Total No. of Questions : 8]

SEAT No. :

PE2304

[Total No. of Pages : 3

[6584]-213
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) What are the major advantages of solar cells over conventional methods of power system? **[5]**

b) Define fill factor and explain current - voltage characteristic of solar cell. **[5]**

c) A photovoltaic cell has an open circuit voltage of 0.6V and a short circuit current of 250 A/m^2 at a cell temperature of 40°C. Calculate the voltage and current density that maximises the power of the cell. What would be the corresponding maximum power output per unit cell area? **[8]**

OR

Q2) a) Explain principle of working of Solar cell with neat sketch. **[5]**

b) Explain different types of solar cells on the basis of material thickness and the type of junction structure. **[5]**

c) A residential house has a power requirement of 400 W for 4 hours every night. It is proposed to meet the requirement by using a PV array, a battery storage system and an inverter. The whole system is over designed so that it can meet one extra night's requirement even if there has been no sunshine during the day. Calculate number of PV modules and batteries required. Given : **[8]**

i) Solar radiation is available for an average of six hours daily and average hourly global radiation flux incident on the array is 650 W/m^2.

ii) Battery rating = 12 V; 120 Ah. Depth of discharge = 0.7 Charging and discharging efficiency = 0.9.

iii) Inverter efficiency at full load =0.85.

P.T.O.

Q3) a) Explain the following terms in short. **[6]**

i) Swept Area

ii) Tip Speed ratio

iii) Power coefficient

b) What are the design considerations of Horizontal and Vertical axis wind turbines? **[4]**

c) A 40 m diameter wind turbine with 3 blades and 700 kW power output. The wind speed is 14 m/s and the air density is 1.225 Kg/m^3 :

i) Find the rotor rpm if the wind turbine operates at a TSR of 4.0.

ii) Find the tip speed of the rotor.

iii) What gear ratio is needed to match the rotor speed to the generator speed if the generator must run at 1800 rpm?

iv) What is the efficiency of wind turbine under these conditions? **[8]**

OR

Q4) a) Explain in detail impact of Wind Power Plant on environment. **[4]**

b) Write a note on operating Characteristics of wind mill. **[5]**

c) A propeller type wind turbine has the following data: Speed of the free wind at a height of 10 m = 12 m/s Air density = 1.226, α = 0.14 , Height of tower = 100 m, Diameter of rotor = 80 m, Wind velocity at the turbine reduces by 20 %, Generator efficiency = 85% Determine. **[9]**

i) Total Power available in wind Power extracted by the turbine.

ii) Electrical power generated Axial thrust on the turbine.

iii) Maximum axial thrust on the turbine.

Q5) a) Write short note on Yaw control. **[6]**

b) Explain maintenance procedure for Solar PV plant. **[6]**

c) Calculate the annual energy output production from a horizontal axis wind turbine with swept area 300 m^2 and operating in a wind regime with an average wind speed of 8 m/s the density of wind is 1.225 kg/m^3 and the wind power coefficient is 0.35. **[6]**

OR

Q6) a) Describe the basic principle of photovoltaic power plant. **[6]**

b) Write short note on DPR preparation for roof top solar plants. **[6]**

c) Explain in short the stand alone systems. **[6]**

Q7) a) Explain the term : **[3]**

i) True density of biomass

ii) Apparent density of biomass

iii) Bulk density of biomass

b) Explain Circulating Fluidized bed gasifier in detail with neat sketch. **[6]**

c) A saw dust sample one gm is heated in muffle furnace to find out the proximate analysis. The sample was heated at temp 105°C for 3 hrs mass is reduced to 0.87gm. Then 1gm sample is heated at 550°C for 9 min mass reduced to 0.27gm. Afterward the 1gm sample is heated at 550°C for 6 hrs and mass is reduced by 0.026gm. Estimate the proximate analysis for the saw dust on dry basis. **[7]**

OR

Q8 a) Explain biodiesel production with transesterification process. **[4]**

b) The ultimate analysis of the biomass Pongamia pinnata used in the downdraft gasifier, for the composition of carbon (C), hydrogen (H), nitrogen (N) and sulphur (S), is carried out using EuroEA Elemental Analyzer AS given as below. **[6]**

Name	C%	H%	N%	S%	ASH%	O%
Pongamia Pinnata	4.462	44.547	8.872	--	1	41.119

Find out the formula for the biomass Pongamia pinnata.

c) Explain with neat sketch Fixed dome type bio-gas plant. **[6]**

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