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ELECTRICAL AND SOLAR
INSTALLATION TECHNOLOGY

June/July 2022

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 6 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) (i) List **two** safety protective wear used in a workshop.
- (ii) State **two** causes of accidents in workshops. (4 marks)
- (b) Describe the following fire extinguishers:
- (i) carbondioxide;
- (ii) water extinguisher;
- (iii) dry powder. (6 marks)
- (c) (i) List the tools and equipment required in steel conduit work.
- (ii) Explain the care and maintenance of tools in a workshop. (6 marks)
- (d) Explain the following as used in structured cabling:
- (i) backbone cabling;
4. (ii) horizontal cabling. (4 marks)
2. (a) (i) Outline **four** factors considered while choosing a site for a steam power station.
- (ii) Draw a schematic diagram of a steam power station. (10 marks)
- (b) (i) State **two** I.E.E.E regulations - requirements regarding ceiling cables.
- (ii) Outline the information required by Kenya Power Company from a client for a completed building to be connected to the power supply. (4 marks)

① Steam Structural

② Valve house

③ Steam turbine

④ Atomator

1. Transport
2. Land
3. Availability of water

Valve house
Steam turbine
Storage

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(c) Figure 1 shows the electrical layout of a workshop.

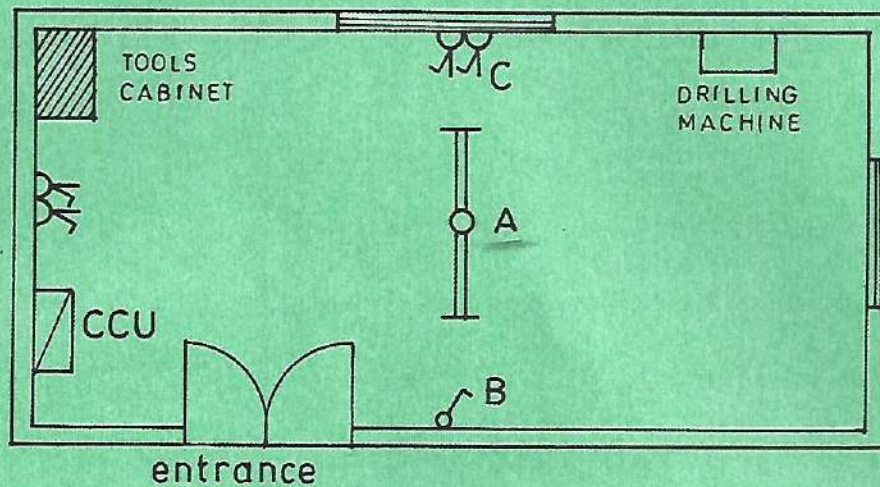


Fig. 1

- (i) Identify the electrical symbols labelled A, B and C.
- (ii) Draw the wiring diagram of the installation. (6 marks)
3. (a) Outline the procedure of determining the cable size for an electrical installation. (5 marks)
- (b) (i) List **two** types of cable joints. (5 marks)
- (ii) State **three** I.E.E.E regulations requirements regarding electrical cables. (5 marks)
- (c) (i) State **two** merits of metallic conduits. (5 marks)
- (ii) Outline **three** I.E.E.E regulations requirements regarding conduits installation. (5 marks)
- (d) (i) Outline **two** factors considered when selecting a wiring system for a particular electrical installation. (5 marks)
- (ii) Draw a labelled cross-section diagram of a PVC sheathed cable twin with earth. (5 marks)

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4. (a) State **two**:
- (i) reasons for using protective switchgear in electrical installations;
 - (ii) merits of cartridge fuses. (5 marks)
- (b) Draw a labelled diagram of a high breaking capacity fuse. (5 marks)
- (c) (i) Draw a circuit diagram of a PME system. 5
- (ii) State **two** merits of the system in c(i). (7 marks)
- (d) Outline **three** reasons for testing an electrical installation. (3 marks)
5. (a) (i) Explain the trickle charge method of charging a battery.
- (ii) State **two** merits of an alkaline battery. ✓ (5 marks)
- (b) A car battery of 6 cells is to be charged at 8A from a 20 V d.c power supply. The terminal voltage of each cell is 1.9 V. Determine the resistance required for this charging current. Neglect the internal resistance of the cells. (3 marks)
- (c) (i) Draw a circuit diagram of an open-circuit alarm system.
- (ii) State **three** merits of the system in c(i). (7 marks)
- (d) With aid of a circuit diagram, explain the operation of a wattmeter connected to a single phase supply. (5 marks)

Generator → Compressor → Alternator
Turbine

SECTION B: SOLAR INSTALLATION TECHNOLOGY

Answer any TWO questions from this section.

6. (a) Describe each of the following accessories as used in P.V solar installations:
- (i) switches;
 - (ii) socket outlets.
- (4 marks)

- (b) (i) Outline the tests carried out in completed solar installations.
- (ii) State **two** types of wiring systems used in P.V solar installations.
- (6 marks)

- (c) Draw a wiring diagram of a P.V solar installation to supply both D.C and A.C loads.
- (6 marks)

- (d) Explain:
- (i) **three** functions of a charge controller;
 - (ii) tracking for a P.V module.
- (4 marks)

7. (a) Explain the following terms used in solar energy systems:

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

- (b) (i) Distinguish between direct and diffuse radiation as used in solar energy systems.

- (ii) State the **three** solar energy conversions.
- (7 marks)

- (c) (i) Outline **three** methods of harvesting solar energy.

- (ii) (I) Draw a labelled diagram of a direct solar drier.

- (II) State **two** merits of a solar drier in c(ii)(I).
- (9 marks)

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8. (a) Outline **three**:

- (i) factors considered when mounting a P.V solar module;
- (ii) maintenance procedures carried out on a P.V solar module.

(6 marks)

(b) State **three** factors when sizing a:

- (i) solar battery;
- (ii) D.C - A.C solar inverter.

(6 marks)

(c) A house has the following electrical appliances:

- Two, 8 watts energy saving lamps used 6 hours per day
- One, 60 watts coloured T.V used for 3 hours per day.
- One, 3 watts mobile charger used for 2 hours per day.

If the system losses are 20%, determine the:

- (i) total daily load energy demand;
- (ii) total daily system energy requirements;
- (iii) charge requirement if the system voltage is 12V.

(8 marks)

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