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2602/105
ELECTRICAL AND SOLAR
INSTALLATION TECHNOLOGY
June/July 2021
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 electric 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 **THREE** questions from this section.*

- (a) Explain structured cabling system as used in buildings. (2 marks)
- (b) Describe **two** components of a backbone cabling in structured cabling. (4 marks)
- (c) Draw a labelled line diagram of a consumers' intake point. (4 marks)
- (d) Figure 1 shows the electrical layout of a single room of a house.

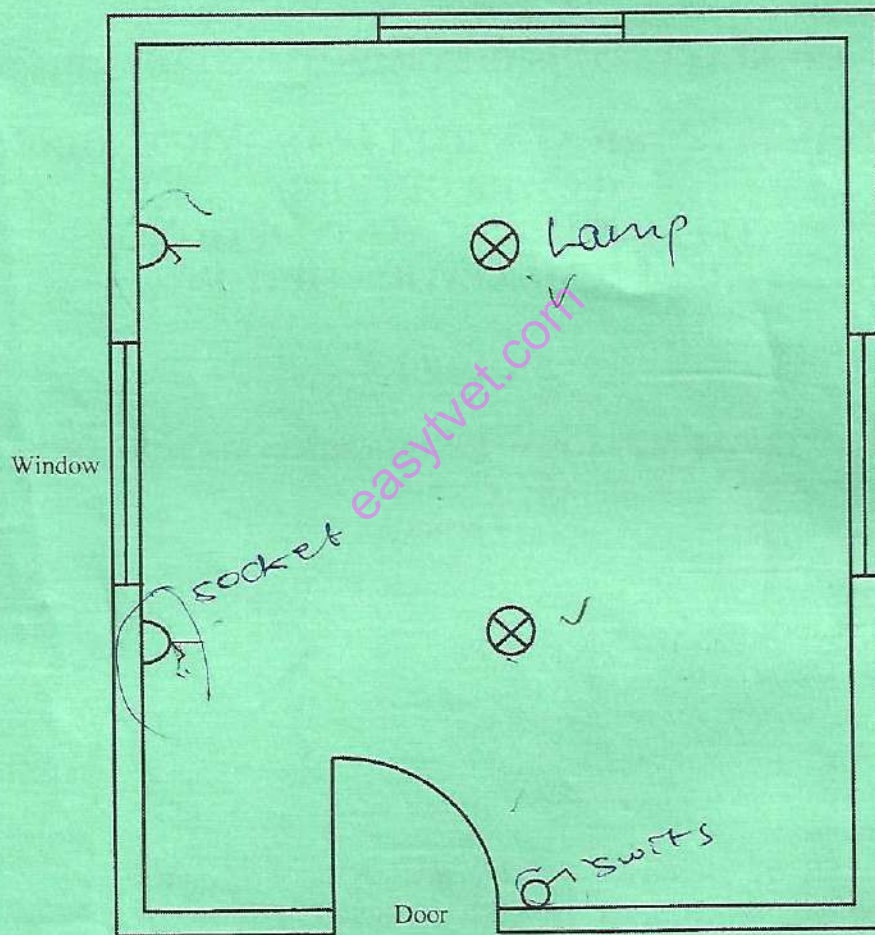


Fig. 1

pole
 |
 Cutout
 |
 meter
 |
 CBBS switchgear
 |
 fuse unit
 |
 CBBS
 14

- (i) Name the symbols shown in the plan; 14
- (ii) List **two** types of wiring systems that can be used to carry out the electrical installation.
- (iii) Draw the wiring diagram of the electrical layout and indicate cable sizes. (10 marks)



Pole → Cutout → meter → switch fuse → fuse switch
 CBS - load

2. (a) Outline the procedure for:

- (i) saving personnel and property from fire;
 - (ii) treating a person with burns.
- loosen any tight clothes on the person
 - Apply smooth jelly
 - place the hand a shade cover with
 person under
 (6 marks)

(b) Explain:

- (i) current rating of a cable;
 - (ii) the effect of temperature rise in cables.
- Amount of current a cable can carry without being destroyed
 when temperature rises it reduces resistivity of a cable hence allow more current to flow through it
 (4 marks)

(c) Distinguish between a 'joint' and a 'termination'. (4 marks)

(d) Figure 2 shows the layout of a conduit installation. (4 marks)

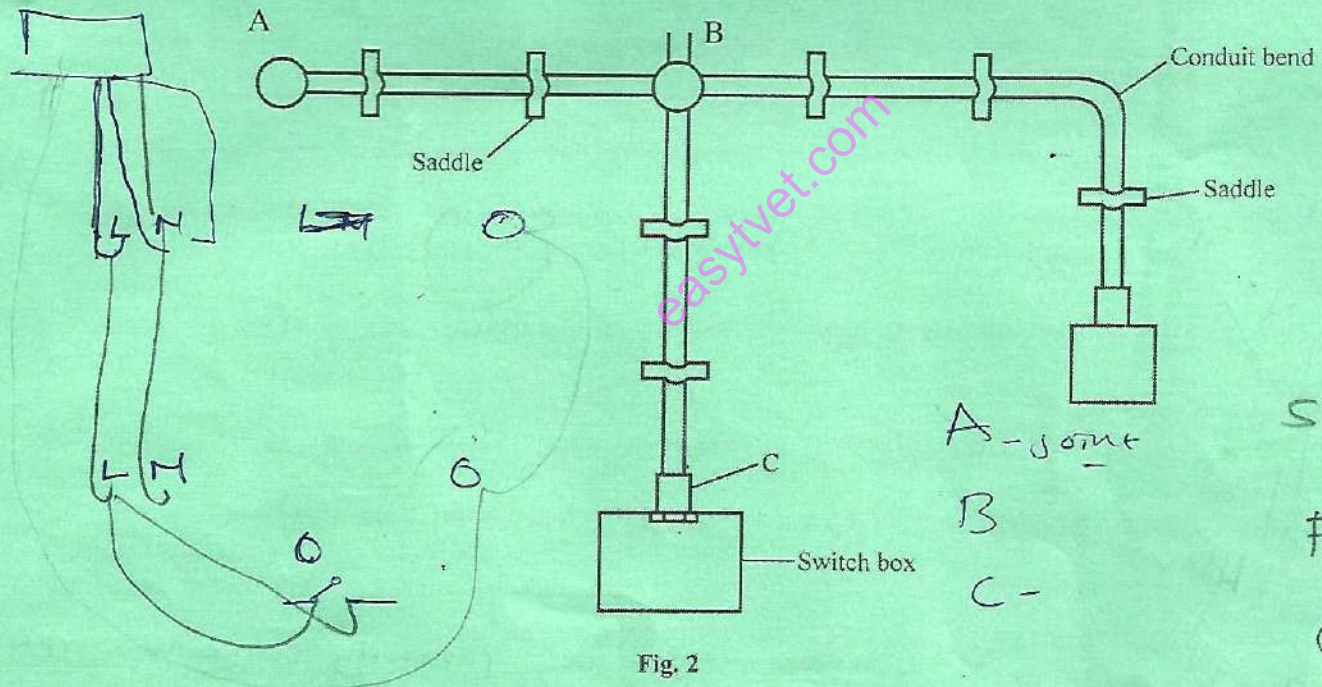


Fig. 2

- (i) Identify the parts labelled A, B and C.
- (ii) State **three** IEE relations requirements regarding the conduit wiring system. (6 marks)

3. (a) Explain the function of each of the following protective devices:

- (i) circuit breaker;
 - (ii) contactors.
- (4 marks)

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- (b) (i) List **two** classes of fuses and for each case state their fusing factors. 2
- (ii) State **four** requirements of a P.M.E system. (8 marks)
- (c) (i) Draw a labelled diagram of an 'electromagnetic overload trip' of a circuit breaker.
- (ii) Explain the operation of the devices in c(i). (8 marks)

4. (a) Table 1 shows the characteristics of the plates and electrolyte of a lead acid cell when in a fully charged and discharged state. Complete the table: (6 marks)

Table 1

Item	Fully charged state	Fully discharged state
Positive plate		
Negative plate		
Electrolyte		

- (i) A battery has a terminal voltage of 12V and internal resistance of 0.25Ω and is charged from a 14 V d.c supply. Determine the charging current.
- (ii) State **four** safety precautions observed in a battery charging room. (7 marks)
- (c) Outline **four** IEE regulation requirements of a bell transformer. (3 marks)
- (d) Draw a labelled circuit diagram of a normally closed burglar alarm system. (4 marks)
- (a) (i) State **two** merits of a hydro-electric power plant.
It is environmentally friendly since no smoke is produced = low initial cost
- (ii) Distinguish between renewable and non-renewable energy systems citing two examples of each.
Renewable energy can be reused e.g. wind which (6 marks)
- (b) Outline **four** factors considered when selecting the site for a nuclear power plant.
Availability of space = Availability of manpower
Availability of nuclear reactor (4 marks)
- (c) Draw a labelled line diagram from generation to distribution in Kenya and indicate the voltage levels at each stage. (6 marks)
- (d) List **four** electrical tests done on a completed installation. (4 marks)

insulation resistance test
Polarity test
Continuity test

Handwritten notes and scribbles on the left side of the page, including a circled '11kV', '11/132', '132/66', '66/33', '33/11kV', and '11/11kV'.

SECTION B: ENGINEERING DRAWING

Answer **TWO** questions from this section.

- dust particles
- poor connection
- Cloudy weather
- Bad incident angle

6. (a) State **four** possible causes of a P.V solar module with low or no power output. (4 marks)
- (b) Outline the maintenance checks done on each of the following:

- (i) solar battery;
 - Clean the battery terminal
 - top up electrolyte level
 - check the state of charge
- (ii) P.v solar module.
 - tightening loose nuts of the rack
 - cutting trees around
 - cleaning using water
 - checking for loose connections

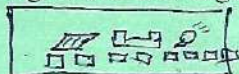
- (c) Explain each of the following factors considered when installing a solar battery:

- (i) location; - it should be located where it benefits from maximum insolation in order to obtain fully state of charge of about 15Ah should be allowed
- (ii) ventilation; - ~~at least~~ should be roof to prevent accumulation of moisture
- (iii) safety and security.
 - in case of ground mounting it should be fenced from theft and damage by animals

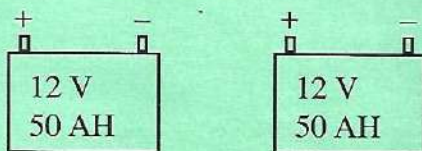
- (d) Explain **four** reasons for correct sizing of cables in solar electrical installations. (4 marks)
- helps increase efficiency
 - helps reduce risk of destruction
 - helps reduce risk of shock

7. (a) (i) State **three** merits of using solar-electricity.
 - readily available
 - no cost of electric bills
 - low risk of shock
- (ii) Explain **two** factors considered when selecting a wiring system of a solar electric installation.
 - cost
 - safety

- (b) Draw a labelled diagram of a charge controller and show its terminal connections. (3 marks)

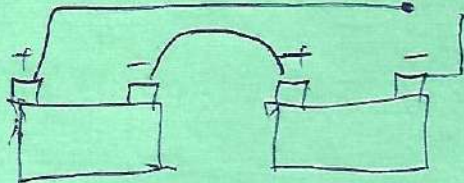


- (c) Figure 3 shows two batteries with same specifications.



Draw the battery connections and show the total voltage, ampere hours and power output in each case when connected in:

- (i) parallel;
 (ii) series.

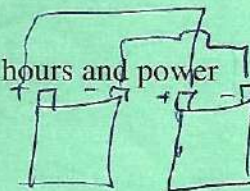


parallel

total voltage

12 V

Current 100 Ah



total voltage = 24 V

(10 marks)

Current 50 Ah

8. (a) Explain each of the following solar terminologies:
- (i) tracking;
 - (ii) insolation.
- (4 marks)
- (b) State **three**:
- (i) methods of harvesting solar energy;
 - (ii) applications of solar-thermal energy.
- (6 marks)
- (c) Outline **four** factors that determine the amount of heat absorbed in a solar flat plate collector.
- (4 marks)
- (d) Draw a labelled diagram of a solar flat plate collector.
- (6 marks)

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