

## Unit 8 - Week 6: Grid connected PV system

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### Assignment 6

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

**Due on 2020-10-28, 23:59 IST.**

1) In grid connected PV system,  
 i. the maximum DC power output of the PV array < the input DC power of the inverter  
 ii. the maximum DC power output of the PV array  $\leq$  the input DC power of the inverter  
 iii. the maximum DC power output of the PV array > the input DC power of the inverter

- a. Only i is correct
- b. Only ii is correct
- c. only iii are correct
- d. i and iii are correct

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 b. Only ii is correct

1 point

2) In a PV module, if the solar cells are connected in series, the electrical efficiency of the module is

- a. Equal to that of the solar cell
- b. Lower than that of the solar cell
- c. Higher than that of the solar cell
- d. None of these

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 b. Lower than that of the solar cell

1 point

3) The electrical efficiency of a PV array compared to the PV module is

- a. Lower
- b. Higher
- c. Same
- d. None of these

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 a. Lower

1 point

4) The ratio of actual energy generated by the PV system to the amount of energy generated by the PV system under full rated power for 24 hours per day for a year is known as \_\_\_\_\_

- a. Specific energy yield
- b. Performance ratio
- c. Capacity utilization factor
- d. None of the above

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 c. Capacity utilization factor

1 point

#### Common data for Q5-Q7

An array of 20 PV modules (multicrystalline) each with a STC rating of 300 Watt peak is operating in an ambient temperature of 35 degree Celsius. The module has a manufacturing output tolerance of 5%, while derating due to dirt and temperature are 5% and -0.5% per degree Celsius respectively. The DC cable loss, inverter efficiency and AC cable loss are 3%, 98% and 1% respectively. Consider daily peak sunshine hour (PSH) to be 5 hours.

5) The actual DC energy (in kWh) from the PV array is

- a. 18.45
- b. 29.37
- c. 22.33
- d. 35.89

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 c. 22.33

1 point

6) The Specific energy yield (kWh per kWp) of the PV system is

- a. 1.27
- b. 3.16
- c. 2.29
- d. 4.05

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 a. 1.27

0 points

7) The Performance ratio of the PV system is

- a. 0.91
- b. 0.65
- c. 0.86
- d. 0.70

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 d. 0.70

1 point

#### Common data for QS-Q10

A solar power plant is to be installed at IIT Guwahati campus to meet the electricity demand of 2 MW. The detailed specifications of the module and inverter are given in the Table 1 and Table 2 respectively. The minimum temperature, maximum temperature and the solar intensity of the site are reported to be 6 degree Celsius, 38 degree Celsius and 800 Watt per sq. meter respectively. There is a 2% voltage drop which occurs when the generated electricity flows from array to inverter. Consider a safety margin of 5% for minimum and maximum range of inverter voltage.

**Table 1** Specifications of module.

Electrical parameters at standard test conditions (STC)						
Power output (W)	Module efficiency ( $\eta$ ) (%)	Voltage at $P_{MAX}$ $V_{MPP}$ (V)	Current at $P_{MAX}$ $I_{MPP}$ (A)	Open-circuit voltage $V_{OC}$ (V)	Short-circuit current $I_{SC}$ (A)	Power tolerance (W)
300	15.10	36.6	8.20	44.8	8.71	0 ~ +5
Temperature coefficient characteristics						
NOCT ( $^{\circ}C$ )	Module efficiency ( $\eta$ ) ( $\%/^{\circ}C$ )	Temperature coefficient of $P_{MAX}$ ( $\%/^{\circ}C$ )	Temperature coefficient of $V_{OC}$ ( $\%/^{\circ}C$ )	Temperature coefficient of $I_{SC}$ ( $\%/^{\circ}C$ )	---	---
47 $\pm$ 2	-0.06 $\pm$ 0.01	-0.4048	-0.2931	0.0442	---	---

**Table 2** Technical specifications of inverter.

Input Data (DC)			
Max. DC Power	Max. DC Voltage	Max. DC Current	MPP(T)/Voltage Range
280 kW	900 V	600 A	425-975 V
Output Data (AC)			
Max. AC Power	Output AC Voltage Range	Max. AC Current	Max. Efficiency
250 kW	270-330 V	540 A	98.3%

8) Minimum number of modules in a string is

- a. 13
- b. 10
- c. 8
- d. 15

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 a. 13

1 point

9) Maximum number of modules in a string is

- a. 25
- b. 28
- c. 18
- d. 20

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 d. 20

1 point

10) The total number of strings connected to the inverter is

- a. 58
- b. 69
- c. 75
- d. 72

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 b. 69

1 point

#### Common data for Q11 and Q12

A grid connected PV power plant with a capacity of 2 MW and an Annual power loss factor of 0.19 is to be installed at a place near Guwahati having latitude of 26 degree north. The PV modules to be used are made from multicrystalline silicon with a conversion efficiency of 14.5% at STC and assume it to be constant. The modules are tilted at an angle equal to the latitude of the location and face due south. The efficiencies of the MPPT and inverter are 95% and 96% respectively. The monthly average of daily radiation incident on the PV modules on the average day of each month is given in the table below.

Month	Jan	Feb	Mar	Apr	May	Jun
$\bar{H}_r \left( \frac{kWh}{m^2 - day} \right)$	6.059	6.460	6.621	6.598	6.385	5.219
Month	Jul	Aug	Sep	Oct	Nov	Dec
$\bar{H}_r \left( \frac{kWh}{m^2 - day} \right)$	4.158	3.998	5.134	6.174	9.306	8.877

11) The total module area (in sq. meter) projected on a horizontal plane is

- a. 25600
- b. 41200
- c. 9800
- d. 34800

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 c. 9800

1 point

12) The actual annual energy output (in GWh) of the plant is

- a. 3.328
- b. 1.865
- c. 2.423
- d. 4.052

No, the answer is incorrect.  
 Score: 0  
 Accepted Answers:  
 a. 3.328

1 point