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**Question Paper Code: 58361**

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2019

One credit

Electrical and Electronics Engineering

15UEE861 -WIND FARM DEVELOPMENT AND OPERATION

(Regulation 2015)

Duration: 1.30 hours

Maximum: 50 Marks

Answer ALL Questions

PART A - (15 x 2 = 30 Marks)

- The amount of energy available in the wind at any instant is proportional to \_\_\_\_ of the wind speed  
(a) Square root power of two (b) Square root power of three  
(c) Square power (d) Cube power
- What is the kinetic energy of 1 cubic meter of air moving at the speed of 10 m/s? The density of air is  $1.2 \text{ kg/m}^3$ .  
(a) 12 J (b) 120 J (c) 60 J (d) 6 J
- The following factor(s) affects the distribution of wind energy  
(a) Mountain chains (b) The hills, trees and buildings  
(c) Frictional effect of the surface (d) All of the above
- The power output per square kilometre of a wind farm consisting of turbines with rotor diameters  $D$  in a mean wind speed  $u_m$  depends approximately on  
(a)  $D^2 u_m^2$  (b)  $D^3 u_m^3$  (c)  $u_m^3$  (d)  $D^3 u_m^2$
- A wind turbine designed for a tip-speed ratio  $\lambda = 9$ , is operating in a mean wind speed of  $12 \text{ m s}^{-1}$ . The turbine blades are 50 m long. Estimate the number of revolutions made by the turbine in 30 years taking the capacity factor as 30%.  
(a)  $10^8$  (b)  $3 \times 10^7$  (c)  $3 \times 10^8$  (d)  $3 \times 10^9$
- The rate of change of wind speed with height is called  
(a) Wind shear (b) Wind rose (c) Wind solidity (d) None of the above

7. Which of these is NOT a part of a modern wind turbine?  
 (a) Compressor            (b) Gear box            (c) Nacelle            (d) YAW Drive
8. The wind direction is measured using an instrument called  
 (a) Pyranometer            (b) Manometer            (c) Anemometer            (d) Wind vane
9. The mean wind speed at site A for a wind farm is 10% higher than at site B. What would be the expected increase in electricity production at site A compared to site B  
 (a) 10%            (b) 20%            (c) 30%            (d) 33%
10. The typical capacity credit of a wind farm is  
 (a) 10-20%            (b) 20-40%            (c) 40-60%            (d) 60-80%
11. Winds caused by greater solar heating of the earth's surface near the equator than near the northern or southern poles, are known as  
 (a) Local winds            (b) Equatorial winds            (c) Planetary winds            (d) Trade winds
12. In a region where the mean wind speed is 8 m s<sup>-1</sup>, the area of land required for a wind farm to produce an average output of 100 MWe is about  
 (a) 33 km<sup>2</sup>            (b) 50 km<sup>2</sup>            (c) 100 km<sup>2</sup>            (d) 150 km<sup>2</sup>
13. Currently, the fastest growing source of electricity generation using new renewable sources  
 (a) Solar            (b) Wind            (c) Hydro            (d) Coal
14. The Nacelle of windmill houses  
 (a) Gearbox            (b) Brakes            (c) Generator            (d) All of the above
15. Turbines blades have \_\_\_\_\_ type cross section to extract energy from wind.  
 (a) Aerofoil            (b) Elliptical            (c) Rectangular            (d) All of the above

PART – C (1 x 20= 20 Marks)

16. (a) (i) Explain in detail about Preventive, Breakdown and Predictive maintenance of WECS system. (10)
- (ii) State and Explains the factors to be considered for ideal location of wind farm (10)
- Or
- (b) (i) Discuss about the techniques and methods employed for central monitoring of wind energy conversion system (10)
- (ii) Explain the Failure analysis, aging and rehabilitation in WECS. (10)