Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PEEL 5302

Fifth Semester Regular Examination – 2014

RENEWABLE ENERGY SYSTEMS

BRANCH(S) : EEE, ELECTRICAL

QUESTION CODE : H 194

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 × 10

   (a) What ranges of wind speed is considered favorable for wind power generation?

   (b) What are the advantages of variable speed constant frequency (VSCF) system over constant speed constant frequency (CSCF) system of wind energy conversion?

   (c) What are the factors affecting the performance of a biogas digester?

   (d) What is fill factor? What is its significance in selecting a PV module?

   (e) For a parabolic collector of length 2m, the angle of acceptance is 15°, find the concentration ratio of the collector.

   (f) What is cogeneration? Explain with an example.

   (g) What is pyrolysis and what type of biomass conversion technology it comes under?

   (h) What is dark saturation current in a semiconductor PV cell and its significance?

P.T.O.

(i) What is Betz limit?

(j) Define the conversion efficiency of a solar cell.

2. (a) Draw the equivalent circuit for a semiconductor PV cell, signify the presence of each component in it and derive the equation for V_{oc}. 5

(b) A solar cell (0.9 cm^2) receives solar radiation with photons of 1.8 eV energy having an intensity of 0.9 mW/cm^2. Measurements show open circuit voltage of 0.6 V/cm^2, short-circuit current of 10 mA/cm^2 and the maximum current is 50% of the short-circuit current. The efficiency of cell is 25%. Calculate the maximum voltage that the cell can give and the fill factor. 5

3. (a) Calculate the power developed by a bio-digester with dry mass input per day 15 kg, retention time of 30 days, operating temperature of 30°C, biogas yield of 0.2 m^3/kg of dry mass, burner efficiency of 65% and methane proportion of 0.85. Assume that heat combustion of methane is 28 MJ/m^3. 5

(b) Highlight the applications of biogas in domestic and industrial sectors. Also explain the operation of wood stoves. 5

4. Derive the expression for power extracted from wind. What is the maximum theoretical power that can be form wind under what condition? 10

5. (a) Explain briefly : (i) Savonius type (ii) Darrieus type wind mill. 5

(b) Explain briefly the effect of tip speed ratio on torque and solidity. 5

6. (a) What is the need of hybrid generation system? 5

(b) Explain the working principle of hybrid electric vehicle with schematic block diagram. 5

7. (a) Explain how the variation of Insolation and temperature affects the I-V characteristics of a solar cell. 5

(b) What are the direct and indirect materials? 5

8. Write short notes on any two of the following : 5 × 2

(a) PV hybrid System.

(b) Peltier Cooling.

(c) Classification of Solar Cells.

(d) Aerodynamics operation in a wind turbine.