Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U8361

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

One credit

Electrical and Electronics Engineering

21UEE861 -WIND FARM DEVELOPMENT AND OPERATION

(Regulation 2021)

Duration: 1.30 hours Maximum: 50 Marks

Answer ALL Questions

PART A - (15 x 2 = 30 Marks)

1. Winds having following speed are suitable to operate wind turbines.

   (a) 5 – 25m/s (b)10 – 35m/s (c)20 – 45m/s (d)30 – 55m/s

2. 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 kg/m^3.

   (a) 12 J (b)120 J (c)60 J (d)6 J

3. The wind speed is measured using an instrument called

   (a) Pyranometer (b) Manometer (c)Anemometer (d) Wind vane

4. The power output per square kilometre of a wind farm consisting of turbines with rotor diameters D in a mean wind speed um depends approximately on

   (a)D^2um^2 (b)D^3um^3 (c)um^3 (d)$D^3\ um^2$

5. A wind turbine designed for a tip-speed ratio $\lambda = 9$, is operating in a mean wind speed of 12 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) 3×10^7 (c) 3×10^8 (d) 3×10^9

6. Turbines blades have ____ type cross section to extract energy from wind.

   (a) Aerofoil (b) Elliptical (c) Rectangular (d) All 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. Change of direction of wind with respect to obstacle is called

(a) Wind shear (b) Wind turbulence (c) Wind solidity (d) None of the above

9. The fraction of power in the wind that a modern wind turbine can extract is approximately

(a) 90% (b) 59% (c) 45% (d) 60%

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. The total power of a wind stream is proportional to

(a) Velocity of stream (b) (velocity of stream)^2

(c) (velocity of stream)^3 (d) 1/ (velocity of stream)

13. Currently, the fastest growing source of electricity generation using new renewable sources is

(a) Solar (b) Wind (c) Hydro (d) Coal

14. A typical spacing between turbines in a wind farm in terms of their rotor diameters D is approximately

(a) 4D×7D (b) 2D×3D (c) 15D×20D (d) 2D×4D

15. The percentage of energy put into a system that does useful work is

(a) Energy conservation (b) Energy efficiency

(c) Renewable energy (d) Energy conversion

PART – C (1 x 20= 20 Marks)

16. (a) (i) Discuss about the Operation and supervision of wind farm. (10)

(ii) Explain in detail about the basic infrastructure of wind energy conversion system (10)

Or

(b) (i) Explain in detail about Offshore wind farm development and its special considerations. (10)

(ii) Explain the Failure analysis, aging and rehabilitation in WECS. (10)