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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program Name: B.Tech Mechanical Engineering

Course Name : Alternate Energy Sources

Course Code : ADEG-331

No. of page/s:

Semester – V

Max. Marks : 100

Duration: 3 Hrs

Section- A (Attempt all of the following) (30)

1. Calculate the sun's altitude, zenith and solar azimuth angles, at 9:00A.M solar time on August 30 at latitude 25°N. (5)
2. Discuss the major environmental concerns for offshore wind farm. (3)
3. Explain the mechanism of production of local winds. (3)
4. Enumerate the most contentious issues surrounding nuclear energy? (3)
5. Gasifier design impacts the tar formation. Comment. (3)
6. Comment on the current status of geothermal energy in India. (3)
7. Define cut-in, rated and cutoff wind speed with reference to power, performance characteristics of a wind turbine? How it is chosen for optimal design of a wind turbine. (5)
8. Explain about the extraterrestrial and terrestrial radiation falling on horizontal surface. (5)

Section- B (Attempt all of the following) (30)

9. Explain the terms with suitable diagrams.
 - a) Yaw control
 - b) Pitch control

- c) Tip speed ratio (6)
10. Describe briefly with neat sketch, the main components of WECS and its working. (6)
11. Calculate the angle made by beam radiation with normal to a flat-plate collector on Dec 1 at 0900 h (local apparent time). The collector is located at latitude $28^{\circ}35'N$, and longitude $77^{\circ}12'E$, and is tilted at an angle of 30° with the horizontal and is pointing due south. (6)
12. Describe various energy extraction technologies used with geothermal sources. (6)
13. Discuss in detail the different processes in gasifier operation. Also explain the effect of gasifying medium on producer gas quality. (6)

Section -C (Attempt the following) (40)

14. (a) Using Betz Model of a wind turbine, derive the expression for power extracted from the wind. What is the maximum theoretical power that can be extracted and under what condition? (10)
- (b) Calculate hour angle at sunrise and sunset on June 21 and December 21 for a surface inclined at an angle of 10° and facing due south ($\gamma=0^{\circ}$). The surface is located in Bombay ($19^{\circ}07'N$, $72^{\circ}51'E$). (10)
15. (a) Following Data were recorded for a two blade HAWT:
 Average wind speed at a standard height of 9m = 8m/s
 $\alpha = 0.13$
 Air density = 1.223 kg/m^3
 Hub height from the ground = 80m
 Rotor diameter = 60m
 Wind speed at the turbine reduces by 30%
 Generator efficiency = 80%
- Calculate:
- a) Total power available in the wind.
 b) Power extracted by the turbine
 c) Electrical power generated
 d) Axial thrust on the turbine
 e) Maximum axial thrust on the turbine. (10)
- (b) Explain how the variation of insolation and temperature affect the I-V characteristics of a solar cell. (10)

OR

(c) Discuss the construction and working of PWR (pressurized water reactor) and compare the specifications, advantages and disadvantages of PWR with BWR. (10)