

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 Solve any four 20
 - a State the role of non-conventional energy sources in the current energy scenario of the India.
 - b Discuss the I-V characteristics of a solar PV cell.
 - c Illustrate the working principle of liquid dominated geothermal power plant.
 - d State the factors considered for site selection to install wind power plant.
 - e Define the following angles with a neat sketch,
 - i. Zenith angle
 - ii. Surface azimuth angle
 - iii. Latitude angle
 - iv. Solar declination angle
- 2 a Illustrate the working principle of KVIC biogas plant with the neat sketch. 10
 - b Determine the Local Solar time and declination at a location latitude $23^{\circ} 15' N$, longitude $77^{\circ} 30' E$ at 12.30 IST on Sep. 28. Equation of time correction is given from table or chart = $-(1^m 01^s)$. 10
- 3 a Discuss types of fuel cells briefly. 10
 - b Solar thermal power plant system installation is expected to minimize the plant's annual energy bill by Rs. 14 lacs. If the capital cost of new solar thermal power plant installation is Rs. 89 lacs and the annual operating and maintenance cost is 5 lacs. Determine, 10
 - (a) The expected payback period for the proposed project.
 - (b) The initial rate of return / return on investment.
- 4 a Show that the ideal maximum theoretical efficiency is 59% (Bet'z coefficient) for a horizontal axis wind turbine. 10
 - b Illustrate the working principle of ocean thermal energy conversion (OTEC) system with the neat sketch. 5
 - c Classify the types of energy audit processes. 5

- 5 a Describe the following briefly, 10
- (i) Factors affects the efficiency of PV cells and
 - (ii) Factors affects the Life cycle of solar PV cell.
- b Following data is given for a family biogas digester; 10
- C.V. of methane = 25 MJ/m^3 , Burner efficiency = 55 %, Number of cows = 7, Retention period = 27 days, Temperature of fermentation = 30°C , Day matter collected/cow/day = 1.5 kg, Density of matter in the fluid in the digester = 50 kg/m^3 , Biogas yield= $0.25 \text{ m}^3/\text{kg}$ of dry input, Methane production in Biogas = 0.8.
- Determine volume of Digester and power available from biogas digester.
- 6 a Describe the solar space heating and cooling. 10
- b Differentiate between the vertical and horizontal axis wind turbine. 5
- c Describe the working principle of Solar PV cells. 5
