

Duration: 3hrs

[Max Marks:80]

- N.B. :** (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

- 1 Attempt any FOUR [20]**
- a** Discuss the different methods of hydrogen production and storage **5**
 - b** State the advantages of concentrating collector over flat plate collector **5**
 - c** State the factors considered for site selection to install wind power plant **5**
 - d** Describe the current scenario of non-conventional energy sources of the India **5**
 - e** Discuss the different methods of hydrogen production and storage **5**
- 2 a** Describe the working principle of natural circulation solar water heater system with a neat sketch. **[8]**
- b** Discuss the factor which affects the efficiency and life cycle of solar PV cell **[8]**
- c** Calculate the sunset hour angle and day length at a location, latitude 35 °N on March 20 **[04]**
- 3 a** Following data is given for a family biogas digester; **[08]**
- C.V. of methane = 26 MJ/m³, Burner efficiency = 65 %, Number of cows = 6, Retention period = 28 days, Temperature of fermentation = 30⁰C, Day matter collected/cow/day = 2.5 kg, Density of matter in the fluid in the digester = 50 kg/m³ Biogas yield=0.25 m³/kg of dry input, Methane production in Biogas = 0.8.
- Determine volume of Digester and power available from biogas digester.
- b** Describe the working of a solar pond with a help of neat sketch. **[08]**
- c** Discuss the I-V characteristics of a solar PV cell **[04]**

- 4 a** A solar photovoltaic plant system installation is expected to minimize the plant's annual energy bill by Rs. 18 lacs. If the capital cost of new solar photovoltaic plant installation is Rs. 92 lacs and the annual operating and maintenance cost is 5 lacs. Determine, **[08]**
- (a) The expected payback period for the project
 - (b) The initial rate of return / return on investment
- b** Illustrate the working principle of Open and Closed OTEC system with the neat sketch. **[08]**
- c** Differentiate between horizontal axis wind turbine and vertical axis wind turbine. **[04]**
- 5 a** A propeller type horizontal wind turbine having wind characteristics, speed of wind is 15 m/s at 1 standard atmospheric pressure and 20 °C. The rotor has diameter of 110 m and its operating speed is 35 rpm at maximum efficiency. Determine: **[08]**
- a) the total power density in the wind
 - b) the maximum obtainable power density assuming $\eta=40\%$
 - c) the torque and axial thrust
- b** Describe the working principle of solar photovoltaic system **[06]**
- c** Describe the working principle of liquid dominated geothermal power plant **[06]**
- 6 a** Estimate the monthly average of daily global radiation on a horizontal surface at Baroda, 22° N, 73 ° 10' E during December. If the average sunshine hour/day is 9.5, $a = 0.32$, $b = 0.45$. (Assume 15 Dec., $I_{sc} = 1367 \text{ W/m}^2$) **[10]**
- b** Illustrate the working principle of KVIC biogas plant with the neat sketch **[10]**
