

Zarqa University

Faculty of Engineering Technology

Department: Energy Engineering

Course title:

Renewable Energy II (Wind Energy)



Prerequisite: Fluid Mechanics I

Instructor: TBD

Lecture's time: TBD

Semester: TBD

Office Hours: TBD

Course description:

Introduction to wind and wind power history. Structure of the wind turbine. Impact of tower height. Maximum rotor efficiency. Introduction to wind turbine generators. Turbine aerodynamics (how wind power works). Average power in the wind. Wind turbine electrical capacity. Wind power probability density function, Weibull and Rayleigh statistics. Wind farms. Specific wind turbine performance calculation. Environmental concerns: noise, view and landscape.

Aims of the course:

1. Define the wind and the power in the wind. Understand the structure of the wind turbine and its conversion principle.
2. Understand the impact of tower height on the output power. And defining the maximum rotor efficiency of the wind turbine.
3. Analyze the average power in the wind and the wind turbine electrical capacity. Calculate the wind power probability density functions, using Weibull and Rayleigh statistics.
4. Understand the concept of wind farms and its environmental impact.

Intended Learning Outcomes (ILOs):

1. Explain the fundamentals of wind and wind power.
2. Determine the Structure of the wind turbine.
3. Understand the impact of tower height.
4. Define the maximum rotor efficiency.
5. Explain the wind turbine aerodynamics.
6. Explain how to find the average power in the wind and its electrical capacity.
7. Specific wind turbine performance calculation.
8. Explain the environmental concerns of wind turbine: noise, view and landscape.

Course structures:

Week	C. Hrs	ILOs	Topics	Teaching Procedure	Assessment methods
1		1	Introduction to Wind & Wind Power History measuring system	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
2,3		1	Wind Turbine Mechanism and its main Components	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
4,5		1	Power in the wind calculations and the Combined Temperature and Altitude Corrections for Air Density	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
6		2,3	Impact of Tower Height. And the Maximum Rotor Efficiency	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
7		4	Calculation of the average Power in the Wind Using the Discrete Wind Histogram	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
8,9		5	Wind Power Probability Density Functions	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
10,11		5,6	Average Power in the Wind with Rayleigh Statistics	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
12,13		7	Specific Wind Turbine Performance Calculations	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
14		6,7	Idealized Wind Turbine Power Curve And Wind Speed Cumulative Distribution Function	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work

15		6,7	-Using Capacity Factor to Estimate Energy Produced -Annualized Cost of Electricity from Wind Turbines	Lectures using power point + home work assignment	1 st + 2 nd examination Final examination Assessment of home work
16		8	Wind energy and environment		
			Exam		

Textbook:

-“Wind energy handbook”, T. Burton, D. Sharpe, N. Jenkins and E. Bossanyi, 2001 by John Wiley.

-“Renewable and Efficient Electric Power Systems”, Gilbert Masters, Wiley, 2012

Reference:

“Handbook on solar wind: effects, dynamics and interactions”, HANS E. JOHANNSON, 2009.

Lecturer hand outs

Assessment Methods:

Methods	Grade	Date
First examination	20%	According to faculty time table
Second examination	20%	
Final examination	50%	
Home work assessment	10%	

