MODULE DESCRIPTOR

Module Title

Renewables and Smart Grids

Reference	EN3201	Version	1
Created	September 2023	SCQF Level	SCQF 9
Approved	February 2024	SCQF Points	15
Amended		ECTS Points	7.5

Aims of Module

This module aims to provide students the ability to evaluate the reliable energy mix of conventional and modern energy generation technologies within a digitalised electricity network leading to smart grids.

Learning Outcomes for Module

On completion of this module, students are expected to be able to:

1	Analyse the operation of the electricity grid with conventional and modern electricity generation mix while highlighting the impact of renewables integration.
2	Assess the prospects of energy storage and the potential of hydrogen energy storage and fuel cells in modernised power systems.
3	Demonstrate knowledge of the Smart Grid components, characteristics and operation.
4	Assess the Smart Grid communication technologies.

Indicative Module Content

Electrical power systems and its four main sectors: Generation, Transmission, Distribution and Demand. Recent diversification in the energy sources used for electricity generation and the impact of integrating modern distributed renewable energy sources into the conventional grid necessitating the transition to smart grids. Prospects of energy storage and the potential of fuel cells and hydrogen energy storage in modernized grids. Smart grids' components, benefits, limitations and operation. Smart grids communication: wired and wireless Communication, Internet of Things (IOT), Smart Meters, Supervisory Control and Data Acquisition (SCADA), and Cyber Security.

Module Delivery

Full-time students: This is a lecture based module supported by tutorial sessions and directed study. Part-time students: This module is delivered by a combination of lectures and tutorials online. It will be supported by online drop-in evening sessions.

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Indicative Student Workload	Full Time	Part Time
Contact Hours	44	44
Non-Contact Hours	106	106
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	150	150
Actual Placement hours for professional, statutory or regulatory body		

ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

Component 1

Type:	Examination	Weighting:	100%	Outcomes Assessed:	1, 2, 3, 4
Description:	A Closed-Book Examination.				

MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

In order to pass the module, students should achieve in their exam an overall grade of D or greater.

Module Grade	Minimum Requirements to achieve Module Grade:
A	A
B	B
C	C
D	D
E	E
F	F
NS	Non-submission of work by published deadline or non-attendance for examination

Module Requirements

Prerequisites for Module	EN2560 or equivalent.
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

1	JONES, L.E., 2017. Renewable energy integration: practical management of variability, uncertainty, and flexibility in power grids. Academic Press.
2	KETCHLEDGE, James A., 2015, Successful Smart Grid Implementation, PennWell
3	JAYAWEERA D.,2016, Smart power systems and renewable energy system integration, Springer.
4	ATUR, V. and KENNEDY, D., 2004. Review of electricity supply and demand in Southeast Europe (No. 17). World Bank Publications.
5	KARAMPELAS P., EKONOMOU L., 2016, Electricity distribution : intelligent solutions for electricity transmission and distribution networks, Springer.
6	RASHID, M.H., 2015. Electric Renewable Energy Systems. Academic Press.