

U1

1. From basic principles obtain an expression for power in wind. Hence show the effect of power coefficient.
2. For a typical horizontal-axis, propeller-type wind mill obtain the condition for maximum power ' P_{max} ', under the dynamic operation.
3. With neat sketch discuss the "Lift and Drag" mechanism the two primary mechanisms for producing forces from the wind.
4. Discuss the two main types of wind turbines along with their advantages and limitations.
5. Discuss the requirements of grid support for wind generator. Hence draw the speed - power characteristic of variable speed wind turbine from basic power equation.
6. Explain the grid support scheme configuration with voltage source inverter based on current control technique for switching inverter.
7. Discuss different converter topologies applicable for power conditioning of wind turbine generator systems with their advantages and limitations .
8. Discuss the following phenomenon as seen by a wind turbine;
 - i) Subsynchronous resonance (SSR) induced by a wind turbine and
 - ii) low-voltage ride-through (LVRT) capability.
9. Discuss in detail the control strategies adopted for Type I, II, III, and IV wind turbines.

U2

10. What is DFIG ? With the help of a per phase equivalent circuit obtain an expression for mechanical torque (T_{mech}) generated by the machine.
11. With a neat sketch of Power flow diagram and Equivalent circuit of a doubly fed induction machine, write the expression for real and reactive power and

torque equation.

12. Discuss following modes of operation of wind turbine;

- i) Sub synchronous motoring operation
- ii) Supper synchronous motoring operation
- iii) Sub synchronous generating operation
- iv) Supper synchronous generating operation

13. with switching diagram explain a typical back-to-back arrangement of inverter and converter circuits to control power flow of wind generation system.

14. Define modulation index. With an example of carrier-based pulse-width modulated signal generation write down the expression for resultant output line voltages.

15. For a lossless DFIG system with steady-state fixed turbine speed, show that speed of the rotor has to change as wind speed changes in order to track the maximum power point of the aerodynamic system.

16. Explain the functions of rotor-side converter (RSC) and grid-side converter (GSC)

17. Explain with SLD and phasor diagram the process of real and reactive power control by grid side converter.

18. Explain the vector-control techniques used for the independent control of torque and rotor excitation current in the DFIG and decouple control of the active and reactive power supplied to the grid.
