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Question Paper Code : 51825

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Sixth Semester

Mechanical Engineering

ME 2023/ME 603 / 10122 MEE 14 – RENEWABLE SOURCES OF ENERGY

(Common to Seventh Semester Manufacturing Engineering)

(Regulations 2008/2010)

(Common to PTME 2023 – Renewable sources of energy for B.E. (Part-Time) Sixth Semester – Mechanical Engineering – Regulations 2009)

Time : Three Hours

Maximum : 100 Marks

Use of standard charts and tables are allowed.

Any missing data can be suitably assumed.

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. List atleast 4 limitations of Solar Energy.
2. Define “Doping”.
3. Write the equation for power output from a Wind Mill giving units for each.
4. State why the configuration of Wind Mill for water pumping is different from that of Wind Mill for power generation ?
5. Write down the typical composition of Producer Gas and Biogas.

6. Name 3 liquid biofuels.
7. How SHP stations are classified based on the capacity (kW) ?
8. What is a Penstock ?
9. Name 4 advantages of Hydrogen Energy.
10. List 4 potential applications of a fuel cell.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Define Beam, Diffused and Global Radiation (6)
- (ii) Calculate the number of daylight hours (day length) in a location (4)
(Latitude 12°58'N) on June 21 and Dec 21 in a leap year.
- (iii) Mention various types of Solar Thermal Collectors and describe the working principle of any one. State the merits of the collector you have described. (6)

OR

- (b) (i) What is the energy conversion efficiency of a 175 W Solar Panel (750 mm × 1500 mm size) for a solar insolation of 1175 W / m² ? (3)
 - (ii) Explain the factors that contribute towards the losses and thereby reduction in the efficiency of a solar cell. (6)
 - (iii) Write a notes on : Solar Pond and Solar Furnace. (7)
12. (a) (i) Describe the following w.r.t a Wind Mill : (8)
 - Leading and Trailing Edge of Blade
 - Pitch & Yaw Control
 - Teetering
 - Nacelle

- (ii) The wind velocity is 10 m/s at 15 °C. Turbine diameter is 10 m. Operating speed of the wind machine is 35 rpm at a maximum efficiency of 40 %.

Calculate the following :

- Total Power Density in Wind Stream
- Maximum Power Density
- Actual Power Density
- Turbine Power Output

OR

- (b) (i) Make a comparison between horizontal axis and vertical axis Wind Turbine. (5)
- (ii) List the characteristics of a favourable wind power site and brief. (5)
- (iii) Write down the basic components of a Wind Energy Conversion System that is connected to utility grid and brief. (6)
13. (a) (i) Describe the 3 thermal processes (Combustion, Gasification and Pyrolysis) in the context of Biomass usage. (10)
- (ii) List the parameters that affect the performance of a Biogas Digester and explain. (6)

OR

- (b) (i) Write a note on Energy Plantation. (4)
- (ii) Explain the process of commercial production of Ethanol from Biomass. (6)
- (iii) What is "Biomass Cogeneration" ? Elaborate. (6)

14. (a) (i) List few advantages and limitations of Geothermal Energy. (6)
- (ii) State and reason out the type of Speed Governor used in micro hydel system for power generation. (5)
- (iii) Derive expression for Energy and Power from Waves. (5)

OR

- (b) (i) Mention two basic types of OTEC system and describe any one with a schematic. (8)
- (ii) Differentiate Tidal and Wave Energy. List the advantages and disadvantages of Wave Energy. (8)

15. (a) (i) Draw the Fuel Cell based electrical power generation scheme and describe the details of each block. (8)
- (ii) List the important properties of Hydrogen (any 8) from energy generation point of view and compare the values with that of any one conventional fuel, say, Petrol / Natural Gas / Diesel (8)

OR

- (b) (i) Describe various methods of storage of Hydrogen. (4)
- (ii) List advantages, disadvantages and applications of Fuel Cell Technology in Indian context. (8)
- (iii) A $H_2 - O_2$ fuel cell operates at $25^\circ C$ whose Gibbs Free Energy is $-237191, kJ / kg - m$ & the heat of reaction with reference to H_2 is $-142919 kJ / kg$. Calculate the efficiency of the cell. (4)