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MODULE DESCRIPTOR

Module Title

Electrical Systems and Smart Grids

Reference	ENM283	Version	2
Created	March 2020	SCQF Level	SCQF 11
Approved	January 2018	SCQF Points	15
Amended	June 2020	ECTS Points	7.5

Aims of Module

This module aims to establish a commendable knowledge base on the reliable energy mix of conventional and modern energy generation technologies within a digitalised electricity network leading to smart grids. The module provides critical understanding of the multidisciplinary aspect of smart grids with an insight into the role of the electrical system's different sectors including generation, transmission, distribution, communications and operation.

Learning Outcomes for Module

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

1	Critically review the conventional and modern approaches in electricity generation, transportation, distribution and consumption while highlighting the impact of technological innovations on the electricity production, prices and associated greenhouse gas emissions.
2	Demonstrate significant understanding and develop skills in solving constrained problems and optimizations with the integration of renewable energies, different load types and demand response.
3	Demonstrate significant knowledge of the Smart Grid components, characteristics, benefits, challenges, standardization, communication, stakeholders and the economical aspect of its operation.
4	Critically analyse the prospects for energy storage in modern power systems.
5	Demonstrate critical understanding of Smart Grid Systems through critically evaluating them within the context of the environment, society and technology.

Module Ref:	ENM283 v2

Indicative Module Content

Basics of Power systems with an overview of its four main sectors: electricity generation, bulk transmission, distribution and the load demand. Demand response and demand management. Recent diversification of energy sources and modern distributed renewable energy generation. Distributed renewable generation and challenges associated with its grid-integration necessitating the transition to smart grids. Prospects for energy storage and the potential of fuel cells and hydrogen technologies into modernized power systems. Introduction to the smart grids' components, benefits and limitations of its operation. Smart grids wide area measurement and communication. The application of information and communications technology (ICT) to provide a secure, reliable and resilient service within a competitive market. Smart grids security and standardization. Smart Grids economics and market operation with smart policies to match its smart capabilities.

Module Delivery

This module will be delivered on campus full time and online via distance learning. The module is taught through lectures and lab sessions.

Indicative Student Workload	Full Time	Part Time
Contact Hours	50	50
Non-Contact Hours	100	100
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:	Coursework	Weighting:	30%	Outcomes Assessed:	5
Description:	A written coursework.				

Component 2

Type:	Examination	Weighting:	70%	Outcomes Assessed:	1, 2, 3, 4
Description:	A closed book examination.				

Module Ref:	ENM283 v2

MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

In order to pass the module, students should achieve a mark of at least 40% in each component (which has a weighting of 30% or more) and an overall grade of D or greater.

Module Grade	Minimum Requirements to achieve Module Grade:
A	Greater than or equal to 70%
B	In the range 60% to 69%
C	In the range 55% to 59%
D	In the range 50% to 54%
E	In the range 40% to 49%
F	Less than 40%
NS	Non-submission of work by published deadline or non-attendance for examination

Module Requirements

Prerequisites for Module	None.
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.