

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.

- 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 assuming leap year? Calculate the day length on May 02nd on a surface sloping southward at an angle of 40° at a place of $19^{\circ} 07' \text{ N}$ latitude & $72^{\circ} 51' \text{ longitude}$. (8)

- 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 (6)
limitations of flat plate collectors.

- Q.5 a) Following observation were recorded from a test on Biogas system: (8)
C.V. of methane: 28.5 MJ/m³; Burner efficiency: 60%; Number of cows: 8; Retention period: 20 days; Temperature of fermentation: 30⁰C; Dry matter collected per cow per day: 2 Kg; Density of dry matter in the fluid in the digester: 50 Kg/m³; Biogas yield: 0.2 m³ 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 25 kmph. The machine operates a water pump having a capacity of 5.1 m³/ hr and a lift of 9 m. The following data is given:
Density of water = 996 Kg/m³; efficiency of water pump = 0.6; efficiency of transmission from rotor to pump = 0.9; C_p = 0.31; λ = 0.75; density of air is 1.2 Kg/m³.
- 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)
