ALTERNATIVE ENERGY SOURCES
(ECEN 4243)

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

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one 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) The radiation intensity on the surface of the sun is approximately
(a) 6.33×10^7 W/m^2 (b) 13.53×10^5 W/m^2
(c) 7.53×10^5 W/m^2 (d) 8.5×10^5 W/m^2

(ii) Solar radiation incident outside the earth's atmosphere is called
(a) Terrestrial Radiation (b) Extra Terrestrial Radiation
(c) Global Solar Radiation (d) None of these.

(iii) The radiation intensity considered at STC is
(a) 1000 W/m^2 (b) 1375 W/m^2
(c) 800 W/m^2 (d) 1200 W/m^2

(iv) Box cooker operates at the temperature
(a) 150^0C (b) 250^0C (c) 80^0C (d) None of these.

(v) The structure of Perovskite material at ambient temperature is
(a) Cubic Structure (b) Hexagonal Structure
(c) Octagonal Structure (d) None of these.

(vi) The ratio of the area of the windmill blade to the swept area is called
(a) Solidity (b) Tip speed ratio
(c) Windmill ratio (d) Both (b) & (c).

(vii) The maximum renewable energy contributes in India from
(a) Wind energy (b) Solar Energy
(c) Biomass (d) Tidal Energy.

(viii) Solar cell is a
(a) voltage source (b) current source
(c) power source (d) heat energy source.

(ix) Maximum efficiency from solar cell can be obtained at
(a) UV range (b) Infrared range
(c) Visible spectrum range (d) In dark.

(x) Anti-reflective coatings are applied to the surface of solar cell,
(a) to increase the temperature (b) to minimize the reflectance
(c) to minimize the absorptance (d) None of these.

Group – B

2. (a) How the energy resources are classified based on techno-socio-economic conditions. Define commercial energy resources.

(b) What is Fuel-cell? State the advantages & disadvantages of geothermal energy.

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

3. (a) Derive a suitable relationship for the power developed in a wind power plant in terms of the wind velocity, sweep area of the windmill and its conversion efficiency.

(b) An rpm of 450 at the tip of a 1m blade using digital tachometer has been measured. How far does the tip of the blade travel in 1 hour? If wind is blowing at 20miles/h, obtain the tip speed ratio.

6 + (3 + 3) = 12

Group – C

4. (a) Briefly describe the different layer of the sun. How much energy actually reaches the earth's surface from the sun? What is hour angle?

(b) Calculate the day length at a location latitude of 35°N on Feb 14.

(5 + 1 + 2) + 4 = 12

5. (a) Calculate the sunset hour angle and day length at a location latitude of 35° N on February 2014.

(b) What are the advantage and disadvantages of concentrating collectors over a flat plate collector? Describe with necessary sketch about the "Box-type Solar Cooker".

4 + (4 + 4) = 12

Group – D

6. (a) What are the advantages and disadvantages of Photovoltaic solar energy conversion? Discuss the effect of series resistance R_s, Shunt Resistance R_{sh} and minority carrier life time on the performance of the solar cell.

(b) A solar cell array is required to deliver 100W peak output at 120V DC bus voltage. The solar cells to be used are rated for 0.1W peak output at o.4V. Assuming that there are no assembly losses, define the array.

(2 + 5) + 5 = 12

7. (a) Discuss about the important losses of the solar cell.

   (b) For a typical photovoltaic cell, open circuit voltage (V_{oc}) and short circuit current (I_{sc}) are 0.611V and 2.75A respectively. Maximum voltage and maximum current are also given as 0.5V and 2.59A. Calculate the Fill Factor and efficiency of the cell. Consider the irradiance 800W/m^2.

6 + 6 = 12

Group – E

8. (a) Explain in brief, the principle of operation of P-I-N solar cell. Discuss about the Tandem solar cell.

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

(4 + 4) + 4 = 12

9. Write short note on any three
   (i) Solar Time
   (ii) Dye sensitized solar cell
   (iii) Fuel cell
   (iv) Declination angle.

(4 + 4 + 4) = 12

Department & Section	Submission Link
ECE	https://classroom.google.com/w/Mjk3MjQwMTM1NjM1/tc/MzYwMDE0MjM0MTc1