

EE4404 Tutorial Questions on Wind Energy

- Q.1 What are the components in a HAWT type wind turbine system? Describe the function of each component.
- Q.2 Why are wind turbine rotor blades twisted towards the end?
- Q.3 What is the specific power in wind at a location with wind speed of 5m/s? Determine the theoretical maximum power output of a 40-m diameter wind turbine generator at this location. Assume density of air to be 1.225Kg/m³.
- Q.4 The wind speed in a city area is 5 m/s at a height of 10m. The location has a friction coefficient of 0.4. What is the specific power at a height of 50m? Assume density of air to be 1.225Kg/m³.
- Q.5 At tip-speed-ratio of 5, what is the rpm of the wind turbine rotor with a diameter of 40m, if the wind speed is 10m/s?
- Q.6 Explain how the rotor blades in a wind turbine get the required thrust to rotate.
- Q.7 What are the various methods used for varying the wind turbine rotor speed based on wind speed?
- Q.8 Draw the complete block diagram of the wind energy conversion system to convert wind energy to electricity for the grid. Briefly explain the function of each block.
- Q.9 Using appropriate equations, explain why it is economical to increase the size of the wind turbine rotor.
- Q.10 Explain the cause of rotor stress in large wind turbines.
- Q.11 From first principle, derive Betz's Law for retrieving maximum energy from wind using a wind turbine.
- Q.12 What is the tip speed ratio (TSR) of wind turbine? How does TSR affect the rotor efficiency of a wind turbine?
- Q.13 Describe the various types of wind turbine generators based on type of speed control used.
- Q.14 Using block diagram, describe the various types of variable speed wind turbine generator systems with electrical control on generator side.
- Q.15 Using block diagram, explain the operation of wind turbine system with a doubly fed induction generator (DFIG).

- Q.16 Using block diagram, explain the operation of variable turbine speed, type 4 wind turbine system with a Synchronous generator.
- Q.17 Draw the ideal power delivered vs wind speed curve for a wind turbine generator. Clearly explain the operation at different wind speed.
- Q.18 What is meant by wind shedding? Explain the various methods for shedding wind power?
- Q.19 The table below gives the measurement of wind speed during one day. Calculate the total energy generated for the day using a 40-m diameter rotor wind turbine generator with rotor efficiency of 40% and generator efficiency of 85%. The cut-in speed is 3 m/s and cut-out speed is 9 m/s. Assume there is no wind shedding.

Wind speed (m/s)	Number of hours recorded during the day
1	5
2	3
4	4
7	6
8	4
10	2