MODULE DESCRIPTOR

Module Title

Wind Turbine Aerodynamic Design and Performance Evaluation

Reference	EN4204	Version	1
Created	October 2023	SCQF Level	SCQF 10
Approved	February 2024	SCQF Points	15
Amended		ECTS Points	7.5

Aims of Module

To develop knowledge of concepts and principles applicable to the aerodynamic design of wind turbines, their operation and performance evaluation under different environmental conditions, and an awareness of the role of wind turbines in decarbonising global economies.

Learning Outcomes for Module

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

1	Critique the advancements in the aerodynamic design of onshore and offshore wind turbines.
2	Conceptualise the principles associated with the aerodynamic performance of wind turbines.
3	Illustrate in detail influences of meteorological aspects on the performance of wind turbines.
4	Examine a wind turbine model's aerodynamic performance under controlled environment using advanced numerical techniques.

Indicative Module Content

Wind turbine aerodynamic design: Horizontal axis wind turbines, vertical axis wind turbines, components of wind turbines, Savonius rotors, Darrieus rotors, NACA blades, chord line and length, camber line and maximum camber, thickness, leading and trailing edges, pressure and suction sides, thin blades, rotor design, stator design, offshore wind turbines, fixed bottom turbines, floating turbines, nacelle, tower, foundation, mooring. Wind turbine aerodynamic performance: Betz limit, power coefficient, blade aerodynamics, startup dynamics, cut-in speed, rotational acceleration, tip speed ratio, rated speed and power, cut-out speed, torque/power curves, wind power density, capacity factor, wake modelling, wake dynamics, farm layout. Meteorological effects: accelerating winds, decelerating winds, wind gusts, ice accretion, blade erosion, waves, severe weather patterns.

Module Delivery

The module is taught through lectures and tutorials, and supported by 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:	Coursework	Weighting:	100%	Outcomes Assessed:	1, 2, 3, 4
Description:	The coursework consists of a written technical report.				

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	EN2702
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

1	James F Manwell, Jon G McGowan, Anthony L Rogers (2010) Wind Energy Explained: Theory, Design and Application; 2nd edition, Wiley.
2	Colin G Anderson (2020) Wind Turbines: Theory and Practice; Illustrated edition, Cambridge University Press
3	Trevor Letcher (2017) Wind Energy Engineering: A Handbook for Onshore and Offshore Wind Turbines; 1st edition, Academic Press.