17EE832

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023
Operation and Maintenance of Solar Electric Systems

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Define Peak Sun hours. With a neat diagram, show that the number of peak sun hours is less than the total number of hours in a day. **(06 Marks)**
    b. Explain the emerging technologies in the field of solar cell production. **(08 Marks)**
    c. Define cell efficiency. The standard value of power in irradiance is 1000 W/m^2. If the cell efficiency is 22% and 15%, for the same area of 0.2m^2. Calculate the total power output. **(06 Marks)**

OR

2   a. Draw a neat I-V and P-V characteristics of a solar cell. **(04 Marks)**
    b. Explain the importance of contacts in electrical connection in a PV cell. **(08 Marks)**
    c. Explain the procedure of creating an array using a PV module with a neat suitable diagram. **(08 Marks)**

Module-2

3   a. Differentiate between String, Multistring, Central and Modular Inverter. **(08 Marks)**
    b. With a neat diagram, explain net and gross metering. **(06 Marks)**
    c. What are ground mounting systems? Differentiate between Ground Rack mounts and Pole mounts. **(06 Marks)**

OR

4   a. Explain the function and position of circuit breakers and fuses in Balance of system. **(08 Marks)**
    b. Explain the concept of Pitched Roof mounts with a neat diagram. **(08 Marks)**
    c. List the functions of Grid interactive inverters. **(04 Marks)**

Module-3

5   a. Draw the diagram representing the orientation of the module installed in southern hemisphere. **(04 Marks)**
    b. Discuss on the various kinds of tools used in determining the shaded zone condition in any given location. **(08 Marks)**
    c. Write the importance of fault current protection while designing the PV system with an example. **(08 Marks)**

OR

6   a. What is meant by array and sub-array protection? **(04 Marks)**
    b. What are some of the energy efficiency initiatives taken to protect the PV system? **(06 Marks)**

c. For a PV systems to be installed in Berlin, Germany (Ambient temperature varies from $-10°C$ to $40°C$). Calculate the minimum and maximum number of modules in a string with the given data:

$V_{OC} = 30.2V$, $I_{SC} = 8.54A$, $V_{pm} = 24V$, $I_{pm} = 7.71A$, MPP voltage range = $(268 - 480 \text{ V})$, Max DC voltage = 600 V, Safety margin for min and max inverter input voltage is 10% and 5% respectively. Temperature coefficient of $V_{OC} = -0.104$ V/°C. Temperature coefficient of $P_{max} = -0.485\%$ / °C. **(10 Marks)**

Module-4

7 a. Explain with a neat diagram, small scale power generators with utility grid. **(10 Marks)**
   b. Enumerate on the appropriate safety measures taken while installing PV systems. **(10 Marks)**

OR

8 a. What is system commissioning? List and explain the information to be including in the system documentation. **(10 Marks)**
   b. What is trouble shooting? Explain how the identification and the process of the problem is done in a PV system. **(10 Marks)**

Module-5

9 a. Explain the process of PV System Costing. **(10 Marks)**
   b. What is Feed in Tarrif's (FiTs)? Explain the important features of FiTs. **(10 Marks)**

OR

10 a. What is Rebate? Explain the important features of Rebate schemes. **(10 Marks)**
   b. List and explain some of the barriers of using PV technology. **(10 Marks)**

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