Renewable Energy Engineering- CHE 4070

Make-Up Examination (Jan-2023)

Type: DES

Q1. What is torrefaction? Mention any four differences between Renewable and Conventional energy sources. (3)

Q2. ------ Part of biomass is utilized in ethanol production. Explain the process of Ethanol production from biomass. (3)

Q3. Mention the importance of controlling rotor speed in a windmill. Define Solidity and Tip-Speed Ratio. (4)

Q4. Find the solar altitude angle when L = 15 N (+), $I_{local} = 85.37$ W (+), and $I_{st} = 92$ W (+) on April 1 at 2 p.m. Also, find the sunrise and sunset times on this day. (3)

Q5. Explain the working of the solid desiccant cooling system. (4)

Q6. What is the difference between gasification and combustion? Describe the steps involved in the gasification process. (3)

Q7. The following data are given for a family-size biogas pant suitable for a dry input mass of 10 kg/day. The retention time is 30 days, the temperature is 30° C, the biogas yield is 0.34 m³/kg, the burner efficiency is 60 %, the fraction of methane in biogas is 0.7, the heat of combustion of methane is 29 MJ/m³, the density of dry matter is 50 kg/m³. Calculate the volume of the biogas plant and the power available from the plant. (4)

Q8. Mention any three advantages and disadvantages of solar and biomass energy. (3)

Q9. Ethane is combusted with 50% excess air which enters a combustion chamber at 25°C. Assuming complete combustion, determine the air-fuel ratio. The stoichiometric equation for ethane combustion is given as $C_2H_6 + 3.5(O_2+3.76 N_2) \rightarrow 2CO_2+3H_2O+ 13.6N_2$ (3)

Q10. Calculate the main dimension of the rotor of a wind machine with the number of blades= 15, blade length= 2m, and solidity=0.4 operating at a speed of 25 kmph. The machine operates a wind pump with a capacity of 6 m3/h and a lift of 20 m. consider the density of water as 996 kg/m³. Pump efficiency and transmission efficiency as 0.5 and 0.8 respectively. Take the density of air as 1.2kg/m^3 and $\lambda = 0.8$. (3)

Q11. During a survey, it was measured that a gross head of 40 m, and a design flow of 150 l/s, for a hydropower plant. what would be the installed capacity? Assume an overall efficiency of 60%. Explain in detail about types of hydropower plants. (4)

Q12. what are the factors affecting wind power? Draw a neat diagram of a horizontal windmill. (3)

Q13. What are the instruments used to measure solar energy? Explain the working of any one of the instruments. (3)

Q14. What are the various stages of anaerobic digestion, Explain in detail. Write any two advantages of the anaerobic digestion process. (4)

Q15. Define irradiance, what are the different types of solar radiation? Explain. (3)