

[Time : 3 hours]

[Marks : 80]

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 physics of solar photovoltaics.
 - b) Strategy for meeting the future energy requirements in India.
 - c) Site selection for Wind mill.
 - d) Importance of Energy Audit.
 - e) Environmental effects in utilization of Geothermal energy.
 - f) Fuel properties of biogas.
- Q.2
- a) Derive an expression for maximum output fraction from wind power. (8)
 - b) Describe working of solar pumping system with neat sketch. (6)
 - c) Describe limitation and scope of tidal power plant. (6)
- Q.3
- a) Calculate the local solar time and declination at a location latitude $23^{\circ}15'N$, Longitude $77^{\circ}30' E$ at 12:30 IST on June 19, 2010. Equation of time correction is given from standard table or chart is $1^{\circ}01''$. (8)
 - b) Explain with sketches applications of biogas. (6)
 - c) Write a note on prospects of geothermal energy in India. (6)
- Q.4
- a) Write a note on horizontal axis type wind turbine with the help of neat sketch. (8)
 - b) Discuss the working of single basin type tidal power plant. (6)
 - c) Discuss the working of flat plate collectors using air as a working fluid with the help of a neat sketch. (6)

- Q.5 a) Calculate the following parameters of a bio-gas system : (8)
- The volume of biogas digester
 - The power available from bio-digester
- Given : Calorific value of methane : 28 MJ/m^3 , Burner Efficiency : 70 %
 Number of Cows : 8 ,Retention Period : 20 days,
 Temperature of Fermentation : 30°C
 Dry matter (Cow Dung) collected per cow per day : 2 kg
 Density of dry matter in the fluid (slurry) 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
- b) Explain the concept of total energy system in India. (6)
- c) Explain basic sun-earth angles in details. (6)
- Q.6 a) Wind at 1 bar and 20°C has a velocity of 12 m/s. (10)
- Calculate:** i) Total power density in wind stream
 ii) Maximum power density
 iii) Reasonable obtainable power density
 iv) Total power produced if rotor diameter is 60 m and it runs at 50 rpm
 v) The torque and axial thrust produced at maximum efficiency.
- b) Discuss the analysis of aerodynamic forces acting on wind mill blades. (6)
- c) Discuss the prospects of Renewable energy sources in India. (4)
