SEAT No. :

P-6685

[6181]-253

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, 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 effect of radiation intensity and temperature on short circuit current, open circuit voltage and power generated in PV cell? **[6]**

b) Explain the term fill factor and its importance as a performance parameter for a solar cell. **[6]**

c) Why is the Levelized Cost of Energy Important? How do you calculate the levelized cost of energy? **[6]**

OR

Q2) a) What are the advantages and disadvantages of solar cell? What is the concept of satellite solar station? **[8]**

b) A house has the following electrical appliance usage: **[10]**

One 18 Watt fluorescent lamp with electronic ballast used 4 hours per day.

One 60 Watt fan used for 2 hours per day.

One 75 Watt refrigerator that runs 24 hours per day with compressor run 12 hours and off 12 hours.

The system will be powered by 12 V_{dc}, 110 W_p PV module.

i) Determine power consumed by devices per day.

ii) Determine capacity of panel assuming 30% energy losses.

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iii) Size the PV panel assuming panel generation factor (PGF) = 3.4

iv) Number of solar panel required.

v) Inverter sizing.

vi) Battery sizing assuming 15% battery losses, 0.6 depth of discharge and three days of autonomy.

Q3) a) What are the basic components of wind energy conversion system? Explain with a neat diagram. **[6]**

b) A wind generator with a 8 m dia. blade has a cut-in Wind speed of 5 m/s at which velocity generates 1.5 kW of power. Determine the efficiency of wind turbine generator set and horizontal force exerted by the wind on the supporting mast and maximum torque. What is the effect of doubling wind velocity to 10 m/s on power generation and the horizontal force and torque? Given: density of air = 1.2 kg/m^3. **[8]**

c) Explain the limitations and possible environmental impacts of wind energy. **[4]**

OR

Q4) a) What is the total power of a wind stream? What do you mean by coefficient of performance and tip speed ratio of a windmill? On what factors does the performance of windmills depend? **[8]**

b) Derive the expression for power extracted from wind considering Betz model of a wind turbine. What is the maximum theoretical power that can be extracted and under what condition? **[10]**

Q5) a) What are the advantages and disadvantages of offshore wind farms? **[6]**

b) Give the stepwise process of estimating number of PV modules required in series and parallel connection and their power calculation. **[6]**

c) If a 95 kW turbine produces 250000 kWh in a year, Find its annual energy output and capacity factor. **[5]**

OR

Q6) a) Write note on how to enhance performance of PV array. **[6]**

b) What is main criterion for selecting the site for a wind farm? **[6]**

c) What are the different components of grid connected PV systems? **[5]**

Q7) a) Write short notes on Biomass resource and their classification. **[6]**

b) Write a short note on bio-gasification. **[5]**

c) What are biomass conversion technologies? Draw a schematic diagram to explain various conversion technologies and products. **[6]**

OR

Q8) a) Explain fermentation process of producing ethanol from sugarcane. **[6]**

b) Distinguish between Fixed and Float drum bio-digesters. **[4]**

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 biomass feeding rate for the gasifier is 180 kg/hr. Calculate the power produced by the engine, if the engine efficiency is 30% and calorific value of biomass is 16000 kJ/kg. Consider efficiency of the gasifier is 0.70. **[7]**

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