

Note:

1. **Question No.1** is compulsory.
2. Attempt **any three** questions from remaining.
3. Assume suitable data if required.
4. Marks are specified in last column.

Q.1 Solve any Five

(20)

- a) State the various direct applications of solar energy.
- b) Describe the potential of renewable energy sources in India.
- c) State the site selection criteria for locating wind mills.
- d) Define solar constant, air mass, solar altitude angle, angle of incidence.
- e) State atleast five sites/places available in India for harnessing geothermal energy.
- f) Describe working of Fixed dome type biogas plant.

Q.2 a) Describe construction and working of wind energy conversion system with neat sketch. (8)

b) Describe working of solar pumping system with neat sketch. (6)

c) Describe working of single basin tidal power plant. (6)

Q.3 a) If the angle of declination on a particular day was $+ 18.25^{\circ}$, which is the date (8)
assuming leap year? Calculate the day length on May 02nd on a surface sloping southward at an angle of 40° at a place of $19^{\circ} 07' N$ latitude & $72^{\circ} 51'$ longitude.

b) Which factors affect the rate of production of biogas? State their ideal values/range for maximum biogas production? (6)

c) State the advantages and disadvantages of geothermal energy. (6)

Q.4 a) State and explain the design considerations in wind turbine design. (8)

b) Describe working of wave energy conversion system with neat sketch. (6)

c) State various parameters which affects performance of solar collectors. State limitations of flat plate collectors. (6)

- Q.5 a) Following observation were recorded from a test on Biogas system: (8)
 C.V. of methane: 28.5 MJ/m^3 ; Burner efficiency: 60%; Number of cows: 8; Retention period: 20 days; Temperature of fermentation: 30°C ; Dry matter collected per cow per day: 2 Kg; Density of dry matter in the fluid in the digester: 50 Kg/m^3 ; Biogas yield: 0.2 m^3 per Kg of dry input; Methane proportion in the biogas: 0.7. Determine volume of digester and power available from biogas digester.
- b) Describe working of Claude cycle OTEC system with neat sketch. (6)
- c) Describe working of central tower receiver using Heliostat mirror with neat sketch. (6)
- Q.6 a) Calculate the rotor radius for a multi-blade wind machine operating at a design speed of (10)
 25 kmph. The machine operates a water pump having a capacity of $5.1 \text{ m}^3/\text{hr}$ and a lift of 9 m. The following data is given:
 Density of water = 996 Kg/m^3 ; efficiency of water pump = 0.6; efficiency of transmission from rotor to pump = 0.9; $C_p = 0.31$; $\lambda = 0.75$; density of air is 1.2 Kg/m^3 .
- b) State the classification of fuel cells in brief and describe working of Molten carbonate fuel cell (MCFC) with neat sketch. (6)
- c) Describe working of low temperature binary fluid system with neat sketch. (4)
