

**APPLICATION OF GREEN ENERGY
(ECEN 4249)**

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) Solar cell is a
 - (a) voltage source
 - (b) current source
 - (c) power source
 - (d) heat energy source.
 - (ii) When the sun is directly on the top of head, it is referred to _____.
 - (a) Zenith
 - (b) Azimuth
 - (c) Declination
 - (d) Hour angle
 - (iii) Biogas is produced from wet biomass through
 - (a) Biological conversion process involving bacteria
 - (b) Using external heat energy
 - (c) Electrolysis
 - (d) None of these.
 - (iv) Angle made by radial line joining the location to the centre of the earth with the projection of the line on the equatorial plane is called _____.
 - (a) Latitude
 - (b) Zenith angle
 - (c) Hour angle
 - (d) Declination
 - (v) Bypass diodes are connected to the PV panel to overcome the
 - (a) Shading Effect
 - (b) To increase the Short ckt current
 - (c) To increase the open ckt voltage
 - (d) None of these.
 - (vi) Most efficient solar cells are
 - (a) Dyesensitized solar cell
 - (b) Amorphous silicon solar cell
 - (c) Mono-crystalline solar cell
 - (d) Polycrystalline solar cell.
 - (vii) A module in a solar panel refers to
 - (a) Series arrangement of solar cells
 - (b) Parallel arrangement of solar cells
 - (c) Series and parallel arrangement of solar cells
 - (d) None of the above.

- (viii) Anti reflection coating (ARC) used in solar cell
(a) To minimize the reflection (b) To increase the reflection
(c) To minimize the absorption (d) To maximize the absorption.
- (ix) The angle through which the earth must turn to bring the meridian of a point directly in sun's rays is called _____.
(a) Hour angle (b) Declination (c) Latitude (d) Air mass
- (x) Which part of flat plate collectors is coated in black?
(a) Transparent cover (b) Absorber plate (c) Insulation (d) Fins.

Group - B

2. (a) Explain the difference between renewable and non-renewable energy. Discuss in brief about different type of renewable energy. [(CO1)(Remember/LOCQ)]
(b) What is Fuel cell? Discuss the difference between a fuel cell and a battery. [(CO2)(Understand/LOCQ)]
(4 + 3) + (2 + 3) = 12
3. (a) If the tip of a wind rotor blade is travelling at 161 km/h and the wind speed is 32 km/h, obtain the tip-speed ratio. [(CO2)(Evaluating/HOCQ)]
(b) What is biogas? Illustrate the advantages & disadvantages of geothermal energy. [(CO2)(Remembering/LOCQ)]
(c) Explain in brief about the Micro Hydel power. [(CO2)(Analyse/IOCQ)]
4 + (2 + 3) + 3 = 12

Group - C

4. (a) Explain what happens to the extra-terrestrial solar radiation after it enters the earth's atmosphere. [(CO3)(Analyze/IOCQ)]
(b) Write in brief about:
(i) Declination angle
(ii) Hour angle. [(CO3)(Understand/LOCQ)]
(c) What is a concentrating collector? Illustrate with an example. [(CO3)(Analyze/IOCQ)]
4 + 4 + 4 = 12
5. (a) Calculate the hour angle at sunrise and sunset on June 21 and December 21 for a surface inclined at an angle of 10° and facing due south ($\gamma = 0^\circ$). The surface is located at Kolkata (22 °34' N, 88 °21' E). [(CO3)(Evaluate/HOCQ)]
(b) Discuss the structure of a flat plate collector using an appropriate diagram. [(CO3)(Understand/LOCQ)]
6 + 6 = 12

Group - D

6. (a) Explain photovoltaic effect. Show an equivalent circuit of the solar cell including the series resistance and shunt resistance. [(CO4)(Analyze/IOCQ)]
 (b) According to you what is the significance of the 'Bypass Diode' and 'Blocking Diodes' in PV Plant. [(CO4)(Evaluate/HOCQ)]
(2 + 4) + (3 + 3) = 12
7. (a) A solar PV panel consists of each cell which has an output capability of 0.3A at 0.5V. Assume that an array of such cells with 75 parallel strings and each string with 200 cells in series is to be building up. Evaluate the array output voltage, array current and array output power. [(CO4)(Evaluate/HOCQ)]
 (b) Explain the current – voltage characteristic and Fill Factor of solar cell. [(CO4)(Understand/LOCQ)]
 (c) Draw the equivalent schematic circuit diagram and classify the output current equation. [(CO4)(Analyze/IOCQ)]
5 + 4 + 3 = 12

Group - E

8. (a) Explain the Maximum Power Point Tracking (MPPT) of a Photovoltaic Plant. [(CO5)(Analyze/IOCQ)]
 (b) Discuss the structure of tandem solar cell and the advantages of the structure. [(CO5)(Understand/LOCQ)]
6 + 6 = 12
9. (a) Differentiate the function of Standalone PV plant and Grid tied PV plant. Draw the block diagram of these two type PV plant. [(CO6)(Analyze/IOCQ)]
 (b) Explain the different parameters of battery and their losses. [(CO6)(Understand/LOCQ)]
7 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	43.75	34.38	21.87

Course Outcome (CO):

After the completion of the course students will be able to

1. Apply the previous knowledge gathered from the course on Environmental Studies.
2. Analyze and categorize the different environment friendly Green energy.
3. Evaluate and calculate the solar radiation and designing of solar thermal collectors.
4. Analyze and design of different type of solar cells and array.

5. Categorize the different type of PV Plant.
6. Understand and identify the different fabrication techniques pertaining to solar cell fabrication.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.