

Renewable Energy Technology (315337)

MSBTE Diploma · K-Scheme · Model Question Paper — Set C

Time: 3 Hours**Max. Marks: 70****Instructions:**

1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Use of non-programmable electronic pocket calculator is permissible.
7. Mobile phone, pager and any other electronic communication devices are not permissible in the examination hall.

Q.1 Attempt any FIVE of the following:**10**

- a) Define: i) Solar declination ii) Hour angle.
- b) State the principle of a pyrliometer and name the radiation measured by it.
- c) Define solar module and solar array.
- d) Define the following terms: i) Cut-in wind speed ii) Tip speed ratio.
- e) State any four advantages of hydrogen as a fuel.
- f) State any two advantages of fixed dome type biogas plant over floating drum type.
- g) Classify small hydro power plants on the basis of installed capacity.

Q.2 Attempt any THREE of the following:**12**

- a) Explain the construction and working of a pyranometer with a neat sketch.
- b) Draw the I-V and P-V characteristics of a solar cell. A silicon cell of $15.6 \text{ cm} \times 15.6 \text{ cm}$ has $I_{sc} = 9.2 \text{ A}$, $V_{oc} = 0.66 \text{ V}$, and at maximum power point $V_m = 0.56 \text{ V}$, $I_m = 8.68 \text{ A}$. Find its fill factor and efficiency at an irradiance of 1000 W/m^2 .
- c) Explain the wind energy conversion system (WECS) with a neat block diagram.
- d) Explain resistance (ohmic) polarization in a fuel cell. State the methods to reduce it.

Q.3 Attempt any THREE of the following:**12**

- a) Explain a grid-connected (on-grid) solar PV system with a block diagram. State two differences between on-grid and off-grid systems.
- b) Distinguish between parabolic trough collector and heliostat field (central receiver) collector on the basis of: i) efficiency ii) scalability iii) storage capability iv) applications.

- c) A village has a large quantity of surplus agricultural waste (dry crop residues). Suggest a suitable biomass conversion process and explain its working with a sketch.
- d) Explain the working of a small hydroelectric power plant with a neat layout. Recommend a suitable turbine for a site with a head of 60 m and moderate flow.

Q.4 Attempt any THREE of the following:

12

- a) Explain the working of a solar air heater with a neat sketch. State its advantages for drying of agricultural products.
- b) Compare horizontal axis and vertical axis wind turbines on any four points. Which is more suitable for rooftop installation? Justify.
- c) Compare compressed gas, liquid and metal hydride methods of hydrogen storage on any four points.
- d) Explain the single basin tidal power plant with a neat sketch.
- e) Classify biogas plants. Explain batch type and continuous type plants.

Q.5 Attempt any TWO of the following:

12

- a) Justify why modern wind turbines prefer variable speed operation. Explain the variable speed constant frequency scheme using AC–DC–AC link with a block diagram.
- b) Compare hydrogen with petrol and CNG as a fuel for motor vehicles on any six points. State any two safety precautions for hydrogen vehicles.
- c) Describe the construction and working of the Chinese fixed dome biogas plant with a neat labelled sketch. State its applications.

Q.6 Attempt any TWO of the following:

12

- a) For Nagpur (latitude 21.15° N), on 10 June at 2:30 PM solar time, a collector facing due south is tilted at 20° . Calculate: i) declination ii) hour angle iii) zenith angle and altitude angle iv) angle of incidence on the collector v) day length.
- b) A wind turbine of 50 m rotor diameter operates with $C_p = 0.4$ ($\rho = 1.225 \text{ kg/m}^3$). i) Calculate the power developed at wind speeds of 6 m/s and 10 m/s. ii) If the rotor turns at 24 rpm at 10 m/s, find the tip speed ratio. iii) What happens to the power if the rotor diameter is doubled? Draw a typical power curve marking cut-in, rated and cut-out speeds.
- c) Explain the binary cycle geothermal power plant and the flash steam geothermal power plant with neat diagrams. Justify which one is suitable for a resource of 130°C hot water.

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in