advanced electrical engineering principles (AHEP-4 C2).
2	Design and assess distributed generation and smart grid solutions, considering reliability, safety, sustainability, economic viability, and regulatory compliance (AHEP-4 C6, C10).
3	Analyse and evaluate digitalisation, IoT, and cybersecurity principles in smart grid systems through simulation and/or laboratory-based investigation, to enhance monitoring, control, and resilience (AHEP-4 C12).

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1: Coursework

Students are required to analyse and design a distributed generation system by applying advanced engineering principles. The task involves evaluating both technical performance and sustainability considerations, and effectively communicating the outcomes, thereby directly addressing the module's learning outcomes.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Coursework	3000	100	N/A

Derogations

Credits shall be awarded by an Assessment Board for those modules in which a pass mark 40% has been achieved, with a minimum mark of 30% in each assessment element.

Learning and Teaching Strategies

Learning combines theoretical exploration with applied laboratory investigation to bridge conceptual understanding and professional competence. Students critically analyse data, test approaches, and evaluate outcomes in practical settings. Blended delivery through the Virtual Learning Environment supports flexibility and reflection. Tutorials focus on independent enquiry, innovation, and readiness for project or dissertation work.

Welsh Elements

This module will be delivered through the medium of English; however, students have the option to submit their assessments in the medium of Welsh. While this module is not currently offered fully through Welsh, Welsh language support and guidance are available, and some learning materials or tutorial discussions may incorporate Welsh elements where appropriate. To further promote bilingual learning, all students have the opportunity to take the 20-credit *Welsh for STEM* short course, designed to develop confidence and subject-specific language skills in both English and Welsh.

Indicative Syllabus Outline

Smart Grid and Distributed Generation Fundamentals: Introduction to the architecture, operation, and control of smart grids and distributed generation systems, including their role in modern power networks.

Modelling and Simulation of Distributed Systems: Application of modelling and simulation tools (e.g. MATLAB/Simulink) to analyse system behaviour, control strategies, and optimisation of distributed energy resources.

Microgrid and Grid-Connected System Design: Design and evaluation of microgrids and grid-connected generation systems, considering system integration, performance, and operational requirements.

Regulatory, Reliability, and Sustainability Assessment: Assessment of smart grid solutions against regulatory standards, reliability metrics, and sustainability criteria, including economic and environmental performance.

Digitalisation and IoT in Smart Grids: Analysis of digital technologies and IoT applications for enhanced monitoring, control, and real-time management of smart grid systems.

Cybersecurity and Resilience in Energy Systems: Evaluation of cybersecurity risks, resilience strategies, and standards compliance to ensure secure and robust operation of modern smart grid infrastructures.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

B. P. Bhattarai, N. R. Karki, R. Karki and A. K. Verma, Eds., *Intelligent Power Grids of Tomorrow: Modeling, Planning, Control and Operation*. Singapore: Springer Nature Singapore, 2026.

Other indicative reading:
Industry software

Plus, various others to be signposted on Moodle.

Administrative Information

For office use only	
Initial approval date	June 2026
With effect from date	September 2026
Date and details of revision	
Version number	1