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**SOLAR AND ELECTRICAL
INSTALLATION TECHNOLOGY**

June/July 2020

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

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

MODULE I

SOLAR AND ELECTRICAL 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.

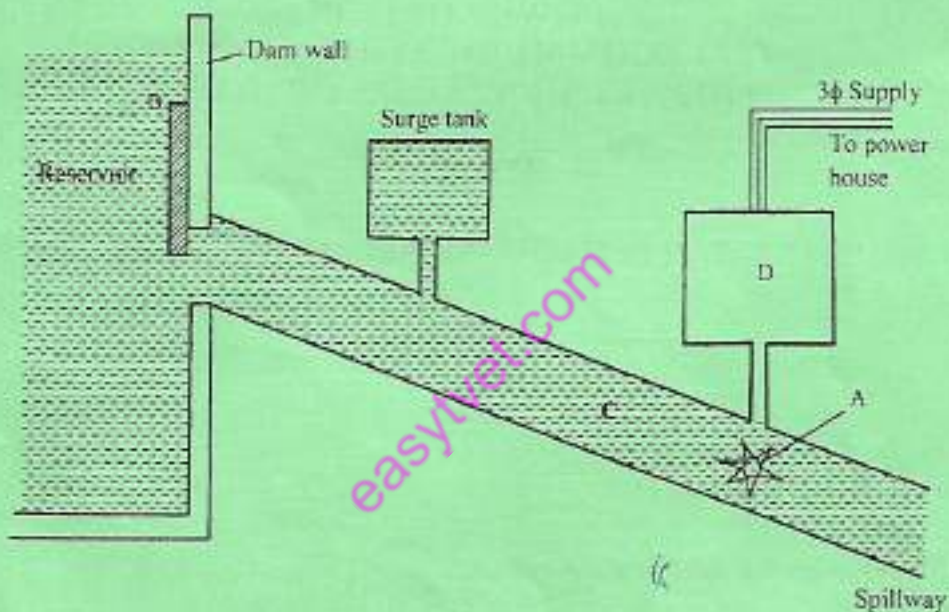
This paper consists of 7 printed pages.

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.

4. (a) Outline **four** safety measures observed when working with electrical equipment. (4 marks)
- (b) State **four** classes of fire citing an example of each. (4 marks)
8. (c) Draw a circuit diagram of each of the following distribution systems:
- (i) D.C two wire system;
- (ii) A.C two wire system. (4 marks)
- (d) Figure 1. shows a layout diagram of an electrical power plant.



10. (i) Identify the type of power plant;
- (ii) Identify the parts labelled A, B, C and D.
- (iii) State the functions of parts A and B. (8 marks)
2. (a) (i) Name **three** parts of a lead acid cell. (6 marks)
- (ii) State **three** indications of a fully charged lead acid cell.
- (b) (i) Explain the constant voltage charging method of a lead - acid cell.
- (ii) A battery of 6 cells is to be charged form a 20 V d.c supply. The terminal voltage of each cell in 2 V. Determine the value of resistance to give charging current of 5 A. (6 marks)

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- (c) Explain **two** functions of a fire alarm. (4 marks)
- (d) (i) Explain the operation of a closed alarm system.
 (ii) Figure 2 shows a layout of a bell circuit.

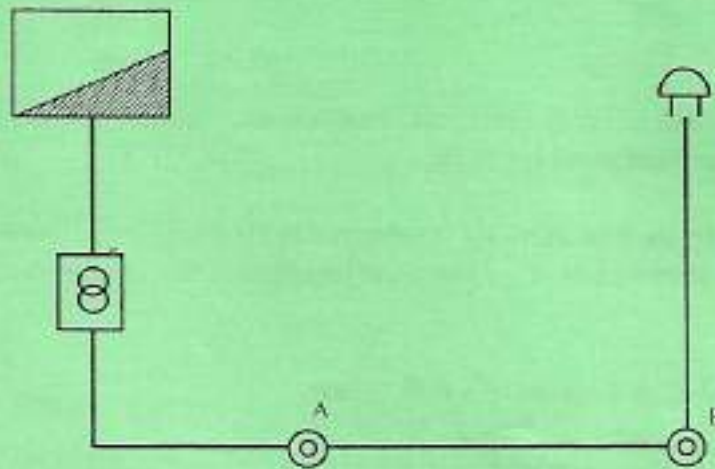


Fig. 2

Draw the wiring diagram such that the bell is operated from push button A and B independently. (4 marks)

3. (a) State **three** IEE regulation requirements regarding the consumers intake point. (3 marks)
- (b) Figure 3 shows the electrical layout of a corridor of a section a house. Draw the wiring diagram for the lamps to be operated from three independent positions. (4 marks)

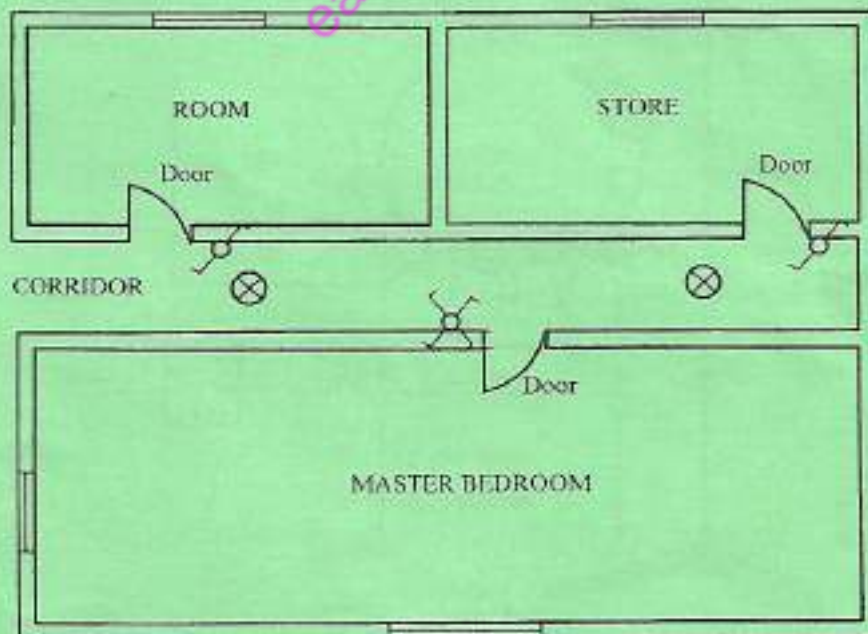


Fig. 3

- (c) (i) Illustrate the operation position of a three heat switch.
 (ii) Name four parts of an instantaneous water heater. (8 marks)
- (d) (i) Describe the insulation resistance test.
 (ii) State the instrument used and the expected reading in (d)(i). (5 marks)

4. (a) State two:
 (i) causes of fire in electrical installations.
 (ii) merits of cartridge fuses. (4 marks)
- (b) (i) Explain how earthing is achieved in electrical installations.
 (ii) List two parts of an electrical installation that can be exempted from earthing. (6 marks)
- (c) Draw a labelled diagram of a H.B.C fuse. (5 marks)
- (d) Figure 4 shows an earth leakage circuit breaker.

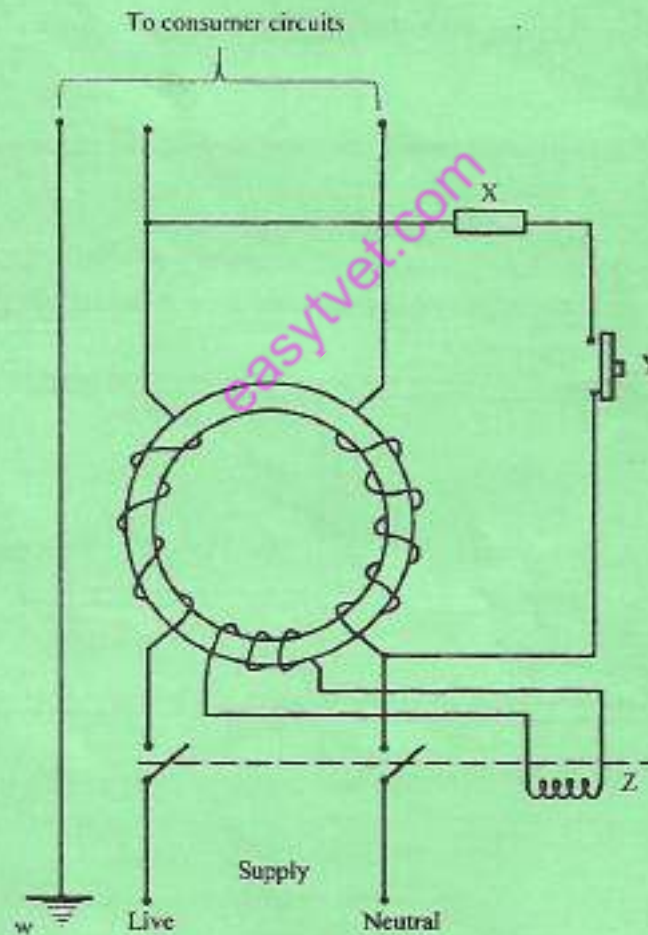


Fig. 4

Identify the:

- (i) type of circuit breaker;
- (ii) parts labelled X, Y, Z and W. (5 marks)

5. (a) Describe each of the following in relation to structured cabling system:

- (i) entrance facilities;
- (ii) horizontal cabling. (4 marks)

(b) Outline the procedure of terminating a flexible cord to a three pin plug. (4 marks)

(c) Figure 5 shows constructional features of an armored cable:

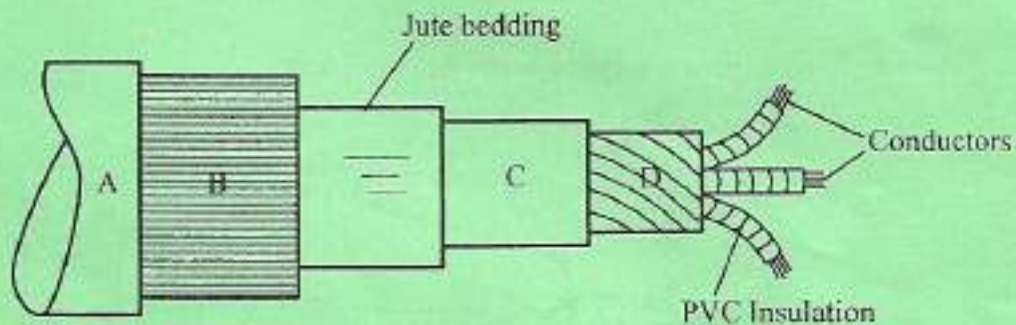


Fig. 5

- (i) Identify the cable.
 - (ii) Name the parts labelled A, B, C and D.
 - (iii) State one application of the cable. (6 marks)
- (d) Draw a labelled diagram of a Busbar Trunking rising mains wiring system. (6 marks)

SECTION B: SOLAR INSTALLATION TECHNOLOGY

Answer any TWO questions from this section.

6. (a) (i) Explain the photo electric effect. (6 marks)

(ii) State four factors that affect the output of a P.V solar module. (4 marks)

(b) Illustrate the earthing of a P.V solar module. (4 marks)

(c) Describe each of the following P.V solar module constructions:

- (i) monocrystalline;
- (ii) polycrystalline. (4 marks)

(d) Draw a block diagram of a solar electric system with both A.C and D.C loads.

(6 marks)

(a) Explain the following with references to solar system:

- (i) angle of incidence;
- (ii) diffuse radiation.

(4 marks)

(b) (i) State two types of solar energy conversions.

(ii) List two areas of applications of each conversion in (b)(i).

(6 marks)

(c) (i) Explain how solar concentrators harvest solar energy.

(ii) Name three types of solar energy concentrators.

(6 marks)

(d) Figure 6 shows a thermo - siphon water heating system.

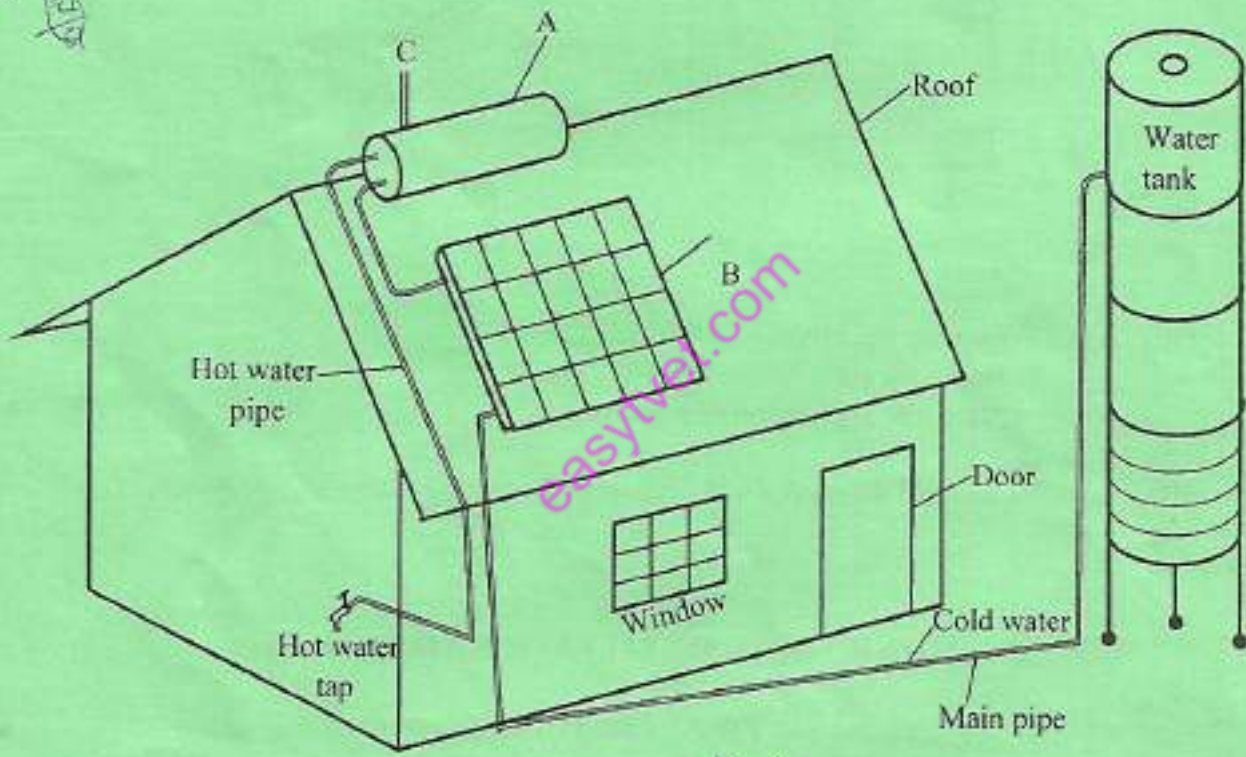


Fig. 6

(i) Identify the parts labelled A, B, C.

(ii) Explain how part B operates.

(4 marks)

8. (a) Outline the procedure of planning and designing a solar-electric system of a house.

(4 marks)

- (b) Explain each of the following as used in P.V solar installation design:
- (i) total daily energy demand;
 - (ii) days of autonomy. (4 marks)
- (c) Describe the procedure of topping the electrolyte for a solar battery during maintenance. (6 marks)
- (d) Identify **three** possible causes for each of the following faults in a solar electric installation:
- (i) battery does not charge when connected to a P.V solar module;
 - (ii) lamps do not come ON even on a sunny day. (6 marks)

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