TEVETA

Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN ELECTRICAL TECHNOLOGY

LEVEL 6 YEAR II EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: APRIL/MAY 2026

SUBJECT: SOLAR TECHNOLOGY

TIME: THREE (3) HOURS

TOTAL MARKS: 100
PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

1. Write your examination number and national registration card numbers on the answer booklet provided. Ensure to append your signature in the space provided on the answer booklet.
2. Write your answer SCRIPT SERIAL NUMBER on the examination register provided and entry slip.
3. There are EIGHT (8) questions in this paper. Question one (1) is compulsory
4. Answer any other four (4) questions from the remaining seven (7)
5. Each question carries 20 marks.
6. Cell phones and programmable calculators are not allowed in the examination room.
7. No candidate is allowed to leave the examination room within the first hour and the last thirty (30) minutes before the end of the examination.

DO NOT TURN THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

QUESTION 1

A. Define the term Standard Operating Procedures (SOPs). (2 marks)

B. Explain the importance of SOPs in the operation of PV systems. (5 marks)

C. Explain the role of **SCADA** in monitoring and controlling solar power systems. (5 marks)

D. Given that a PV panel generates 250 W per module and a system has 20 modules, calculate the total system capacity. (4 marks)

E. A solar battery has an open-circuit voltage of 12.6V and a measured **load** voltage of 11.8V. Determine the voltage drop and explain its implications. (4 marks)

Total [20 marks]

QUESTION 2

A. State four (4) key maintenance tasks for solar equipment (4 marks)

B. Explain the benefits of solar-powered agricultural products, such as solar pumps and sprinklers. (6 marks)

C. A solar refrigerator requires 400 Wh/day to operate efficiently. If it is powered by a 100W solar panel, calculate the number of hours of sunlight needed daily to sustain operation. (5 marks)

D. Solar lanterns have a battery capacity of 1200mAh at 3.7V. If a load consumes 300mA, calculate how many hours the lantern will run before depletion. (5 marks)

Total [20 marks]

QUESTION 3

A. Explain the differences between ground mount and roof mount PV systems (4 marks)

B. Explain the importance of solar panel orientation and tilt angle in maximizing energy efficiency. (5 marks)

C. A PV module weighs 18 kg, and the mounting structure must support a total of 10 modules. Calculate the required support structure load capacity. (5 marks)

D. A solar panel experiences 20% shading due to a nearby structure. If its normal power output is 200W, calculate the expected power reduction. (6 marks)

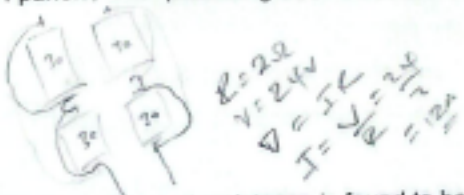
Total [20 marks]

QUESTION 4

A. Describe the differences between home lighting systems and street lighting systems, focusing on installation procedures. (5 marks)

B. Explain the steps involved in carrying out physical inspection before commissioning a solar system. (5 marks)

C. A solar array consists of 4 panels, each producing 30V. Calculate the total output voltage in:



i. series. (2 marks)

ii. parallel (2 marks)

iii. series-parallel (2 marks)

D. A system undergoes continuity testing and resistance is found to be 2Ω. If the applied voltage is 24V, calculate the expected current flow. (4 marks)

Total [20 marks]

QUESTION 5

A. Define solar energy (2 marks)

B. Describe the role of solar energy in renewable energy solutions (4 marks)

C. Compare and contrast off-grid and Grid-tied systems (5 marks)

D. State one (1) advantage and disadvantage of each system in 'C' above. (4 marks)

E. A house consumes 5 kWh/day and operates on a stand-alone PV system. If the region has 5 peak sun hours per day, calculate the required solar panel capacity assuming 80% efficiency. (5 marks)

Total [20 marks]

QUESTION 6

A. Explain three (3) distinctions between series, parallel, and series-parallel connections for solar panels. (6 marks)

B. Explain the operation of 3-phase inverters (4 marks)

C. A 48V solar battery bank is configured using 12V batteries connected in series. Calculate the number of batteries required. (5 marks)

D. A solar inverter has an input power of 1200W and operates with an efficiency of 85%. Calculate the output power. (5 marks)

Total [20 marks]

QUESTION 7

A. Describe the unit of solar energy received and explain its significance in solar system sizing. (4 marks)

B. Explain the different solar PV system types by stating when each is most appropriate. (6 marks)

C. A household uses 300W per appliance for 8 hours daily. Calculate the total watt-hour consumption per day. (5 marks)

D. A PV module has a peak power rating of 250W and the system requires 5 kW of total capacity. Calculate the number of modules required (5 marks)

Total [20 marks]

QUESTION 8

A. Describe the importance of hazard and shading assessments before installing a solar system. (5 marks)

B. Explain measuring tools used for site assessment and their importance in determining installation feasibility (5 marks)

C. A site receives an average solar irradiation of 4 kWh/m²/day. If a solar panel has an efficiency of 20%, calculate the energy generation potential per square meter. (5 marks)

D. A 12V battery system is controlled by an MPPT charge controller, which operates at 95% efficiency. If the battery requires 500W of charging power, calculate the required input power. (5 marks)

Total [20 ma

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