M.TECH/RE/1ST SEM/REEN 5102/2016

RENEWABLE ENERGY I
(REEN 5102)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i)   A good latent heat storage medium should have
         (a) large volume change during the phase change
         (b) high value of the latent heat of fusion
         (c) low thermal conductivity in both the phases
         (d) both (b) & (c).

   (ii) Infrared ray wavelength starts from
         (a) 750nm   (b) 300nm
         (c) 1000nm   (d) none of these.

   (iii) The seasonal variation in available solar radiation at any location is determined by
         (a) zenith angle   (b) solar declination
         (c) solar azimuth angle   (d) both (b) & (c).

   (iv) MPPT is related with
         (a) charge controller   (b) Photovoltaic panel
         (c) battery   (d) none of these.

   (v)   The earth's orbit is
         (a) circular   (b) elliptical
         (c) parabolic   (d) cylindrical.

   (vi) Capacity of battery can be defined by
         (a) ampere hour   (b) kilo-volt
         (c) kilo watt   (d) Joule per sec.

   (vii) The unit of solar irradiance is
          (a) Amp/m^2 (b) W/m^2
          (c) Kilo Calories   (d) none of these.

   (viii) Silicon is suitable for solar cell, for its
          (a) band gap energy   (b) crystal structure
          (c) high EHP   (d) none of these.

   (ix)   The temperature of the outer most layer of sun is
          (a) 5770K   (b) 300K   (c) 0K   (d) 1000 K.

   (x)   Maximum solar cell efficiency can be achieved at
          (a) 25^0C (b) 45^0C (c) 0^0C (d) 35^0C.

Group – B

2. (a) What is hour angle of sun? What is Albedo in connection with solar radiation? Write in brief about the Solar Photovoltaic.

   (b) Calculate the solar time corresponding to 12.00 (IST) at Pondicherry (11.92^0N, 79.92^0E) on 17th July. The standard meridian for IST is 82.5^0E (Mirzapur).

                                              (2 + 3 + 2) + 5 = 12

3. (a) Describe with necessary sketch, Collector cum storage water heater.

   (b) Find the Transmittance-absorptance product ($\tau \alpha$) for a collector having single cover with KL=0.125 and absorber having absorptance 0.90. The angle of incidence for incoming radiation is 40^0.

                                              6 + 6 = 12

Group – C

4. (a) What parameters can be measured by pyranometer? Explain its working principle.

   (b) Justify whether solar PV panels should be placed at an angle with the horizontal surface or horizontally for practical purposes.

                                              (2 + 6) + 4 = 12

5. (a) Explain how plane reflectors can augment the amount of incident radiation on an absorber?

   (b) Briefly discuss the causes of attenuation of solar radiation by the atmosphere. What is Albedo? Define clearness index and identify the parameter on which it depends.

                                              5 + (2 + 2 + 3) = 12

Group – D

6. (a) Explain in details the working principle of solar cells with equivalent circuit and I-V curve.

   (b) Describe the Stand-alone and Grid tied Photovoltaic system.

   8 + (2 + 2) = 12

7. (a) What are the important parameters of materials required to be considered for solar cell fabrication — discuss.

   (b) Write short note on: (i) Fill Factor of solar cell (ii) Photovoltaic panel (iii) Inverter for PV system.

   6 + (2 + 2 + 2) = 12

Group – E

8. (a) What is the role of flat plate collector in low-temperature solar systems? Analyse the mechanism of operation of simple flat-plate water heater.

   (b) Derive the expression of reflectance for the above mentioned system. Calculate the reflectance of glass at normal incidence and at an incidence angle of 75°. The average refractive index of glass is 1.526.

   (3 + 4) + (3 + 2) = 12

9. (a) Briefly describe the working principle of Shallow Solar Ponds. Draw the schematic diagram of SSP based domestic solar water heater.

   (b) Determine the criterion for static stability that provides the salinity gradient for solar ponds.

   (3 + 5) + 4 = 12