BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – Dip.EE-2022
Course Name – Solar Power Technologies
Course Code - DEEPE401B
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Choose the correct option. A solar cell converts light energy into

a) Electrical energy b) Thermal energy
c) Sound energy d) Heat energy

(ii) Select the correct option. The imaginary lines encircling the earth horizontally are called

a) Latitudes b) Longitudes
c) Isobars d) Isotherms

(iii) Select the correct option. The significance of temperature compensation in PV panel systems is

a) It ensures accurate voltage measurements b) It prevents panel overheating
c) It adjusts the panel's orientation with temperature changes d) It regulates the panel's power output

(iv) Identify the aspects of hybrid solar thermal plants that contribute to grid stability and reliability.

a) Their ability to store excess energy for later use b) Their capacity to generate power consistently throughout the day
c) Their integration with conventional power plants for backup d) Their ability to operate independently of the grid

(v) Select the correct option. In hybrid solar thermal plants, the backup energy source typically serves

a) To compensate for inefficiencies in solar energy conversion b) To provide continuous power supply during nighttime hours
c) To reduce the reliance on solar energy during peak demand periods d) To offset the intermittency of solar energy production

(vi) Identify the primary technology used in parabolic trough power plants to concentrate solar energy.

a) Flat mirrors b) Parabolic mirrors

c) Solar panels
d) Fresnel lenses

(vii) Identify the method that is not a common method for estimating the initial size of a solar power system.

a) Load analysis
b) Rule of thumb calculations
c) Shadow analysis
d) Simulation software

(viii) Identify the factor that can impact the accuracy of sun hour calculations.

a) Soil composition
b) Moon phase
c) Air pollution levels
d) Ocean currents

(ix) Select the losses in a photovoltaic (PV) system primarily attributed to

a) Inefficient solar panel manufacturing
b) Loss of sunlight during transmission
c) Conversion losses during energy storage
d) Various inefficiencies in system components and operations

(x) Select from the following that is not a factor contributing to resistive losses in a PV system.

a) Resistance in electrical cables
b) Dust and dirt on solar panels
c) Internal resistance of solar cells
d) Resistance in connectors and junction boxes

(xi) Select the correct option. "Array sizing" refers to it in the context of a PV system.

a) Selecting the appropriate solar panel brand
b) Determining the optimal number of solar panels for a system
c) Choosing the color of solar panels
d) Estimating the cost of installing a PV system

(xii) Identify the parameter that is not typically considered during module selection for a PV system:

a) Warranty period
b) Weather resistance
c) Height of nearby trees
d) Temperature coefficient

(xiii) Choose the role of "fill factor" in module selection for a PV system.

a) It determines the colour of solar panels
b) It represents the ratio of actual maximum power output to theoretical maximum power output.
c) It indicates the reliability of solar panels.
d) It measures the physical dimensions of solar panels

(xiv) Choose the purpose of considering the degradation rate of solar panels during module selection.

a) To estimate the lifespan of solar panels
b) To determine the optimal tilt angle of solar panels
c) To calculate the efficiency of solar inverters
d) To assess the color temperature of sunlight

(xv) Choose the correct statement regarding the selection of solar panels for a PV system.

a) Modules with higher temperature coefficients are preferred for better performance.
b) Modules with lower temperature coefficients are preferred for better performance.
c) Temperature coefficient has no impact on module selection
d) The temperature coefficient is inversely related to the efficiency of solar panels.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. At LST 6:00 am. Determine the Hour Angle in northern hemisphere. (3)
3. Describe the factors that affect the output of solar panels. (3)
4. Explain the effect of temperature on PV model performance. (3)
5. Explain the significance of Short circuit current "Isc" in PV Module Parameters. (3)
6. A PV system consists of 24 solar modules connected in series. Each module has a voltage output of 40 volts and a maximum power output of 300 watts. Estimate the total voltage and power output of the PV system. (3)

OR

Explain the impact of inverter losses on overall PV system efficiency. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain the process of voltage measurement in PV panels. (5)
8. A panel of 150-watt maximum power capacity at optimum position in Odisha. Calculate per day energy generated. Global irradiance in Odisha is 4.77 kw/sq-m. (5)
9. Explain the primary function of a direct-steam solar tower power plant. (5)
10. A PV system requires 40 kWh of energy per day and operates in an area with an average solar irradiance of 6 kWh/m²/day. Evaluate the minimum area of solar panels needed, assuming an efficiency of 15%. (5)
11. Describe peak sun and peak sun hour with proper diagram. (5)

12. A photovoltaic (PV) cell has the following parameters Short-circuit current (Isc) = 5 A, Open-circuit voltage (Voc) = 0.6 V, Maximum power output (Pmax) = 2 W. Calculate the fill factor (FF) of the PV cell. (5)

OR

Explain the working of Pyrheliometer. (5)

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