

Total No. of Questions : 8]

SEAT No. :

P-1430

[Total No. of Pages : 4

[6004]-625

**B.E. (Mechanical Engineering)**

**RENEWABLE ENERGY TECHNOLOGIES**

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

*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 and 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 below solar cells with neat sketch. **[6]**

- i) Mono Crystalline
- ii) Cd-Te and
- iii) CIGS

b) Explain the effects of factors affecting electricity generated by a solar cell. **[6]**

c) If for a given solar power plant, total revenue generated in 25 years is Rs. 19966500 and installation cost of the plant is Rs. 7535730. Calculate Cost Pay Back Time (CPBT) and Life Cycle cost for producing a kWh of electricity by 100 wpsolar PV system over a life time of 25 years. **[6]**

OR

**Q2) a)** Explain following third generation solar cells with neat sketch. **[8]**

- i) Polymer based solar cell
- ii) Quantum Dots solar cell
- iii) Multi Junction Tandem cells and
- iv) Hybrid solar cell

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

**P.T.O.**

Load	Number	Power Rating (Watt)	Hr/day
Light (CFL)	3	18	5
Fan	2	50	8
Computer	1	100	2

Find :

- Energy supplied (Wh) by the battery to inverter input considering inverter efficiency = 85 %.
- Considering Depth of Discharge (DOD) of 50 %, calculate the required charge capacity of battery (24V).
- Considering two days of autonomy, calculate battery charge capacity.
- Calculate no. of batteries needed for 24 V system voltage if the available battery configuration is 12 V and 100 Ah.
- Calculate the number of panels of 60 wp for the above case considering 6 sunshine hours of 1000 W/m<sup>2</sup> -day.

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

- Q3)**
- Explain different components of wind turbines with neat sketch. [6]
  - Explain the following topologies for a wind turbine. [6]
    - Rotor axis rotation
    - Rotor Position and
    - Rotor Speed
  - Write a short on Wind power generation curve and Betz coefficient. [6]

OR

- Q4)**
- Explain Horizontal and Vertical Axis turbine with neat sketch. [8]
  - A propeller type wind turbine has the following data : [10]
 

Speed of free wind at a height of 10 m = 12 m/s  
 Air density = 1.226 kg/m<sup>3</sup>  
 $\alpha=0.14$   
 Height of the tower = 100 m  
 Diameter of the rotor = 80 m  
 Wind velocity at the turbine reduces by 20 %.  
 Generator efficiency = 85 %

Find

- i) Total power available in the wind
- ii) Power extracted by the turbine
- iii) Electrical power generated
- iv) Axial thrust on the turbine

Maximum axial thrust on the turbine

- Q5)**
- a) Explain off shore and on shore wind farms providing their advantages and disadvantages. [6]
  - b) Write a short note on : [6]
    - i) ICT based monitoring and control of wind farm
    - ii) Solar PV tracking
  - c) Explain Pitch controlled and Stall controlled power control for wind turbines. [5]

OR

- Q6)**
- a) List out and explain various components of solar photovoltaic system. [6]
  - b) Write a short note on : [6]
    - i) Effect of dust on PV and remedies
    - ii) Site selection for wind farm
  - c) Write a short note on Yaw control mechanism used in wind turbine with neat sketch. [5]

- Q7)**
- a) List out and explain various type of biomass. [6]
  - b) Write a short note on Bio-Diesel. [6]
  - c) Explain process of pyrolysis with neat sketch. [5]

OR

Q8) a) Explain following characteristics of biomass : [6]

- i) Ultimate analysis
- ii) Proximate analysis and
- iii) Thermo- gravimetric analysis

b) Write a short note on Bio-Hydrogen. [5]

c) A biomass gasifier is used to run a compression ignition engine. The engine operates in the dual fuel mode with 80% diesel replacement. The gasifier engine system produces 210Kw of power. Calculate the biomass feeding rate to the gasifier if the efficiency of the engine is 30% and the calorific value of biomass is 16000 kJ/kg. Consider the efficiency of gasifier is 0.7. [6]

