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ELECTRICAL ENGINEERING (POWER OPTION) LEVEL 6

ENG/OS/PO/CR/06/6

INSTALL SOLAR SYSTEM

July/August 2024

Time: 3 Hours



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

**WRITTEN ASSESSMENT
3 HOURS**

INSTRUCTIONS TO CANDIDATE:

1. This paper consists of **TWO** sections: **A** and **B**.
2. Answer **ALL** questions in sections **A** and any **THREE** in section **B** in the answer booklet provided.
3. Marks for each question are indicated in the brackets.
4. Do not write on the question paper
5. Answer all questions in **English**.

This paper consists FIVE (5) printed pages.

Candidate should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

SECTION A: (40 Marks)**Answer all Questions in this section**

1. Photo voltaic cells in a domestic PV module are stringed and one cell shaded as shown in figure 1, sketch the expected I-V curve for the module. (4 marks)

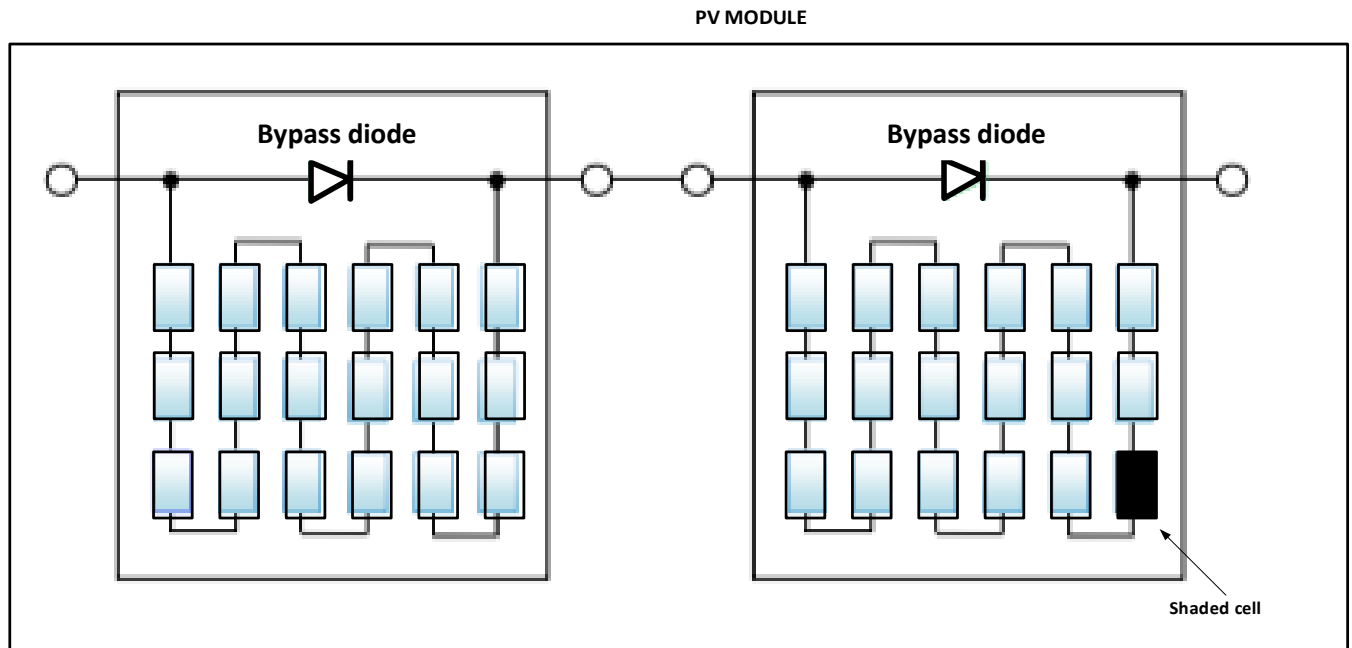


Figure 1

2. Solar energy has a diverse range of applications across various sectors. Mention FOUR applications of solar energy. (4 marks)
3. Atieno went to buy a solar PV module in one of the leading supermarket in Kisumu, the manufactures manual of the module had an I-V curve shown in figure 2. Indicate the short circuit current (I_{sc}), voltage at maximum power (V_{mp}) and maximum power (P_{max}) for the module under standard test conditions. (4 marks)

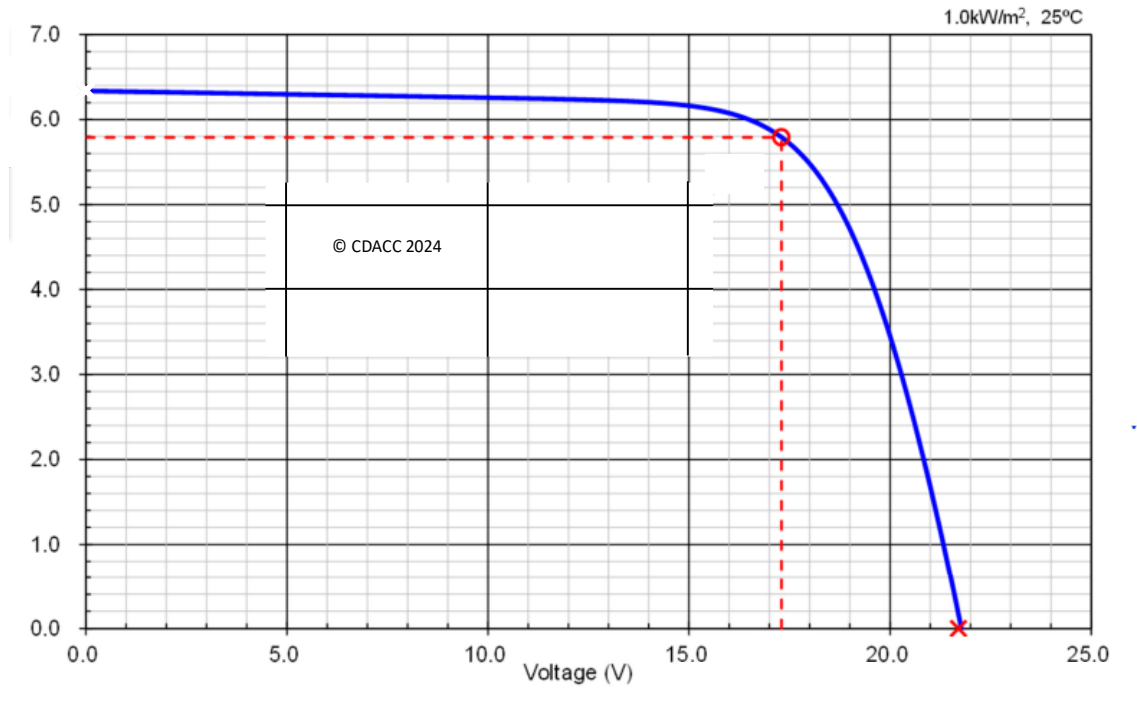


Figure 2

4. When installing a grid-tied solar PV system, safety measures are crucial to protect both the technicians and the equipment. List **two** safety measures to be observed when installing a grid tied solar PV system (2 marks)
5. A solar PV technician was tasked to perform some tests on a complete grid tied solar PV system. Outline **three** tests he carried out. (3 marks)
6. Final circuits are grouped as per the current rating and the type of load, list **three** final circuits installed in a grid tied solar PV system? (4 marks)
7. A hotel wanted to purchase polycrystalline solar modules for a power backup system. Outline **three** advantages of polycrystalline solar module that made the school make this choice. (3 marks)
8. Choosing the right site for mounting solar modules in a grid-tied PV system is crucial for maximizing energy production and system efficiency. Mention **four** factors to consider when choosing solar module mounting site for a grid tied solar PV system. (4 marks)

9. Creating a comprehensive site safety plan is essential for ensuring the safety of personnel and minimizing risks during the installation of grid-tied solar PV systems. State **five** components of a site safety plan for grid tied solar PV installation. (5 marks)
10. Lead acid batteries are best used in grid tied solar PV system for their durability. Outline the composition of Electrolyte as used in lead acid batteries. (2 marks)
11. Amorphous silicon (a-Si) solar cells are thin-film photovoltaic devices that are manufactured using a different process compared to traditional crystalline silicon solar cells. Briefly explain how amorphous silicon solar cells are made. (2 marks)
12. When industries dispose off batteries containing lead, they must take precautions to prevent environmental contamination. List **two** dangers associated with lead disposal to the environment. (2 marks)

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SECTION B: (60 Marks)

Attempt Only THREE questions

13. It is your first week in a solar PV installation firm and your supervisor has asked you to prepare a simple sketch of grid-tied solar PV system.
- a) Draw a wiring diagram of a simple single-phase AC grid-tied solar PV system. (10 marks)
 - b) List **ten** component of the system in wiring diagram a) above. (10 marks)
14. a) By following start up procedures you can ensure the successful installation and integration of a grid tied solar system. Describe the start-up procedures during grid tied solar PV installation? (16 marks)
- b) Give any **four** benefits of licensing a solar PV installer. (4 marks)
15. a) (i) If a charge controller is not used in a solar home system, several potential issues may arise. Outline this potential issues. (4 marks)
- (ii) What is the effect of temperature on the output of a solar PV module? (2 marks)
- b) Describe the procedure used to verify current and voltage on grid tied solar PV installation components. (10 marks)
 - c) What is the difference between string and array with reference to solar system design? (4 marks)
16. a) Balance of System (BOS) refers to all the components of a solar photovoltaic (PV) system other than the solar panels themselves. While solar panels are the most visible part of a solar PV installation, the BOS components are essential for the proper functioning and integration of the system. Name **five** (BOS) components. (5 marks)
- b) With the aid of a single line diagram, describe the arrangement of a Grid Tie Hybrid system which includes (i)solar PV (ii) wind power (10 marks)
 - c) Commissioning solar PV systems verifies that the installation has been adequately and safely completed according to plans. Outline the key steps of a commissioning procedure. (5 marks)

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