RENEWABLE ENERGY SYSTEMS
(MECH 3262)

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 parameter is used as an index to describe the standard of living of the people in a country?
(a) industrial production (b) per capita energy consumption
(c) number of cars per house (d) population density.

(ii) For a reversible adiabatic process, the change in entropy of the system is
(a) zero (b) infinite (c) negative (d) unity.

(iii) A solar cell is
(a) voltage source, controlled by flux of radiation
(b) current source, controlled by flux of radiation
(c) uncontrolled voltage source
(d) uncontrolled current source.

(iv) The percentage of the incoming radiation reflected back to space by the earth is
(a) 10% (b) 20% (c) 30% (d) 40%.

(v) A cylindrical parabolic concentrator requires
(a) 2 – axis tracking (b) single – axis tracking
(c) no tracking (d) seasonal adjustments only

(vi) What is responsible for the movement of carriers after creation of an electron-hole pair due to radiation?
(a) Diffusion process (b) Drift process
(c) Built-in electric field across the junction (d) External voltage.

(vii) The range of wind speed suitable for wind power generation 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.

(viii) The turbine used in a tidal range plant is
(a) Pelton turbine
(b) Kaplan turbine with variable pitch blades
(c) Kaplan turbine with fixed pitch blades
(d) Francis turbine.

(ix) Small hydro plants have
(a) high head and small capacity (b) low head and small capacity
(c) low head and high capacity (d) high head and high capacity.

(x) The temperature at the inner core of earth is about
(a) 1000°C (b) 2000°C (c) 4000°C (d) 10000°C.

Group – B

2. (a) Describe the different forms of non-conventional energy resources and their importance in the present scenario.

(b) What are the advantages of non-conventional energy resources over conventional resources?

7 + 5 = 12

3. (a) Explain various aspects of energy conservation and its significance.

(b) Briefly discuss various methods of energy storage systems with suitable examples.

6 + 6 = 12

Group – C

4. (a) What are the *disadvantages* of solar energy utilization? Name the principal modes of direct utilization of solar energy.

(b) Define concentration ratio of a solar collector. Name three collectors requiring one-axis sun tracking.

(3 + 3) + (3 + 3) = 12

5 (a) What is the principle of solar photovoltaic energy conversion? Briefly explain the phenomenon of photoconduction in an *intrinsic* semiconductor.

(b) A PV system feeds a dc motor to produce 2.5 hp power at the shaft. The motor efficiency is 87%. Each module has 45 multi-crystalline silicon solar cells arranged in 9×5 matrix. The cell size is $125mm \times 125\ mm$ and the cell efficiency is 15%. Calculate the number of modules required in the PC array. Assume global radiation incident normally to the panel as 1.5 kW/m^2.

(2 + 5) + 5 = 12

Group – D

6. (a) Sketch a neat diagram and explain the functions of different components of a wind turbine.

(b) What are the advantages and disadvantages of wind energy conversion systems?

8 + 4 = 12

7. (a) With the help of a schematic sketch, explain the layout of a typical micro-hydel power plant.

(b) Briefly discuss the applications of solar photovoltaic systems.

7 + 5 = 12

Group – E

8. (a) State *four* advantages and *four* limitations of biomass energy use. Explain the desirable properties of bio-ethanol that makes it suitable as automobile fuel.

(b) Compare the environmental impacts of geothermal energy harnessing with others.

(4 + 4) + 4 = 12

9. (a) What do you understand by 'Tidal range power'?

(b) Compare tidal and wave energy technologies and identify the limitations of such technologies.

4 + 8 = 12

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