Module Code	CE7J01
Module Name	J1: Wind Energy
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Asst. Prof. Breiffni Fitzgerald (breiffni.fitzgerald@tcd.ie) **Lecturer(s):** Asst. Prof. Breiffni Fitzgerald, Prof. Biswajit Basu
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Explain the impact of surface roughness and orography on wind speed profiles. LO2. Calculate wind speed at a given height using the log law and power Laws. LO3. Carry out siting assessment. LO4. Derive the Betz equation for wind power extraction using an idealized Wind turbine. LO5. Calculate power curve to analyse the impact of various control systems in a wind turbine. LO6. Explain concepts related to wind turbine design. LO7. Carry out analysis of gearbox for stresses generated and fatigue design. LO8. Demonstrate ability to carry out aerodynamic analysis for a wind turbine. LO9. Analyse noise generated by wind turbines and its impact. LO10. Model wake effects for wind farms. LO11. Analyse offshore wind turbines for join wind wave loading. LO12. Demonstrate ability to carry out economic analysis for wind energy technology. **Graduate Attributes: levels of attainment** To act responsibly - Attained To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Attained

Module Content

To develop a detailed foundation of the issues associated with the development of wind energy for electrical energy supply. The module will focus on the current state of wind energy technology domestically and internationally and will consider the future development of wind resources. Content will include:

- Overview of wind energy and introduction to wind flow.
- Fluid mechanics for wind energy
- Wind resources and siting
- Ideal wind turbines and practical constraints. Power Curves
- Turbine design (tower, blades, gearbox, foundations)
- Aerodynamics ad aeroelasticity
- Wake effects and wind farm design
- Controls in wind turbines
- Fixed and variable speed operation
- Offshore wind turbines, Joint wind and wave effects
- Wind turbine economics, lifecycle cost
- Grid integration and transmission

Teaching and Learning Methods

Teaching strategies:

- Lectures
- Coursework
- Mini projects

Assessment Details[2]

Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Examination	3 hour examination	All	80%	End of term
Coursework 1	Problem sheet	LO1 – LO4	7.5%	4
Coursework 2	Data analysis of wind speed at a site and estimation of the associated wind power resource	LO3	7.5%	8
Project	Modelling of a wind turbine	LO10, LO11	5%	12

Reassessment Requirements

None

Contact Hours and Indicative Student Workload[2]	**Contact hours: 36** **Independent Study (preparation for course and review of materials): 20** **Independent Study (preparation for assessment, incl. completion of assessment): 70**
Recommended Reading List	Wind Energy Explained: Theory, Design and Application (2009) Manwell, McGowen and Rogers, Wiley, 2nd Edition. Wind Energy Handbook (2001) Burton, Sharpe, Jenkins, Bossyani, John Wiley, New York. Wind Power Generation and Wind Turbine Design (2010) Tong (Ed.), WIT Press. Boston. Offshore Wind Farms: Technologies, Design and Operation (2016) Ng and Ran (Eds.), Woodhead Publishing Ltd., Cambridge Renewable Energy Resources (2006) Twidell and Weir, Taylor and Francis, London.
Module Pre-requisite	N/A
Module Co-requisite	N/A
Module Website	N/A
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	
Academic Start Year	1st September 2019
Academic Year of Date	2019/2020