MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code :EC-802C

RENEWABLE ENERGY

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 (PV) cell is basically a

a) $p - n$ junction

b) photo-transistor

c) amorphous $p - n$ junction

d) none of these.

ii) Which of the following is not renewable energy source ?

a) Hydropower b) Tidal power

c) Geothermal d) Fuel cell.

iii) Capacity of a micro hydel power plant is

a) up to 100 kW b) 101 to 1000 kW

c) 1 to 25 MW d) 100 MW.

iv) Bio-diesel can be mixed with which of the following ?

a) Petrol b) Diesel

c) Kerosene d) All of these.

v) Bio-gas consist of

a) only methane

b) methane and carbon dioxide

c) only ethane

d) none of these

e) all of these.

vi) Most of potentially exploitable geothermal heat is stored in

a) water

b) dry rocks

c) air

d) steam aquifers.

vii) The turbine normally employed in tidal powder is

a) simple impulse type

b) propeller type

c) reaction type

d) reversible type.

viii) Parabolic type of disc collector can generate temperature up to

a) 100°C b) 200°C

c) 300°C d) 400°C.

ix) Output of wind turbine depends on air velocity

a) proportionally b) exponentially

c) cubically d) to the power of 4.

x) The range of wind speed favourable to the most of the wind turbine is

a) 1 to 4 m/s b) 25 to 40 m/s

c) 40 to 50 m/s d) none of these.

xi) Per unit cost of power is high in case of

a) Biogas plant

b) Solar PV plant

c) Biomass gasifier plant

d) Wind turbine plant.

GROUP – B

(Short Answer Type Questions)

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

2. a) Mention the different types of geothermal resources and indicate which one can be commercially utilized.

   b) With a simple sketch explain how a liquid dominated geothermal resource can be used for power generation indicating the thermodynamic cycle followed. 2 + 3

3. Explain briefly the impact of non-conventional energy sources on India. 5

4. Draw and explain the equivalent of an ideal and practical solar PV cell. 5

5. Draw the following :

   a) Power *vs* speed characteristics of a wind turbine.

   b) Block diagram depicting ethanol production from sugarcane. 3 + 2

6. What is the economics and future prospect of tidal energy ? 5

GROUP – C

(Long Answer Type Questions)

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

7. a) Define 'Betz Limit' and derive the expression for maximum power coefficient for wind turbine.

   b) Explain the following terms showing velocity duration and power duration curve of wind energy :

   (i) cutin speed

   (ii) rated wind speed

   (iii) cutout speed. 7 + 8

8. What are the advantages and disadvantages of Bio-diesel over the conventional mineral Diesel oil ? Explain with example. 15

9. a) Briefly describe manufacturing process of commercial Multicrystalline Silicon cell. Highlight the steps taken in manufacturing the minimize wastage of material.

   b) A house has a power requirement of 400 W for 4 hours every night. A PV array made up of modules with single crystalline silicon cells, a battery storage system and inverter is to be designed for this load. It is also to be taken care that one night's requirement will have to be taken care even if there is not sunshine in the day. Calculate number of PV modules and batteries required. Given (i) Solar radiation is available for average 6 hours daily and average global radiation flux incident on array is 650 W/M sq. (ii) Battery rating 12V, 120 AH, depth of discharge = 0·7, charging and discharging efficiency = 0·9, (iii) Inverter efficiency at full load = 0·85, (iv) Module size = 1·191 M × 0·533 M. 8 + 7

10. a) Describe the basic principle of operation of an MHD generator. Derive expressions for maximum power generation per unit volume of generator.

    b) With the help of schematic diagram explain the operation of closed cycle MHD generating system.

7 + 8

11. Write notes on any *three* of the following : 3 × 5

a) Magneto hydrodynamic energy conversion.

b) Microhydel generation.

c) Advantages of non-conventional sources over conventional sources.

d) Biodiesel.

e) Wave energy.