

2601/105  
2602/105  
2603/105  
ELECTRICAL AND SOLAR  
INSTALLATION TECHNOLOGY  
Oct./Nov. 2022  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**DIPLOMA IN ELECTRICAL AND ELECTRONICS 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 TWO sections; A and B.*

*Answer any THREE questions from section A and any TWO questions from section B.*

*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.**

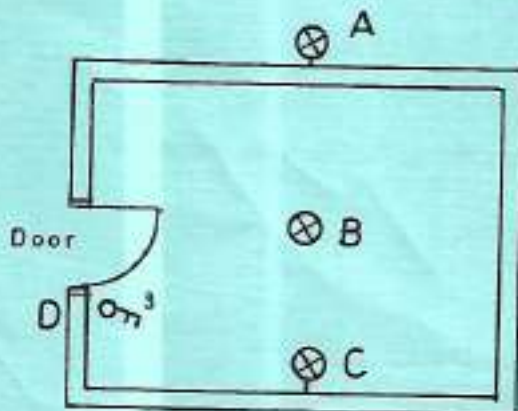
**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**



## SECTION A: ELECTRICAL INSTALLATION

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

1. (a) State two advantages of each of the following materials used in electrical cables:
- (i) copper;
  - (ii) rubber. (4 marks)
- (b) (i) Draw a labelled construction diagram of a MIMS cable.  
(ii) State **two** advantages of the cable in (b)(i). (5 marks)
- (c) (i) Explain the following factors that determine the type of wiring system for an electrical installation:
- I. cost;
  - II. safety.
- (ii) Explain **two** reasons for using flexible conduits in electrical installations. (6 marks)
- (d) (i) Draw a labelled diagram of a busbar trunking wiring system:  
(ii) State **two** merits of the wiring system in (d)(i) over the conduit system. (5 marks)
2. (a) (i) Distinguish between ring and radial power circuits.  
(ii) State **two** I.E.E regulations requirements regarding the circuits in (a)(i). (6 marks)
- (b) Figure 1 shows the electrical layout of a plan of a room. A three gang, 1-way switch controls lamps A, B and C. Draw the wiring diagram. (4 marks)



### KEY:

- A - Security lamp
- B - Room lamp
- C - Wall mounted lamp
- D - 3 Gang way switch

Fig.1



- (c) Define the following as used in electrical installations:
- (i) earthing;
  - (ii) earth lead;
  - (iii) earth continuity conductor. (6 marks)
- (d) Draw a labelled schematic diagram of a current operated earth leakage circuit breaker. (4 marks)
3. (a) (i) State the measuring instrument that measures the following electrical quantities:
- I. power;
  - II. resistance.
- (ii) Draw a circuit diagram showing connection of an ammeter and a voltmeter to a load. (5 marks)
- (b) (i) Outline **four** reasons for testing and inspecting an electrical installation.
- (ii) Illustrate the continuity test for a circuit having one socket. (7 marks)
- (c) (i) Describe 'structured cabling'.
- (ii) List **five** components of structured cabling. (8 marks)
4. (a) (i) List **three** types of Bell indicator elements.
- (ii) With aid of a labelled diagram, explain operation of a trember bell. (10 marks)
- (b) Outline **four** safety precautions observed in a battery charging room. (4 marks)
- (c) (i) Draw a labelled circuit diagram of trickle charging current method of a battery.
- (ii) A 30 V, DC supply is used to charge six battery cells with e.m.f per cell 1.9 V. Determine the settings of a variable resistor to give an initial charging current of 4 A. (6 marks)
5. (a) (i) Explain 'Electric shock' with reference to safety.
- (ii) Outline the procedure for rescuing a colleague who has received an electric shock and is in contact with live wires. (6 marks)
- (b) State the function of the following workshop tools:
- (i) combination pliers;
  - (ii) hacksaw;
  - (iii) screw driver. (6 marks)



- (c) (i) Outline **two** factors considered when selecting a site for a nuclear power station.  
(ii) Draw a labelled line diagram of a typical electrical distribution and transmission system and indicate the voltage levels. (8 marks)

### SECTION B: SOLAR INSTALLATION TECHNOLOGY

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

6. (a) Explain each of the following terminologies with reference to solar sizing:  
(i) daily system energy requirement;  
(ii) battery capacity. (4 marks)

- (b) A domestic house consists of the following loads:

One - 10 W fluorescent lamps used daily for 4 hours

Four - 8 W LED lamps used daily for 3 hours

One - 2 W mobile phone charger used daily for 3 hours

The house is supplied by a 12 V DC system; if the system losses are 15%, determine the:

- (i) total energy demand;  
(ii) system energy requirement;  
(iii) ampere hour supplied by the battery. (7 marks)

- (c) Outline the maintenance procedure for lamps and switches. (6 marks)

- (d) List **three** documents containing information required for carrying out troubleshooting and repair of a solar PV installation. (3 marks)

7. (a) Define the following solar energy terminologies:

- (i) irradiance;  
(ii) diffuse radiation. (4 marks)

- (b) (i) Outline **four** factors that effect the amount of solar energy absorbed by a surface:

- (ii) Draw a labelled diagram of a parabolic dish concentrator. (6 marks)

- (c) State **two**:

- (i) applications of solar thermal energy;  
(ii) advantages of solar water heaters. (4 marks)

- (d) Draw a labelled diagram of a box cooker. (6 marks)

2601/105

2602/105

2603/105

Oct./Nov. 2022

8. (a) List **two** regulations governing solar PV technicians licensing in Kenya. (4 marks)
- (b) (i) Outline **four** factors that determine the output of a solar cell.  
(ii) Draw a labelled construction diagram of a solar cell. (8 marks)
- (c) State **two**:  
(i) functions of a charge controller;  
(ii) types of charge controllers. (4 marks)
- (d) Outline the procedure of installing a domestic solar PV system. (4 marks)

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