MODULE DESCRIPTOR

Module Title

Advanced Fuel Cell and Electrolyser Systems

Reference	EN5201	Version	1
Created	September 2023	SCQF Level	SCQF 11
Approved	February 2024	SCQF Points	15
Amended		ECTS Points	7.5

Aims of Module

To establish expertise in the theory, design and performance analysis of fuel cell/electrolyser

Learning Outcomes for Module

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

1	Synthesise advanced concepts related to complex flow systems within a fuel cell/electrolyser.
2	Evaluate various analytical and numerical analysis techniques for solving complex fuel cell/eletrolyser design problems.
3	Analyse complexity of materials and manufacturing process selection of fuel cell/electrolyser.
4	Appraise integrated approach to achieve a balance of plant of fuel cell/eletrolyser system.

Indicative Module Content

Classification of fuel cells and electrolyser, Basic principles and working mechanisms, Efficiency and environmental benefits, Electrochemical Fundamentals, Stack architecture, Electrode materials and catalysts, Membrane materials and ion exchange processes, Gas diffusion layers and flow field design, PEMFC working principles and advantages, Membrane materials and properties, Water management and heat transfer in PEMFC, SOFC working principles and Advantages, Electrode materials and reactions in SOFC, Stack design considerations and optimization, Performance modeling and simulation techniques, Stack sizing and power output estimation, Degradation mechanisms and lifetime estimation, Balance of plant components and system design, Power conditioning and control systems, Thermal management and waste heat recovery, Safety considerations and regulations, Transportation applications, Advances in fuel cell/eletrolyser materials research, Material selection and characterization techniques Manufacturing processes and quality control, Cost reduction strategies and scalability considerations.

Module Delivery

The module will be delivered though lecture and supported by tutorial and workshop and guided self-study.

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Indicative Student Workload	Full Time	Part Time
Contact Hours	40	40
Non-Contact Hours	110	110
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

Component 1 comprises of 100% of the module grade. To pass the module, a D grade is required

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	EN4201 Low Emission Vehicles
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

1	PEM Fuel Cell Modeling and Simulation using Matlab by Colleen Spiegel, 1st Edition, Academic Press, May 20, 2008
2	Fuel Cell Systems Explained, 3rd Edition, Andrew L. Dicks and David A. J. Rand, John Wiley and Sons, 2018
3	Solid Oxide Fuel Cells ? From Materials to System Modeling, Meng Ni and T S. Zhao, 2013. Royal Society of Chemistry.