

**RENEWABLE ENERGY RESOURCE AND CHARACTERISTICS  
(REEN 5101)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group – A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which of the following is used as fuel for transportation?  
(a) Ethanol            (b) Aldehyde            (c) Ketone            (d) Nitrogen
  - (ii) Photovoltaic cell converts solar energy into  
(a) Heat energy            (b) Electric energy  
(c) Mechanical energy            (d) Chemical energy
  - (iii) Concentrated solar power (CSP) systems use \_\_\_\_\_ to focus a large area of sunlight into a small beam  
(a) Lenses            (b) Mirrors  
(c) Tracking systems            (d) All of the above
  - (iv) Lift force on airfoil acts in a direction \_\_\_\_\_ to the \_\_\_\_\_ direction.  
(a) perpendicular, wind            (b) perpendicular, relative wind  
(c) parallel, wind            (d) parallel, relative wind
  - (v) Wind turbine blades are generally made of  
(a) steel            (b) copper  
(c) epoxy composites            (d) aluminium
  - (vi) Black painted panels which are hanged at roofs to trap heat and energy from sun, are  
(a) Solar cells            (b) Solar heater  
(c) Solar furnace            (d) Solar battery
  - (vii) In a hydro power plant  
(a) Potential energy possessed by stored water is converted into electricity  
(b) Kinetic energy possessed by stored water is converted into potential energy  
(c) Electricity is extracted from water  
(d) Water is converted into steam to produce electricity

- (viii) The example of turbine suitable for low head and high flow rate applications, is  
(a) Francis (b) Pelton  
(c) Kaplan (d) Turgo
- (ix) In order to produce solar energy during sunlight, where the energy is stored in the batteries?  
(a) Nickel Sulfur (b) Zinc Cadmium  
(c) Nickel Cadmium (d) Nickel Zinc
- (x) Tip speed ratio of a wind turbine is  
(a)  $\frac{\text{blade tip speed}}{\text{rotor speed}}$  (b)  $\frac{\text{blade tip speed}}{\text{wind speed}}$   
(c)  $\frac{\text{wind speed}}{\text{blade tip speed}}$  (d)  $\frac{\text{rotor speed}}{\text{blade tip speed}}$

### **Group – B**

2. (a) Classify the fuel cell. Describe the working principle of polymer electrolyte membrane fuel cell with the help of a diagram.  
(b) Briefly discuss the renewable energy sources and their importance.  
**(3 + 4) + 5 = 12**
3. (a) State Kirchhoff's law of radiation. What is electromagnetic radiation? What is visible ray's range?  
(b) A thin metal plate of 4 cm diameter is suspended in atmospheric air whose temperature is 290K. The plate attains the temperature of 295K when one of it receive radiant energy from a heat source at the rate of 2W. If heat transfer coefficient on both surfaces of the plate is stated to be 87.5 W/m<sup>2</sup>C, calculate the reflectivity of the plates.  
**(2 + 4 + 1) + 5 = 12**

### **Group – C**

4. (a) Explain the working principle of a photovoltaic cell with the help of schematic diagram. Differentiate concentrate and non-concentrate collectors.  
(b) Write a short note on 21 cm radiation?  
**(7 + 2) + 3 = 12**
5. (a) Consider a 0.25-m-long vertical plate that is at 70°C. The plate is suspended in air that is at 25°C. Estimate the boundary layer thickness at the trailing edge of the plate if the air is quiescent. How does this thickness compare with that which would exist if the air were flowing over the plate at a free stream velocity of 5 m/s? Properties of air at  $T_f = 320.5$  K:  $\nu = 17.95 \times 10^{-6}$  m<sup>2</sup>/s, Pr = 0.7,  $\beta = T_f^{-1} = 3.12 \times 10^{-3}$  K<sup>-1</sup>.

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- (b) Write short notes on the followings:  
(i) Heat transfer in packed bed  
(ii) Pyranometer.

**6 + (2 × 3) = 12**

**Group – D**

6. With the help of suitable schematic diagrams, explain the working principle of various types of Anemometers used for wind speed measurement.

**12**

7. (a) Explain the torque and power characteristics of a typical wind turbine.  
(b) Briefly describe the factors influencing wind flow on global and local scale.

**7 + 5 = 12**

**Group – E**

8. (a) Discuss the principles of  
(i) Geothermal energy conversion system  
(ii) Ocean thermal energy conversion system  
(iii) Tidal energy conversion system.

- (b) Discuss in detail the key roles of cellulose, hemicellulose and lignin in biomass.

**(2 + 2 + 2) + 6 = 12**

9. Write short notes on any three of the followings:  
(i) Chemical composition of biomass  
(ii) Geothermal scenario in India  
(iii) Thermal analysis (TGA, DTA and DSC)  
(iv) Power generation using geothermal heat.

**(4 × 3) = 12**

Department & Section	Submission Link
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