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**ELECTRICAL AND SOLAR
INSTALLATION TECHNOLOGY**

June/July 2023

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING
(POWER OPTION)
(TELECOMMUNICATION OPTION)
(INSTRUMENTATION OPTION)**

MODULE I

ELECTRICAL AND SOLAR INSTALLATION TECHNOLOGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Non-programmable electronic calculator;

Drawing instruments;

This paper consists of EIGHT questions in TWO sections; A and B.

Answer THREE questions from section A and TWO questions from section B in the answer booklet provided.

All questions carry equal marks.

Maximum marks for each part of a question are as indicated.

Candidates should answer the questions in English.

This paper consists of 5 printed pages.

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

SECTION A: ELECTRICAL INSTALLATION TECHNOLOGY

Answer any **THREE** questions from this section.

1. (a) List **four** safety protective wear used in the workshop and for each case state one function. (4 marks)
- (b) Outline **two** maintenance practices for electrical tools. (2 marks)
- (c) Explain each of the following elements of a thermal power station:
- (i) boiler;
 - (ii) condenser;
 - (iii) prime mover. (6 marks)
- (d) (i) Draw a labelled diagram of a surge tank with reference to hydro power stations.
- (ii) State **two** merits of a hydro-electric power station.
- (iii) Explain the term 'white meter'. (8 marks)
2. (a) (i) **Table 1** shows types of measuring instruments, quantity and unit they measure.

Complete the table.

Table 1

TYPE OF INSTRUMENT	QUANTITY	UNIT
Ammeter		
Voltmeter		
Ohmmeter		
Wattmeter		

- (ii) Draw a schematic diagram of a wattmeter measuring power in a single phase load. (7 marks)
- (b) (i) Outline **three** reasons for carrying out effectiveness of earthing test in a complete electrical installation.
- (ii) Name the instrument and reading expected in the test in (b)(i). (5 marks)
- (c) With the aid of a labelled diagram, describe the polarity test procedure on a circuit with one lamp controlled by one way switch using an ohmmeter. (8 marks)

3. (a) Explain the following as used in cable size selection:
- (i) permissible voltage drop;
 - (ii) ambient temperature. (4 marks)
- (b) Distinguish between each of the following methods of joining electrical conductors:
- (i) soldering bit;
 - (ii) pot and laddle. (4 marks)
- (c) (i) Draw the following accessories used in steel conduit wiring system:
- I. end box;
 - II. tee box;
 - III. spacer bar saddles.
- (ii) State **three** I.E.E regulations requirements regarding conduits wiring systems. (6 marks)
- (d) Draw a labelled diagram of catenary wiring system. (6 marks)
4. (a) (i) Define 'final circuit'.
- (ii) State four I.E.E regulations requirements regarding final circuits. (6 marks)
- (b) **Figure 1** shows the plan of a house.

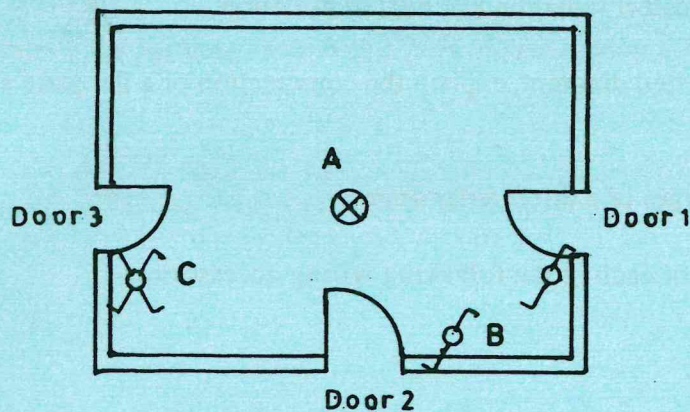


Fig. 1

- (i) Identify the electrical symbols A, B and C.
- (ii) Draw the wiring diagram of the electrical installation layout. (6 marks)

- (c) (i) State **two** advantages of a cartridge fuse;
(ii) Draw a labelled diagram of the fuse in (c)(i). (5 marks)
- (d) Draw a labelled diagram of an earthing protection system for a house. (3 marks)
5. (a) Outline **three**:
- (i) indications of a fully charged lead-acid battery cell.
(ii) merits of a lead acid battery. (6 marks)
- (b) Draw a circuit diagram of a constant voltage charging method of a battery. (4 marks)
- (c) (i) List **three** types of electric bells.
(ii) Draw a labelled diagram of a 12 V bell operated by a bell switch via a bell transformer. (7 marks)
- (d) Explain the purpose of relay switches in alarm circuits. (3 marks)

SECTION B: SOLAR INSTALLATION TECHNOLOGY

Answer any TWO questions from this section.

6. (a) Explain **two** solar energy conversions. (4 marks)
- (b) Distinguish between direct radiation and diffuse radiation. (4 marks)
- (c) With the aid of a labelled diagram, explain the construction of a flat plate solar collector. (7 marks)
- (d) Draw a labelled diagram of a direct solar drier. (5 marks)
7. (a) Explain the function of each of the following wiring accessories:
- (i) ceiling rose;
(ii) top plug. (4 marks)
- (b) (i) State **two** wiring systems used for solar P.V installation.
(ii) With aid of a labelled diagram, explain the procedure of making a Britannia joint. (8 marks)

- (c) Outline the constructional features of each of the following solar cells:
- (i) monocrystalline;
 - (ii) polycrystalline. (4 marks)
- (d) Draw a labelled wiring diagram of a solar P.V installation. (4 marks)
8. (a) Explain the following terms as used in solar installations:
- (i) tracking;
 - (ii) depth of discharge. (4 marks)
- (b) (i) Outline **two** factors considered when sizing the following solar P.V devices:
- I. inverter;
 - II. charge controller.
- (ii) A 12 V solar PV home system has a demand of 360 Wh. Determine the ampere-hour consumed by the system. (6 marks)
- (c) Outline **three**:
- (i) maintenance procedures of a P.V solar module;
 - (ii) causes of solar battery having a low state of charge after being charged during the day. (6 marks)
- (d) Illustrate the earthing system of a pole mounted solar P.V module. (4 marks)

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