

Total No. of Questions : 8]

SEAT No. :

PD4719

[Total No. of Pages : 3

[6404]-225

B.E. (Mechanical Engineering)

RENEWABLE ENERGY TECHNOLOGIES

(2019 Pattern) (Semester - VIII) (Elective -VI) (402051B)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of electronic pocket calculator is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Explain the following solar cells with neat sketch. [6]

- i) Single Crystalline -
- ii) Poly Crystalline

b) Write a short note on. [6]

- i) Payback Time and
- ii) Levelized Energy Cost for solar energy generation

c) List out and explain the various PV components used in designing PV system. [6]

OR

Q2) a) Write a short note on. [8]

- i) Factors affecting electricity generated by a solar cell and
- ii) Solar Cell Equation

b) Design a standalone PV system for the load specified in the table. [10]

Load	Number	Power Rating (Watt)	Usage Hr/day
T.V	1	100	2
Refrigerator	2	50	8
Computer	3	18	5

Find:

- i) Energy supplied (Wh) by the battery to inverter input considering inverter efficiency = 85 %.
- ii) Considering Depth of Discharge (DOD) of 50 %, calculate the required charge capacity of battery (24V).
- iii) Considering two days of autonomy, calculate battery charge capacity.
- iv) Calculate no. of batteries needed for 24 V system voltage if the available battery configuration is 12 V and 100 Ah.
- v) Calculate the number of panels of 60 W_p for the above case considering 6 sunshine hours of 1000 W/m²-day.

Assume battery efficiency = 80 %, Assume controller circuit efficiency = 100%.

P.T.O.

- Q3) a)** Write a short note on. [6]
- i) Betz coefficient and
 - ii) Tip Speed Ratio
- b) Explain the Horizontal and Vertical axis wind turbines with neat sketch. [6]
- c) With neat sketch, explain the concept of Upwind and Downwind rotor position for wind turbines. [6]

OR

- Q4) a)** List out and explain the components of wind turbine with neat sketch. [8]
- b) Wind at 1 standard atmospheric pressure and 15°C temperature has a velocity of 10 m/s. The turbine has a diameter of 120 m and its operating speed is 40 rev/min at maximum efficiency. Calculate. [10]
- i) Total power density in the wind stream
 - ii) Maximum obtainable power density assuming, $\eta = 40\%$,
 - iii) Total power produced in kW and
 - iv) Torque and axial thrust. Assume air density as $\rho = 1.226 \text{ kg/m}^3$

- Q5) a)** Write a short note on. [6]
- i) Yaw control mechanism used in wind turbine
 - ii) Solar PV tracking
- b) Write a short note on. [6]
- i) Site selection for wind farm
 - ii) ICT based monitoring and control of wind farm
- c) Write a short note on effect of dust on PV and suggest few remedies for it. [5]

OR

- Q6) a)** Explain off shore and on shore wind farms providing their advantages and disadvantages. [6]
- b) List out and explain various components of solar photovoltaic system. [6]
- c) Explain Pitch controlled and Stall controlled power control for wind turbines. [5]

- Q7)** a) Explain Biogas Digester with neat sketch. [6]
b) Explain following characteristics of biomass: [6]
i) Ultimate analysis
ii) Proximate analysis and
iii) Thermo- gravimetric analysis
c) Differentiate between Aerobic and Anaerobic digestion. [5]

OR

- Q8)** a) Write a short note on Bio-Diesel. [6]
b) List out and explain various type of biomass. [5]
c) A biomass gasifier is used to run a compression ignition engine. The engine operates in the dual fuel mode with 75 % diesel replacement. The biomass feeding rate for the gasifier is 170 kg/hr. Calculate the power produced by the engine, if the engine efficiency is 28 % and calorific value of biomass is 15500 k.J/kg. Consider efficiency of the gasifier is 0.70. [6]

