

**SOLAR PHOTOVOLTAIC SYSTEM DESIGN
(REEN 5244)**

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 noon means
(a) 12 noon (b) Sun above the meridian
(c) Local standard time (d) None of these
- (ii) Solar constant determines the energy received from the sun
(a) per unit area of surface perpendicular to the direction of propagation of the radiation.
(b) per unit time per unit area of surface perpendicular to the direction of propagation of the radiation at the mean earth-sun distance.
(c) per unit time
(d) per unit area of surface parallel to the direction of propagation of the radiation.
- (iii) Solar cell voltage reduces for every one degree temperature increase is
(a) 2.3mV (b) 23mV
(c) 0.23mV (d) None of the above
- (iv) Fraction of global radiation, that is reflected by the receiving surface is called
(a) Albedo (b) Terrestrial radiation
(c) Global Radiation (d) None of the above
- (v) Pull rate in Czochralski technique depends on
(a) Temperature (b) Quality of silicon
(c) Area (d) None of these
- (vi) Designing of micro-inverter matches the lifetime of
(a) PV modules (b) Battery
(c) Pv module structure (d) None of these

- (vii) 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
- (viii) In a Grid tied PV system transmitted power is
(a) DC Power (b) AC Power
(c) Both DC and AC (d) None of these
- (ix) 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
- (x) III-V compound materials are used in solar cell because
(a) Materials cost is very low (b) For better stability of solar cell
(c) Easily available (d) For wide band gap

Group - B

2. (a) Discuss the sun's trajectories in different seasons.
(b) What is solar time? Calculate the solar time corresponding to 10.00 (IST) at Delhi (28.70° N, 77.10° E) on 25th December of 2019. The standard meridian for IST is 82.5° E (Mirzapur).
5 + (2 + 5) = 12
3. (a) Illustrate the function of different generation of solar cells.
(b) What is declination angle? Calculate the declination angle for March 31 in a leap year.
7 + (2 + 3) = 12

Group - C

4. (a) Explain with necessary diagram of I-V characteristics of solar cell. Explain the performance of solar cell with the change of temperature.
(b) A solar cell area of 0.9 cm^2 , receives solar radiation with photons of 1.8eV energy having an intensity of 0.9 mW/cm^2 . Measurements shows open circuit voltage of 0.6V/cm^2 , Short Circuit current of 10mA/cm^2 and maximum current is 50% of the short circuit current. Efficiency of the cell is 25%. What is the maximum voltage output and Fill Factor.
(4 + 3) + 5 = 12
5. (a) Explain the necessity of 'Bypass Diode' and 'Blocking Diodes' in PV Plant. What is string and array?
(b) A solar cell has an output capability of 0.5A at 0.4V . Assume that an array of such cells with 100 parallel strings and each string with 300 cells in series is to be building up. What will be the array output voltage, array current and array output power.
(4 + 4) + 4 = 12

Group - D

6. (a) In which direction the solar panels are placed in structure? Explain the reasons.
(b) Discuss the different types of batteries related with PV plant. What is Deep cycle battery?

4 + (5 + 3) = 12

7. (a) Illustrate with necessary diagram of three phase DC to AC converter.
(b) Explain the different parameters of battery and their losses.

7 + 5 = 12

Group - E

8. (a) Discuss about the different type of charge controller connected with PV systems.
(b) Describe the Stand-alone and Grid tied Photovoltaic system.

6 + 6 = 12

9. Write short note on any three:

(3 × 4) = 12

- (i) MPPT
- (ii) DC Pump powered by PV system
- (iii) Grid Connected PV Plant
- (iv) Standalone System

Department & Section	Submission Link
RE	https://classroom.google.com/w/MzM1MTM2MTM0NjY4/tc/Mzc0NDU0OTI5MTI5