1601/105
1602/105
ELECTRICAL AND SOLAR
INSTALLATION TECHNOLOGY
Oct./Nov. 2017
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONICS ENGINEERING

MODULE I

ELECTRICAL AND SOLAR INSTALLATION TECHNOLOGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
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**.*
Maximum marks to each part of a question are indicated.
All dimensions are in millimeters.
Candidates should answer the questions in English.

This paper consists of 4 printed pages.

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

Turn over

SECTION A

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

1. (a) (i) Define the term 'final circuit'.

(ii) Explain **four** IEE regulations requirements regarding final circuits. (6 marks)

(b) Draw the wiring diagram for a final circuit serving.

(i) 3 lights each controlled by a single pole switch using ceiling-rose method.

(ii) 4 socket outlets connected in radial. Indicate the colour of cables and the appropriate fuse. (8 marks)

(c) Draw the preferred graphical symbols for the following:

(i) play;
(ii) socket-outlet;
(iii) cooker control unit;
(iv) link with separable contacts. (4 marks)

(d) Explain the reasons for testing a completed installation before being connected to power supply. (2 marks)

2. (a) Name:

(i) **three** types of a.c power supply systems;
(ii) **four** electric power authorities in Kenya. (5 marks)

(b) Draw a labelled diagram of a three phase 4-wire distribution system. Include **three** domestic and **one** industrial consumers. (9 marks)

(c) With the aid of a diagram, describe the polarity test of a switch with circuit dead. (6 marks)

3. (a) State **two** types of conductor materials for cables. (2 marks)

(b) With the aid of cross-sectional diagrams, differentiate between twin core and twin concentric cables. (6 marks)

(c) State **four** rating factors considered when determining the size of an electric cable. (4 marks)

(d) A two-core copper cable supplies current to a 240 V single phase load of 20 kW at 0.8 power factor lagging. The cable is 50 metres long and each conductor has a cross-sectional area of 35 mm^2. Determine the voltage drop in the cable. Take resistivity of copper as 17.5 $\mu\Omega$ mm. (8 marks)

4. (a) State **three** merits of cartridge fuses. (3 marks)

(b) Draw a labelled cross sectional diagram of a high breaking capacity fuse. (5 marks)

(c) Explain the following with respect to earthing:

(i) earth electrode;
(ii) earth continuity conductor;
(iii) earthing lead. (6 marks)

(d) With the aid of a diagram, explain the operations of a voltage operated earth leakage circuit breaker. (6 marks)

5. (a) List **two** types of alternating current machines. (2 marks)

(b) (i) Draw a labelled diagram showing construction features of a D.C machine.

(ii) Describe any **three** parts in (b)(i). (8 marks)

(c) Draw a labelled schematic diagram of capacitor start capacitor run single phase induction motor. (5 marks)

(d) Outline **five** procedures followed when dismantling an electric machine for repair. (5 marks)

SECTION B

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

6. (a) Explain the following solar terminologies:

(i) insolation;
(ii) solar constant. (4 marks)

(b) (i) Describe the principle of solar radiation.

(ii) State **three** types of radiations in (b)(i). (6 marks)

(c) Outline **two**:

(i) applications of solar energy;
(ii) methods of harvesting solar energy. (2 marks)

(d) (i) With the aid of a diagram differentiate between direct and diffuse radiations.

(ii) Explain the effect of shading on solar systems. (8 marks)

7. (a) (i) Define the term 'wiring systems'.

(ii) State **four** factors considered when selecting a wiring system for a particular solar system. (4 marks)

(b) Draw a labelled block diagram of a solar electric system. (6 marks)

(c) Outline the procedure recommended when installing a solar electric system. (6 marks)

(d) Table 1 shows results of trouble shooting of solar electric system. Complete the table.

Table 1

Problem	Cause	Remedy
Tripped circuit breakers or blown fuse		
Fluorescent lamp does not work		

(4 marks)

8. (a) Explain the following with respect to solar energy:

(i) total daily energy requirements;
(ii) peak-sun hours. (4 marks)

(b) Outline **four** steps followed when determining total daily energy required in (a)(i). (8 marks)

(c) A solar system has daily energy requirement of 300 watt-hours. The 12 V storage battery has a maximum allowable daily depth of discharge of 0.4 and the number of storage days is 5. Determine the battery capacity for the system. (5 marks)

(d) State **three** maintenance checks done on the wiring of a solar installation. (3 marks)

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