Course unit title:	**Wind Energy**				
Course unit code:	AEEE362				
Type of course unit:	Required				
Level of course unit:	Bachelor (1st Cycle)				
Year of study:	4				
Semester when the unit is delivered:	7 (Fall)				
Number of ECTS credits allocated :	6	Lectures:	3 hrs/week	Labs:	0
Name of lecturer(s):	Dr Alexis Polycarpou				
Aim of the Course	The aim of the course is to bring in students to the deep concepts and principles of the wind technologies used for the design, application, evaluation and development of these energy systems. Particular emphasis is given to the development of an understanding of the issues surrounding the deployment of wind turbines in the electricity grid.				
Learning outcomes of the course unit:	• Gain in-depth knowledge and understanding of the main principles underlying the field of wind turbine operation and also having a critical awareness of the wider context of wind energy systems. Environmental and technological impact on surroundings is also investigated. • Explain and apply the concepts of energy contained in wind and potential power generation. Describe the properties of wind, dependence of air density on pressure, humidity and temperature, and dependence of energy on wind density. • Perform literature search of statistical data, and learn how to obtain wind speed measurement values data in order to theoretically implement a utility project. • Describe the electrical and magnetic concepts, as well as technical components of the wind turbine and their characteristic parameters corresponding to various types of turbines. • Explain how the variability of wind turbine production is incorporated in the grid, grid connection standards and protection system required.				
Mode of delivery:	Face-to-face				
Prerequisites:	None	Co-requisites:	None		
Course contents:	1. Wind energy technologies - History of wind power generation, Betz'Law.				

	- Structural considerations and basic operation of wind turbine - Wind turbine economics 2. Wind energy and power - Wind kinetic energy, reflection of rotor radius and wind speed on output electrical power - Basic energy conversion equations - Betz operational limit. 3. Wind properties and measurement - Statistical distribution of wind speed. - Power density, Weibull distribution, air density affecting parameters. - Configurations to measure wind, error estimates and computed quantities. 4. Wind turbine generator components - The rotor system - Various configurations and designs of turbines. - Normal and extreme wind model - Wind turbine blade aerodynamics 5. Electricity and generator - Principles of electromagnetism, alternating current and electrical machines. - Energy conversion from mechanical to electrical using synchronous generators (variable speed permanent magnet and direct drive) 6. Deploying wind turbines in the power grid - Dispatch of wind resources in transmission and distribution (effect on reactive power and power factor) - Power quality issues (flicker, harmonics) - Protection for overvoltage and lightning - SCADA data acquisition. 7. Wind energy systems - Calculation of estimated output power for specific wind turbines at proposed locations. - Effect of height and direction of wind speed on output power. - Calculation of capacity factor, optimal turbine rotation speed.
Recommended and/or required reading:	
Textbooks:	Pramod Jain (2011) *Wind Energy Engineering*, McGraw-Hill, ISBN: 978-0-07-171477-8.
References:	- T. Ackermann, Wind Power in Power Systems, John Wiley & Sons, 2005 - Alexis Polycarpou, Wind Energy, McGraw-Hill, e-Book, 2013.

Planned learning activities and teaching methods:	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constraints and revision timetable. The final assessment of the students is formative and is assured to comply with the subject's expected learning outcomes and the quality of the course.