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Paper Code : ME-703B

RENEWABLE ENERGY SYSTEMS

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Photo-voltaic cell is basically a
   a) *p-n* junction
   b) photo-transistor
   c) Amorphous *p-n* junction
   d) none of these.

ii) The standard value for solar constant as per NASA standard is
   a) 1150 W/m^2 b) 1353 W/m^2
   c) 2100 W/m^2 d) 1825 W/m^2.

iii) Which is not renewable energy source ?
   a) Hydropower b) Tidal power
   c) Geothermal d) Fuel cell.

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iv) The greenhouse gas is
   a) Carbon Dioxide b) Methane
   c) Nitrous oxide d) All of these.

v) Tidal power plants are built on
   a) Seashore b) cricks
   c) plates d) mountain range.

vi) The range of wind speed suitable for wind power generator is
   a) 0 to 5 m/s b) 5 to 25 m/s
   c) 25 to 50 m/s d) 50 to 75 m/s.

vii) The solar constant measured by satellites is approximately
   a) 1366 b) 1412
   c) 1321 d) none of these.

viii) The energy content of biomass fuel depends upon
   a) Carbon content b) Moisture content
   c) Ash content d) All of these.

ix) Bright sunlight provides luminance of approximately
   a) 10,000 candel/sq m
   b) 1,000 candel/sq m
   c) 10,00,000 candel/sq m
   d) 1,00,000 candel/sq m.

x) Types of geothermal fluids used as input to power plants
   a) Hot Brine b) Cold Water
   c) Sea Water d) Vapour.

xi) Pelton turbine is used for
   a) high head b) low head
   c) medium head d) none of these.

xii) Fill factor indicates the
   a) solar radiation b) energy of solar cell
   c) quality of solar cell d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Discuss solar water heating system with anti-freeze with a neat sketch.
3. How are electrical and thermal energies converted to hydrogen energy ?
4. Explain with a schematic diagram the floating drum type biogas plant and fixed dome type biogas plant.
5. List the advantages and disadvantages of a tidal barrage scheme as a source of electrical power.
6. What are the different types of fuel cells ? State the advantages and limitations of fuel cells.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Write the advantages and disadvantages of concentrating collectors over flat plate type of solar collector.
   b) With a schematic diagram, discuss a solar-thermal electric power plant.
   c) A P.V. system feeds a d.c. motor to produce 1 hp power at the shaft. The motor efficiency is 85%. Each module has 36 multicrystalline silicon solar cells arranged in 9 × 4 matrix. The cell size is 125 mm × 125 mm and cell efficiency is 14%. Calculate the number of modules required in the PV array. Assume global radiation incident normally to the panel as 1 kW/m^2. 4 + 6 + 5

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8. Discuss on Spectral energy distribution of solar radiation with the help of a suitable diagram. Discuss on depletion of solar radiation. How is electrical power produced by distributed collector solar thermal electrical power plant ? Discuss how solar energy is transferred into electrical energy in solar PV cell ? What do you mean by CR of a collector ? Discuss on fixed mirror solar collector. 2 + 2 + 3 + 4 + 2 + 2
9. a) Mention the type of biomass gasifier and explain each of them with the help of schematic diagram.
   b) Discuss each of the operational parameter of biogas plant in detail.
   c) Calculate the volume of a cow dung based biogas plant required for cooking needs of a family of five adults and lighting need with two 100 C.P. Lamps for the three hours daily. Also calculate the required number of cows to feed the plant. Assume standard values of data where required. 5 + 5 + 5
10. a) What do you understand by Geothermal Energy ? What is geothermal field ?
    b) What are the merits & demerits of Geothermal energy ?
    c) What are the major applications of Geothermal energy ?
    d) Explain various types of Geothermal resources. 4 + 4 + 3 + 4
11. a) For wave energy generation, show that potential energy density per unit area is $\frac{1}{4} gpa^2$, symbols have their usual meanings.
    b) What are the advantages and disadvantages of wave energy ?
    c) What are the main criteria in selecting the site of a wind farm ? 5 + 5 + 5