Course Code	Course Title	Credits (ECTS)
ECE-565	Wind Energy Technology	8
Department	**Semester**	**Prerequisites**
Engineering	Fall or Spring	ECE-560
Type of Course	**Field**	**Language of Instruction**
Elective	Engineering	English
Level of Course	**Year of Study**	**Lecturer(s)**
2st Cycle	2nd	Prof Anastasis Polycarpou
Mode of Delivery	**Work Placement**	**Co-requisites**
Face-to-face	N/A	None

Objectives of the Course:

The main objectives of the course are to:

- Provide basic understanding of the wind energy technologies and structures.
- Describe the basic design and operation of a wind turbine.
- Provide the theoretical tools for the modeling and design of wind turbines.
- Present the main characteristics of a wind turbine and its connection to the electricity grid.
- Introduce the state-of-the-art wind technology used and the future trends.
- Provide analytical methods for turbine performance evaluation and testing.
- Present the main regulations, guidelines and standards used.

Learning Outcomes:

Upon completion of the course students are expected to:

- Explain the basic characteristics of the wind as a source.
- Describe the aerodynamics of wind structures and argue on its basic parameters affecting wind turbine design.
- Apply Momentum Theory Concepts for the analysis and design of a wind turbine.
- Describe the basic structure of the wind turbine and its main characteristics.
- Design the electrical part of a basic wind turbine
- Evaluate the effect of the blade design in the wind turbine performance
- Investigate different designs and explain their advantages and disadvantages
- Explain wind turbine installation, integration and operation.
- Estimate the performance of a wind turbine based on its design and meteorology historical data.
- Analyze the wind turbine as a control system and discuss the effect of it main parameters.
- Investigate the potential of wind farms and its connection to the grid.

Course Contents:

- Introduction to modern Wind Energy. Brief history.
- Wind characteristics and sources. Wind as a resource. The Atmospheric Boundary Layer. Wind Data Analysis, Resource and Energy Production Estimation.
- Aerodynamics of Wind Turbines. One-dimensional Momentum Theory and the Betz

Limit.

- Horizontal Axis Wind Turbines. General Concepts of Aerodynamics. Blade Design and Element Theory.
- Computational and Aerodynamic Issues in Aerodynamic Design.
- Wind Turbine Loads. Turbine Mechanics and Rotor Dynamics. Turbine Structural Response Modeling.
- Electrical Aspects of Wind Turbines. Power Transformers. Electrical Machines and Power Converters. Variable-Speed Wind Turbines
- Wind Turbine Design and Testing. Basic Design Procedure. Evaluation and Testing.
- Wind Turbine Topologies. Wind Turbine Standards, Technical Specifications, and Certification. Load Scaling Relations. Power Curve Prediction.
- Wind Turbine Control System. Grid-connected Turbine Operation.
- Wind Turbine Siting, System Design, and Integration. Installation and Operation Issues.
- Wind Farms and Basic Wind Energy applications. Offshore Production.

Learning Activities and Teaching Methods:

Lectures, in-class examples, exercises, design project.

Assessment Methods:

Homework, mid-term and final exams, design project reports.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
J. F. Manwell, J. G. McGowan, A. L. Rogers	Wind Energy Explained: Theory, Design and Application, 2nd Edition	Wiley	2009	978-0-470-01500-1

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
A. Schaffarczyk	Understanding Wind Power Technology: Theory, Deployment and Optimisation	Wiley	2014	978-1-118-64751-6
P. Jain	Wind Energy Engineering	McGraw-Hill	2010	978-0071714778
H-J. Wagner , J. Mathur	Introduction to Wind Energy Systems: Basics, Technology and Operation (Green Energy and Technology)	Springer	2012	978-3642329753