AEEE362 - Wind Energy

Course Title	Wind Energy				
Course Code	AEEE362				
Course Type	Compulsory				
Level	BSc (Level 1)				
Year / Semester	6th (Spring)				
Teacher's Name	Dr. Alexis Polycarpou				
ECTS	5	Lectures / week	3	Laboratories/week	0
Course Purpose	The aim of the course is to introduce students to the principles of operation of wind technologies. The concept used for the design, application, evaluation and development of these energy systems is also examined. 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	By the end of the course, students must be able to: 1. Understand 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 covered. 2. 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. 3. Create a report with literature and statistical data, and learn how to obtain wind speed measurement values data in order to theoretically implement a utility project. 4. Evaluate the electrical and magnetic concepts, as well as technical components of the wind turbine and their characteristic parameters corresponding to various types of turbines. 5. Understand how the variability of wind turbine production is incorporated in the grid, grid connection standards and protection system required.				
Prerequisites	None	Corequisites	None		
Course Content	Course contents: • Wind energy technologies, history of wind power generation, Betz'Law, structural considerations, basic operation of wind turbine, and wind turbine economics. • Wind energy and power, wind kinetic energy, reflection of rotor radius and wind speed on output electrical power, basic energy conversion equations.				

	• Wind properties and measurements, statistical distribution of wind speed, power density, Weibull distribution, air density affecting parameters, configurations to measure wind, error estimates and computed quantities. • Wind turbine generator components, the rotor system, various configurations and designs of turbines, normal and extreme wind model, wind turbine blade aerodynamics. • 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. • Electricity generation, principles of electromagnetism, alternating current and electrical machines, energy conversion from mechanical to electrical using synchronous generators (variable speed permanent magnet and direct drive). • 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.
Teaching Methodology	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 and can also be downloaded from the e-learning platform or the lecturer's webpage. 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.
Bibliography	**Textbooks:** • Pramod Jain (2011) *Wind Energy Engineering*, McGraw-Hill, ISBN: 978-0-07-171477-8.. • Alexis Polycarpou, Wind Energy, McGraw-Hill, e-Book, 2013. **References:** • T. Ackermann, Wind Power in Power Systems, John Wiley & Sons, 2005.
Assessment	The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted 40% and 60%, respectively, and compose the final grade of the course. Mid-term written exams are used for the continuous assessment of the students. The students are also required to undertake a mini research project regarding the theoretical implementation of a wind farm. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the

	semester via the course outline. An indicative weighted continuous assessment of the course is shown below: • Mid-Term written exams 70% • Mini research project 30% 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 constrains and revision timetable. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	**English**