Code : 102611

B.Tech 6th Semester Exam., 2022

(New Course)

RENEWABLE ENERGY SYSTEMS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* of the following questions : 2×7=14

(a) Define cut-out speed of a wind turbine.

(b) Mention the different types of biofuels.

(c) Draw an equivalent circuit of a practical solar PV cell.

(d) What do you mean by MPPT?

(e) What is solar time?

(f) What do you understand by energy conservation?

(g) What are the different types of solar PV panels?

(h) What is the difference between horizontal axis and vertical axis wind turbines?

(i) Draw the power versus wind speed characteristics of a wind turbine.

(j) How can we measure the solar irradiance?

2. *(a)* Discuss the main features of renewable energy sources and explain the importance of non-conventional energy sources in the context of global warming. 7

(b) What is the status of non-conventional energy sources in India and what are their future prospects? 7

3. *(a)* Discuss the principle of a solar collector. How can collector coating be used to improve the performance of a collector? 7

(b) Draw a schematic diagram of a solar pond based electric power plant with cooling tower and explain its working. 7

4. *(a)* Explain the *I-V* characteristics of a solar cell and define fill factor. What is the significance of fill factor? 6

(b) A *P-V* system feeds a d.c motor to produce 1 hp at the shaft. The motor efficiency is 85%. Each module has 36 multi-crystalline silicon solar cells arranged in a 9×4 matrix. The cell size is 125 mm × 125 mm and the cell efficiency is 12%. Calculate the modules required in the *P-V* array. Assume global radiation incident normally to the panel is 1 kW/m^2 8

5. *(a)* Explain the operation wind energy system with a neat sketch. 6

(b) A HAWT has the following data :

Speed of wind = 10 m/s at 1 atm and 15 °C

Diameter of rotor = 120 m

Speed of rotor = 40 rpm

Calculate the maximum possible torque produced at the shaft. 8

6. *(a)* Explain the process of production of biogas from biomass. What are the main advantages of anaerobic digestion of biomass? 6

(b) The consumption pattern of the biogas in a biogas plant is given below :

20 l/h from 08:00 to 12:00 hours

40 l/h from 13:00 to 16:00 hours

10 l/h from 20:00 to 24:00 hours

Determine the size of the gasholder and the required gasholder capacity 8

7. *(a)* Explain the various types of generating systems and generators considered for use in micro hydro resources. 6

(b) Estimate the net power available from a proposed micro hydro scheme at a site having a small stream with a flow rate of 200 litres per second at ahead of 35 m. Assume density of freshwater as 995 kg/m^3 and overall efficiency of the whole system as 50%. 8

8. *(a)* Explain the variation of power output of a wind turbine with tip speed of the rotor. 7

(b) With the help of a schematic diagram, explain the working of a solar water heating system. 7

9. Write short notes on the following : 14

   (a) Solar refrigeration and air conditioning systems

   (b) Pitch-regulated and stall-regulated wind turbine

• • •