

Renewable Energy Technology (315337)

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

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 constant ii) Insolation.
- b) List any four applications of solar concentrating collectors.
- c) Name any four materials used for the fabrication of solar cells.
- d) List any four types of generators used in wind power generation.
- e) Define polarization in a fuel cell. Name its types.
- f) List any four raw materials (feedstock) used for biogas generation.
- g) What is OTEC? State the minimum temperature difference required for its working.

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

- a) Explain series and parallel connection of solar cells with diagrams. State the advantage of each.
- b) Explain a liquid flat plate collector with a neat sketch. State any two applications.
- c) Explain lift and drag forces acting on the blade of a wind turbine with a neat sketch.
- d) Describe compressed gas and liquid hydrogen methods of hydrogen storage.

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

- a) A solar PV plant is to be installed in a region with frequent cloudy weather. Explain which component of solar radiation will dominate, its effect on PV output, and the measures to minimise the loss.
- b) Explain the need of a gearbox in a wind turbine with a block diagram. State the alternative used in gearless turbines.

- c) Draw a neat labelled sketch of the Chinese (fixed dome) biogas plant and explain its working.
- d) Distinguish between tidal energy and wave energy on any four points.

Q.4 Attempt any THREE of the following:

12

- a) Explain the working of the Campbell–Stokes sunshine recorder with a neat sketch.
- b) Explain the production of hydrogen by electrolysis of water with a neat sketch.
- c) Compare hydrogen fuel cell vehicle and battery electric vehicle on the basis of:
i) refuelling/charging time ii) driving range iii) infrastructure iv) environmental impact.
- d) Explain the role of topography and river characteristics in the selection of a site for a small hydroelectric power plant.
- e) State and explain the factors to be considered while selecting a site for a biogas plant.

Q.5 Attempt any TWO of the following:

12

- a) i) Compare constant speed and variable speed wind turbines on any four points.
ii) Explain the DFIG based variable speed wind energy conversion system with a block diagram.
- b) Explain the safety precautions to be followed for the storage, transportation and utilisation of hydrogen.
- c) A farmer has 8 cattle, each giving 10 kg of fresh dung per day. Gas yield is 0.04 m³ per kg of fresh dung, dung is mixed with water in the ratio 1 : 1 and retention time is 40 days. Calculate: i) daily gas production ii) volume of digester iii) volume of gas holder (60 % of daily gas). Suggest a suitable type of biogas plant.

Q.6 Attempt any TWO of the following:

12

- a) Design an off-grid solar PV system for a rural house with the following loads: 6 LED lamps of 9 W for 6 h/day, 2 fans of 60 W for 8 h/day, one LED TV of 80 W for 4 h/day and laptop/mobile charging of 65 W for 3 h/day. Assume peak sun hours = 5.5 h, inverter efficiency 90 %, battery efficiency 85 %, derating factor 0.8, 24 V system, 12 V/150 Wp modules, 12 V/150 Ah batteries, 2 days autonomy and 70 % depth of discharge. Find the number of modules, battery bank and inverter rating.
- b) i) Suggest a suitable location for a wind farm in Maharashtra and justify your choice. ii) A site has an average wind speed of 7 m/s and another site 5 m/s. For a turbine of 40 m rotor diameter ($\rho = 1.225 \text{ kg/m}^3$, $C_p = 0.4$), calculate the power developed at each site and justify which site is better.

- c) Explain the effect of temperature difference on the power output and efficiency of an OTEC plant. Calculate the Carnot efficiency of an OTEC plant when: i) surface water is at 28 °C and deep water at 6 °C ii) surface water is at 24 °C and deep water at 6 °C. Comment on the result.

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

