Type: DES

Q1. Explain about types of solar water heating systems. Draw a diagram and explain the working of solar solid desiccant cooling system. (4)

Q2. Justify the statement "liquid type flat plate collectors are more efficient than Air type collectors". Explain the working of a liquid-type flat plate collector. (3)

Q3. What is the operating principle of a wind turbine? Define the Thrust Coefficient and wind efficiency. (3)

Q4. Calculate the collector-plate efficiency factor and heat-removal factor for a smooth, 2-m-wide, 8m-long air collector with the following design. The flow rate per unit collector area is 0.8 m³/min. m². The air duct height is 1.5 cm, the air density is 1.1 kg/m³ the specific heat is 1 kJ/kg.K, and the viscosity is 1.79×10^{-5} kg/m.s. The collector heat-loss coefficient U_c is 20 kJ/h.m².K.

 $Nu_{sm} = \frac{0.0192 \,\text{Re}^{3/4} \,\text{Pr}}{1 + 1.22 \,\text{Re}^{-1/8} (\text{Pr} - 2)}$ (4)

Q5. Define Torrefaction Explain in detail about various kinds of Gasifiers. (3)

Q6. Classify hydro power plants based on their size. (3)

Q7. Why is the pre-treatment process important before the conversion process of biomass? Mention the basic reactions in the biomass gasification process. Define gross head. (4)

Q8. What are the various factors that affect wind power? explain the working of horizontal axis wind turbine. (3)

Q9. Find the solar altitude angle when L = 15 N (+), $l_{\text{local}} = 85.37$ W (+), and $l_{\text{st}} = 92$ W (+) on April 1 at 2 p.m. Also find the sunrise and sunset times on this day. (3)

Q10. A biomass gasifier is used to run an ignition engine. The engine operates in dual fuel mode with 85% diesel replacement. The system produces 300kW of power. Calculate the biomass feeding rate to the gasifier if the efficiency of the engine is 30% and the calorific value of biomass is 16000kJ/kg. consider the efficiency of the gasifier as 0.7. (5)

Q11. Describe the working of the Closed loop air-conditioning system using an air tunnel with the help of a neat diagram (3)

Q12. Explain various stages in producing biogas? (2)

Q13. What is a solar pond? Explain its working with the help of a neat diagram. (4)

Q14. A propeller type wind machine operating at a location having a wind speed of 30kmph and rotating at 18rpm has a rotor diameter of 70m. calculate the power which the machine can extract from the wind if both wake rotation and the effects of drag are considered. Use ϵ =0.011 and the density of air =1.2 kg/m³

$$C_{p} = \left(\frac{16}{27}\right) \times \left[\exp\left(-0.3538 \times \lambda^{-1.2946}\right) - \varepsilon \times \lambda\right]$$
(4)

Q15. A community requires 60 kW of power output to meet its daily electricity needs. If the site survey indicates 100 m of gross head to be available, what design discharge is required to meet the community's electricity needs? Assume an overall efficiency of 55%. (2)