

B.Tech III Year II Semester (R13) Regular Examinations May/June 2016

NON CONVENTIONAL SOURCES OF ENERGY

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

PART – A

(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- (a) Explain solar constant.
 - (b) Explain solar surface azimuth angle.
 - (c) What do you understand by instantaneous efficiency and stagnation temperature?
 - (d) Define: (i) Aperture. (ii) Concentration ratio.
 - (e) Write the equation for total power available in wind and draw a graph for it.
 - (f) Write energy balance equation for a well-mixed sensible heat liquid storage tank.
 - (g) Briefly explain energy from bio mass.
 - (h) Briefly explain four main elements necessary for exploiting geothermal energy.
 - (i) Write two differences between fuel cell and battery.
 - (j) Write about figure of merit.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- 2 (a) Define declination.
(b) Calculate total radiation on tilted surface at 30° to horizontal at Delhi (28.68°N) on March 22. The horizontal beam and diffuse radiation are 60 W/m^2 and 150 W/m^2 respectively and solar time is 11 AM. Take albedo of ground is 0.2.

OR

- 3 (a) Briefly explain the instruments used for measuring solar radiation.
(b) Explain terrestrial radiation.
(c) Calculate the: (i) Zenith angle. (ii) Solar azimuth angle for a place with latitude 43° at 9.3 AM solar time on February 13.

UNIT – II

- 4 (a) With the help of figure, draw the thermal resistance network showing collector losses FPC.
(b) A FPC operates when the total radiation on the surface is 760 W/m^2 . Calculate the outlet temperature of water, useful heat extracted and stagnation temperature from the following data:
(i) Mass flow rate = 0.02 kg/s .
(ii) Collector inlet fluid temperature = 43°C .
(iii) Ambient Temperature = 26°C .
(iv) Effective optical efficiency = 0.77.
(v) Effective heat loss coefficient = $1.65 \text{ W/m}^2\text{K}$.
(vi) Specific heat of water = 4.18 kJ/kg K .

OR

- 5 A cylindrical parabolic concentrator is having 2.5 m width 9 m length. The outside diameter of the absorber tube is 6.5 cm. The collector is used to heat a fluid whose temperature at the inlet of the absorber is 160°C and the flow rate is 450 kg/hr . The beam radiation falling on the collector is 700 W/m^2 . The ambient temperature is 28° . Estimate: (i) Useful heat gain rate. (ii) Instantaneous collection efficiency based on beam radiation alone. The following fluid and optical properties may be used:
 $C_p = 1.26 \text{ kJ/kg}^\circ\text{C}$, $\rho = 0.85$, $(\tau\alpha)_b = 0.78$, $\nu = 0.93$, Collector efficiency factor $(F') = 0.85$ and overall heat transfer loss coefficient $U_l = 7 \text{ W/m}^2\text{K}$.

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UNIT – III

- 6 (a) Explain cabinet solar dryer with a suitable sketch.
(b) Wind is flowing at 1 std. atm pressure and 15°C temperature. Through a propeller type wind turbine with a velocity of 25 m/s. Assuming a turbine diameter of 60 m and a turbine wheel revolution of 50 RPM, estimate. (i) The maximum obtainable density. (ii) Torque at maximum efficiency. (iii) Axial thrust.

OR

- 7 (a) Explain the concept and principle of working of solar pond.
(b) With a neat sketch explain space heating system using liquid FPC.

UNIT – IV

- 8 With a neat sketch explain biomass gasification.

OR

- 9 With the help of flow diagram and T-S diagram explain flash steam power plant.

UNIT – V

- 10 (a) With a neat sketch explain alkaline fuel cell.
(b) For a thermoelectric power generation following parameters are given:
Temperature of hot reservoir = 700° K
Temperature of sink = 300° K
Figure of merit for the material, $Z = 2 \times 10^{-3} \text{ K}^{-1}$. Find the efficiency of the thermoelectric generator. What will be the Carnot efficiency?

OR

- 11 With a neat flow diagram explain different components of MHD generator (Open cycle).
