Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (EE-PS)/SEM-1/PSM-103(C)/2012-13

2012
RENEWABLE ENERGY SOURCES

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Solar constant is equal to

a) $1387\ W/m^2$ b) $1353\ W/m^2$

c) $1567\ W/m^2$ d) $1657\ W/m^2$.

ii) Wind energy contained

a) kinetic energy b) potential energy

c) wave energy d) heat energy.

iii) Doping Materials used to made silicon solar cell are

a) Ge and B b) P and Bo

c) Te and Cd d) Cu and Ga.

iv) The speed at which the wind turbine starts delivering shaft power

a) cut in speed b) cut out speed

c) rotor speed d) rated wind speed.

v) Tip speed ratio of a wind turbine is defined as

a) $\lambda = 3\pi RN/2V_\infty$ b) $\lambda = 2\pi RN/V_\infty$

c) $\lambda = \pi RN/V^3_\infty$ d) $\lambda = 4\pi RN/V_\infty$.

vi) Clarity index of solar radiation lies between

a) 2 to 3 b) 0·8 to 0·9

c) 5·7 to 6·8 d) 0·1 to 0·7.

vii) Biomass gasification is the process of

a) Converting a solid into a gaseous fuel with any solid carbonaceous fuel

b) Converting a solid or liquid into a gaseous fuel with any solid carbonaceous residue

c) Converting a solid or liquid into a gaseous fuel without leaving any solid carbonaceous residue

d) Converting a solid into a liquid fuel without leaving any solid carbonaceous residue.

viii) Anaerobic digestion is the process involves microbial digestion of biomass and is done in the

a) presence of oxygen b) absent of oxygen

c) presence of nitrogen d) absent of nitrogen.

ix) A hydro electric scheme operates at a head of 100 m and the water flow rate is 2000 m^3/s. The power potential is

a) 1962 MW b) 2000 MW

c) 1500 MW d) 1200 MW.

x) Which turbine is used to power conversion for hydro plant by

a) Pelton turbine b) Keplon turbine

c) Francis turbine d) all of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

2. Discuss the different types of solar cell according to manufacturing process. Also discuss efficiency of different generation of solar cell.

3. The annual average wind velocity at a height of 10 m over a flat terrain is 8 m/s. The boundary layer exponent is $x = 0{\cdot}14$. Find the annual average power density (W/m^2) in the wind at a height of 25 m. Assume the Rayleigh distribution over the terrain and $1{\cdot}425\ kg/m^3$ as the density of air.

4. What is the anaerobic digestion ? What are the end products ? Explain the process of gasification and combustion of bio mass. 2 + 1 + 2

5. Draw and discuss the equivalent circuit of solar cell. Explain the V-I and P-V characteristics of Photovoltaic Modules. 2 + 3

6. Explain in brief the following : 5×1

   a) Tip speed ratio

   b) Solidity

   c) Power coefficient

   d) Angle of incidence

   e) Angle of inclination.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.

$3 \times 15 = 45$

7. a) Give the classification of hydro power plant. Draw the layout block diagram for micro hydro power plant. Explain each component in brief. 8

   b) A hydro power plant with 950 MW output has an efficiency of 83%. The plant load factor is 75%. It operates at a constant head of 80 m. Calculate

      i) the maximum flow rate required

      ii) the quantity of water to be stored behind a dam to cater for a year's load requirement. 7

8. a) Discuss the different types of solar photovoltaic system. Explain each of them using block diagram. 9

   b) How to measure the solar radiation ? Discuss any one of the solar radiation measuring equipment. 6

9. a) What is biomass ? How is it useful ? 4

   b) What are the factors affecting the generation of biogas ? Discuss each of them in brief. 5

c) Discuss briefly different types of biogas plant. Compare the fixed dome type plant and movable drum type plant.

3 + 3

10. a) Discuss the Aerodynamics of wind rotors. Also find out the total thrust and aerodynamic power developed in a three blade wind turbine using blade element theory. 4

b) Find the required diameter of a wind turbine to generate 4kW at a wind speed of 8m/s and a rotor speed of 120 rpm. Assume power coefficient is 0·4; efficiency of mechanical transmission is 0·9 and efficient of Generator is 0·95. 3

c) Calculate the angle made by beam radiation with the normal to a flat plate collector, pointing the south location in New Delhi (27° 30'N, 760 42' E) at 10·00 hour solar time on October 29th. The collector is tilted at an angle of 35° with the horizontal. Also calculate the day length. 8

11. Discuss in short any *five* of the following : 5×3

a) Horizontal axis wind energy turbine

b) Local Solar Time

c) Mud Jar Biogas Plant

d) Pelton Turbine

e) Pyrohiliometer

f) Angle of declination.