

2601/105

2602/105

2603/105

**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.

1. (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)
- (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.

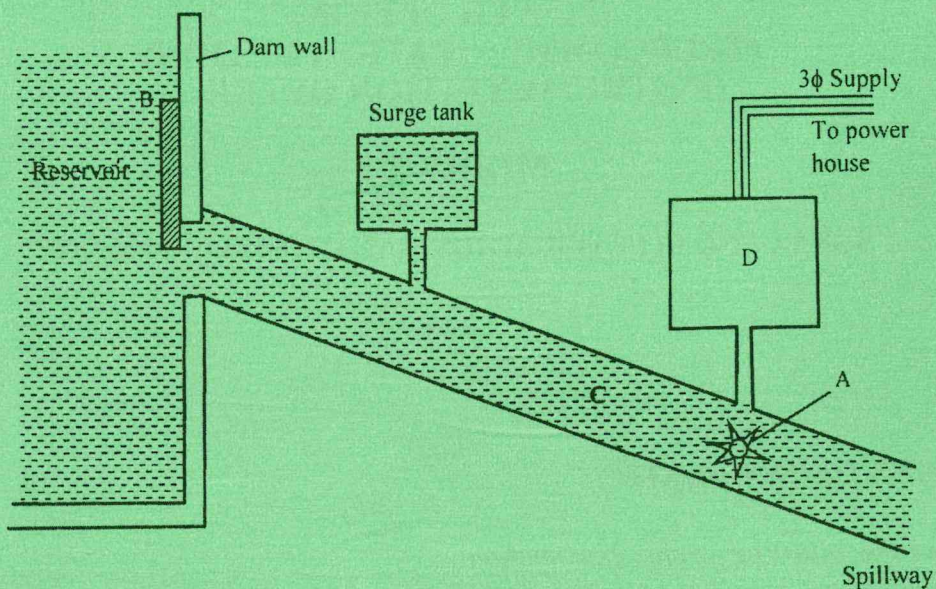


Fig. 1

- (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.
(ii) State **three** indications of a fully charged lead acid cell. (6 marks)
- (b) (i) Explain the constant voltage charging method of a lead - acid cell.
(ii) A battery of 6 cells is to be charged from a 20 V d.c supply. The terminal voltage of each cell is 2 V. Determine the value of resistance to give charging current of 5 A. (6 marks)

- (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.

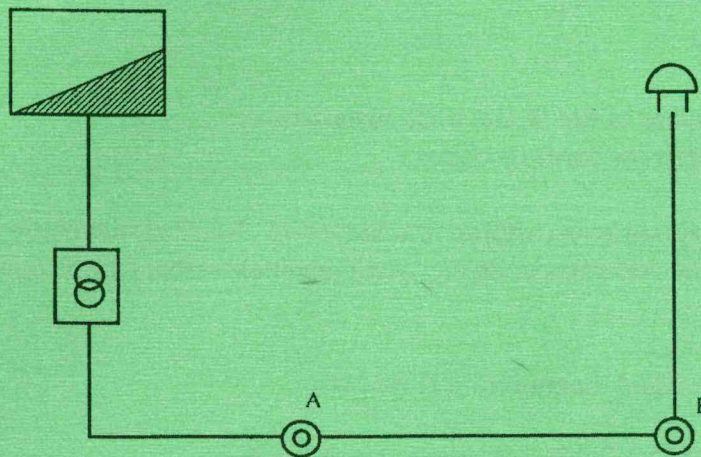


Fig. 2

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)

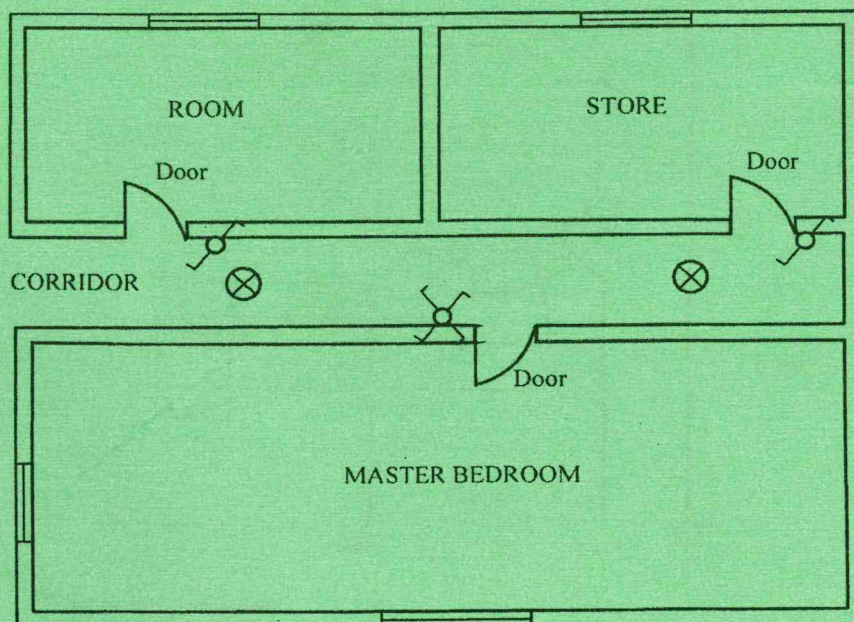


Fig. 3

- (c) (i) Illustrate the operation position of a three heat switch. (8 marks)
(ii) Name four parts of an instantaneous water heater.
- (d) (i) Describe the insulation resistance test. (5 marks)
(ii) State the instrument used and the expected reading in (d)(i).
4. (a) State two: (4 marks)
(i) causes of fire in electrical installations.
(ii) merits of cartridge fuses.
- (b) (i) Explain how earthing is achieved in electrical installations. (6 marks)
(ii) List two parts of an electrical installation that can be exempted from earthing.
- (c) Draw a labelled diagram of a H.B.C fuse. (5 marks)
- (d) Figure 4 shows an earth leakage circuit breaker.

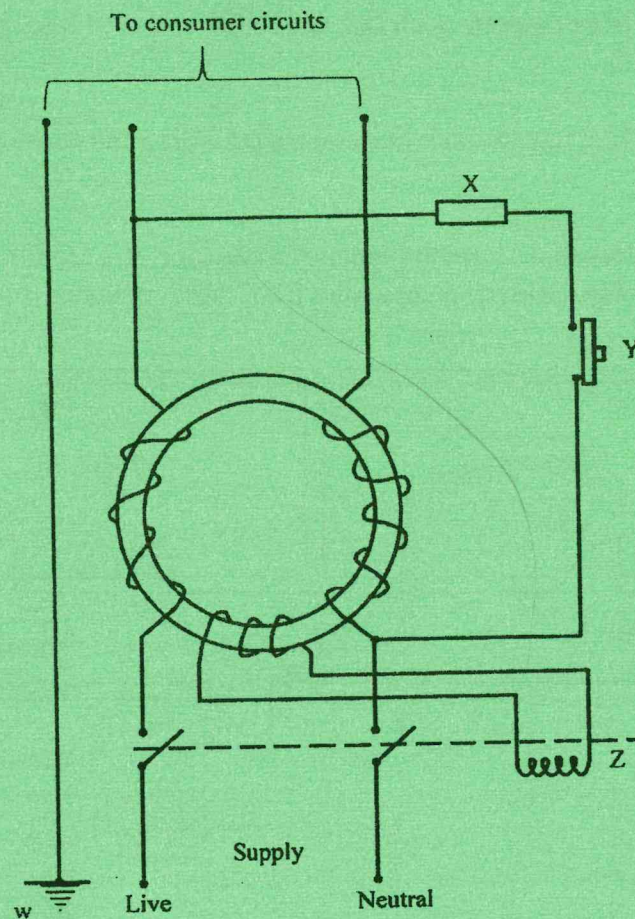


Fig. 4

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; (4 marks)
 - (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:

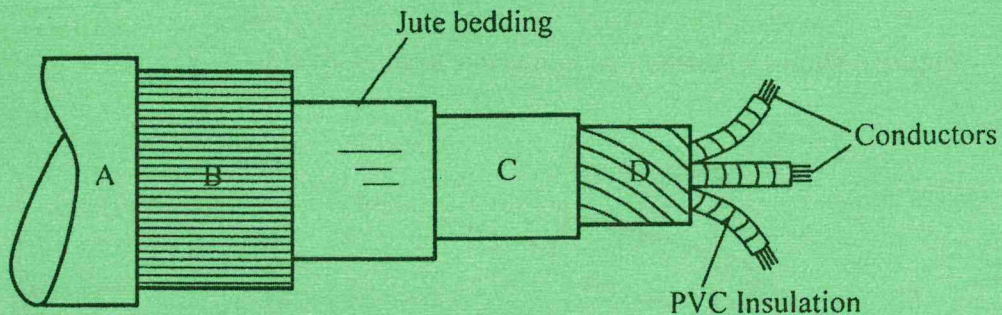


Fig. 5

- (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.
- (ii) State **four** factors that affect the output of a P.V solar module. (6 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)
7. (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.

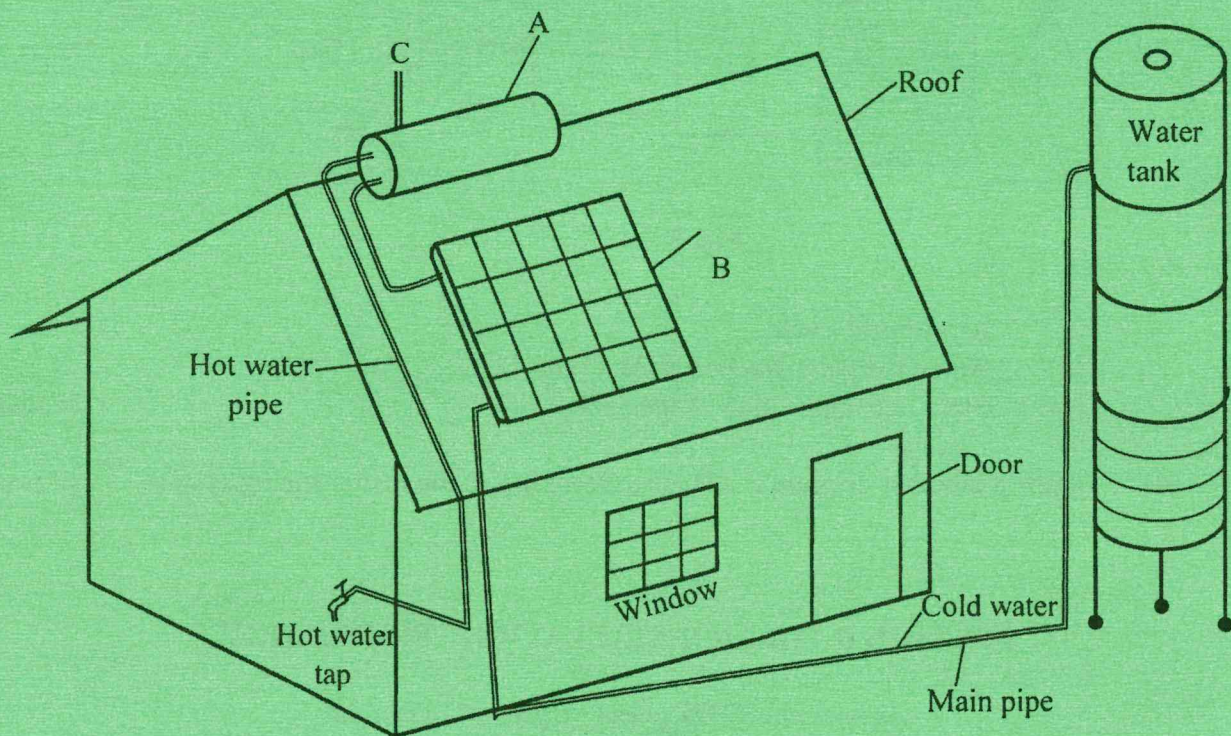


Fig. 6

- (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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