EX/PG/EST/T/129B/[illegible]/2018

M.Tech. (Energy Sc. & Technology) 2nd. Semester 2018

Wind Energy Systems

Time 3 hr. Full Marks 100

Answer ***any five*** questions

1. (a) State and explain the various factors related to the siting of a Wind Energy Conversion System. Discuss the various site parameter and its influence on the wind flow patter over a terrain. 09

   (b) Discuss frequency distribution & cumulative frequency distribution as related to estimation of wind energy potential assessment and wind turbine output power estimation. 07

   (c) Define (i) Inflation (ii) Payback period. 04

2. (a) Define (i) Probability density function (ii) Cumulative distribution function. 04

   (b) How would you utilize weather data and determine Weibull parameters. 06

   (c) Derive the expression for Weibull Cumulative Distribution function F(x) as a function of dimensionless wind velocity. 06

   (d) Differentiate between Drag Propulsion & Lift Propulsion 04

3. (a) Explain why a Multiblade Wind Turbine Rotor attains a lower power coefficient compared to a 3 Bladed Wind Turbine. 06

   (b) Describe the procedural steps to find the $\frac{C_d}{C_l}$ (minimum) for a aerofoil graphically. 04

   (c) With standard notation derive the Torque & Thrust equation from the blade element theory. Also discuss the limitation of the Momentum theory. 10

4. (a) Explain the Prandrl's tip loss model as used in wind turbine theory & explain how would you introduce it in the fundamental equation. 10

   (b) Explain the functional difference between Stall regulated & Pitch regulated wind turbine. 06

   (c) Explain why the breaking mechanism for a wind electric generator is located between the turbine hub and gearbox. 04

5. (a) With standard notations derive the expression for the force acting on a piston rod of a water pumping system and also derive the torque demand of the pump during the upward stroke. 08

   (b) Explain the functioning of an air-vessel in a reciprocating wind water pumping system. 04

   (c) Explain the various mechanisms used for the safety of a wind turbine system operating under high wind velocity & discuss its functioning. 06

6. (a) Define "Energy Pattern Factor" and explain its importance is energy estimation of wind energy 06

   (b) Describe the terms Linear Repayment & Annuity 04

   (c) Explain the various electrical generator configurations as used for wind electrical generators. 10