KERALA AGRICULTURAL UNIVERSITY
B. Tech. (Agrl. Engg.) 2022 & Previous Admissions
IV Semester Final Examination – July 2024

Fpme.2208 **Fundamentals of Renewable Energy Sources (2+1)** **Marks: 50**
Time: 2 hours

I **Choose the correct answer** **(10x1=10)**

1. Which of these resources does not produce CO_2 during electricity generation?
   (a) Coal
   (b) Methane
   (c) Uranium
   (d) Biogas
2. The value of concentration ratio of flat plate collector is:
   (a) 1000
   (b) 10
   (c) 100
   (d) 1
3. What is the standard value of solar constant?
   (a) 1 kW/m^2
   (b) 1.367 kW/m^2
   (c) 1.5 kW/m^2
   (d) 5 kW/m^2
4. The range of wind speed suitable for wind power generator is:
   (a) 0-5 m/s
   (b) 5-25 m/s
   (c) 25-50 m/s
   (d) 50-75 m/s

Fill in the blanks

5. Gasification of biomass is a _____ conversion process

State True or False

6. Nuclear energy is a renewable energy.
7. At solar noon, the hour angle is +90°.
8. The short circuit current of a solar cell is directly proportional to radiation intensity.
9. The wind turbine rotor having low value of solidity runs slower.
10. A device for converting substances into gas is called as gasifiers.

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. Write about Clean Development Mechanism.
2. What are the angles often used in analyzing the solar radiation?
3. A hetrojunction solar cell of active area 6 cm^2 gave the following results: Voc = 400 mV, short circuit current = 200 mA under an insolation equal to 0.8 Sun. What is the energy conversion efficiency of the device? (Assume Fill Factor of 80%).
4. Define lift and drag.
5. A multi-blade type wind machine (solidity = 0.5) uses 18 blades, each of length 1 metres. Considering a rotor diameter of 1.086 metres, what is the value of the mean chord length of each blade used?
6. Mention the applications of updraft gasifiers.
7. What are the key features of Biodiesel process?

III **Answer ANY FIVE of the following** **(5x4=20)**

1. Write some important applications of renewable energy in agriculture.
2. Calculate the average value of solar radiation on a horizontal surface for June 19, at the latitude of 10° N. The constants a and b are as 0.30 and 0.51 respectively. The average sunshine hours per day are 9.1.
3. Illustrate the effect of light on I-V characteristics of p-n junction.
4. What are the functions of a versatile and reliable control system to perform in wind turbine generator?
5. Mention the advantages and disadvantages of WECS.
6. Explain a few techniques for maintaining the bio-gas production.
7. Calculate the biomass requirement per hour to replace 50 kg of Light Diesel Oil (LDO) operated steam generator. Assume calorific value of LDO and biomass are 40 MJ/kg and 19 MJ/kg respectively, and overall efficiency for both gasification and LDO operated steam generated system is about 20 %.

IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. A cylindrical parabolic concentrator is having 2.5m width and 9m length. The outside diameter of the absorber tube is 6.5.cm. The collector is used to heat a fluid whose temperature at the inlet of the absorber is 160°C and flow rate is 450 Kg/hr. The beam radiation falling on the collector is 700 W/m^2. The ambient temperature is 28°C. Estimate
   (i) Useful heat gain rate
   (ii) Exit fluid temperature
   (iii) Instantaneous collection efficiency based on beam radiation alone

   The following fluid and optical properties may be used.

   C_p = 1.256 KJ/Kg°C; ρ = 0.85; $(\tau\alpha)_b$ = 0.78;
   γ= 0.93; Collector efficiency factor (F') = 0.85;
   Overall heat loss coefficient (U_l) = 7.0 W/m^2 °C.
2. (a) The following data are given for a family biogas digester suitable for the output of five cows: the retention time is 20 days, temperature 30°C, dry matter consumed per day = 2 kg, biogas yield is 0.24 m^3 per kg. The efficiency of burner is 60%, methane proportion is 0.8. Heat of combustion of methane = 28 MJ/m^3. Calculate:
   (i) The volume of biogas digester
   (ii) The power available from the digester

   (b) Highlight the advantages of anaerobic digestion process.

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