1601/105
1602/105
ELECTRICAL AND SOLAR
INSTALLATION TECHNOLOGY
June/July 2021
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONICS ENGINEERING (POWER OPTION) (TELECOMMUNICATION OPTION)

MODULE I

ELECTRICAL AND SOLAR INSTALLATION TECHNOLOGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
- *Non-programmable scientific calculator/mathematical tables;*
- *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** in the answer booklet provided.*
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.

Turn over

SECTION A: ELECTRICAL INSTALLATION TECHNOLOGY

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

1. (a) (i) State **three** IEE regulations requirement for the consumers intake point.

(ii) Draw a line diagram showing the sequence of control equipment at the consumer's intake point.

(8 marks)

(b) (i) State **two** ways of controlling a lamp from multiple positions.

(ii) Using the ceiling rose method, draw a wiring diagram of one lamp controlled from one position.

(5 marks)

(c) Outline **three** IEE regulation requirements regarding 13 A socket outlets.

(3 marks)

(d) Draw and label a diagram of a non-instantaneous water heating system.

(4 marks)

2. (a) Name **three**:

(i) authorities of power generation in Kenya.

(ii) sources of electrical energy.

(6 marks)

(b) Draw a labelled block diagram of a diesel power plant. (4 marks)

(c) Describe each of the following parts of a hydro electric power plant.

(i) dam;
(ii) generator.

(4 marks)

(d) Draw the following electrical distribution system:

(i) A.C **two** wire;

(ii) A.C **three** phase 3 wire.

(6 marks)

3. (a) State **three** properties of a good:

(i) conductor;
(ii) insulator.

(6 marks)

(b) Describe the construction of a P.V.C cable. (2 marks)

(c) Outline the procedure of soldering a cable joint using a soldering iron. (4 marks)

(d) (i) State **three** IEE regulation requirements regarding cables and conductors.

(ii) Figure 1 show the construction diagram of a PILCSWA cable.

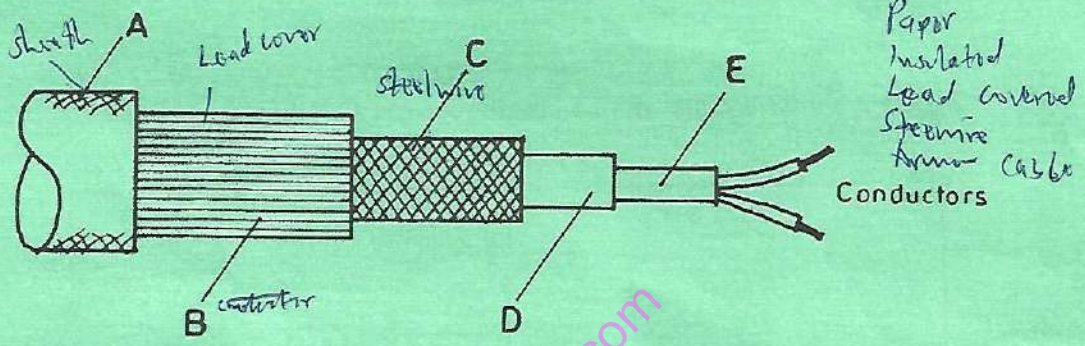


Fig.1

Name the parts labelled A, B, C, D and E.

(8 marks)

4. (a) State **two** reasons of using protective devices in electrical circuits. (2 marks)

(b) Explain the following as used in electrical circuit protection:

(i) circuit breaker;

(ii) short circuit.

(4 marks)

(c) (i) State **two** advantages and **two** disadvantages of rewirable fuses;

(ii) (I) Draw a labelled diagram of a catridge fuse;

(II) List **three** colour codes and their ratings for the fuse in c(ii)(I).

(10 marks)

(d) Illustrate the parts of an earthing system. (4 marks)

5. (a) Describe each of the following parts of a D.C machine:

(i) Brushes;
(ii) Armature;
(iii) Commutator.

(6 marks)

(b) (i) Distinguish between a cummulative compound and a differential compound wound generator.

(ii) Draw the equivalent circuit diagrams of each of the following D.C machines:

(I) shunt motor;
(II) separately excited generator.

(6 marks)

(c) Figure 2 shows a diagram of a single phase A.C induction motor:

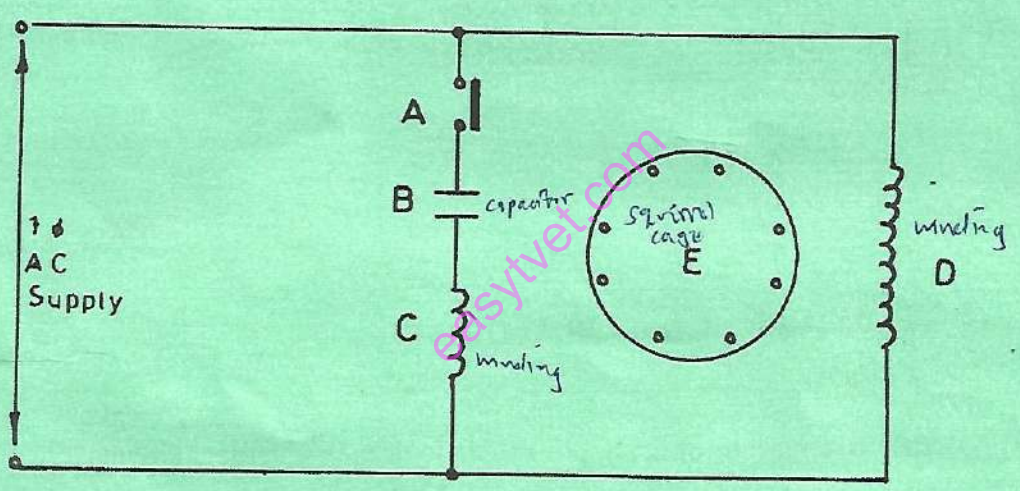


Fig.2

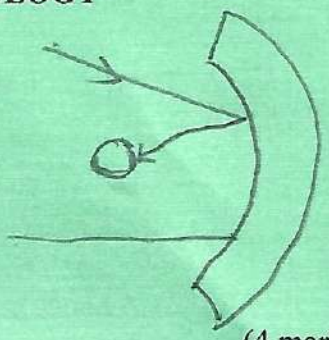
(i) Identify the type of motor.
(ii) Name the parts labelled A, B, C, D and E.
(iii) Explain the function of the part labelled B.

(8 marks)

COLOR	FUSE RATING
Green	43 A
RED	30 A
YELLOW	20 A
BLUE	15 A
WHITE	5A

SECTION B: SOLAR INSTALLATION TECHNOLOGY

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



6. (a) Explain the following as used in solar electric systems:

(i) photo voltaic effect;

(ii) photo electric effect.

(4 marks)

(b) Draw and label a diagram showing the construction of a solar cell. (5 marks)

(c) Explain the functions of the following accessories:

(i) socket outlets;

(ii) ceiling roses.

(4 marks)

(d) (i) Name **three** wiring systems used in P.V solar installations; sheath conduit Trunking

(ii) Illustrate how the polarity test is carried out on a lighting circuit.

(7 marks)

7. (a) Define each of the following solar energy terminologies:

(i) Insolation;

(ii) Direct radiation. Heat from the Sun that reaches ~~earth~~ the Earth when the day is not cloudy

(4 marks)

(b) Draw a labelled diagram of a solar flat plate collector. (6 marks)

(c) State **four** merits of solar water heater. (4 marks)

(d) With aid of a labelled diagram, explain the green house effect. (6 marks)

8. (a) Explain each of the following as used in designing solar electrical installations:

(i) sizing;

(ii) daily load energy demand.

(4 marks)

(b) Explain the factors considered when selecting the size of each of the following P.V solar devices:

(i) inverter;

(ii) charge controller.

(4 marks)

(c) A house has the following solar electric installation requirements:

Four - 8 W lamps operated for 3 hours daily
1 transistor radio rated 10 W operated 3 hours daily
1 mobile charger rated 4 W operated 2 hours daily.

Determine the

(i) total daily energy demand;

(ii) total daily energy requirements if the losses are 15% of the load.

(7 marks)

(d) Outline the:

(i) maintenance procedure for lamps and switches in a solar installation;

(ii) **three** precautions to be observed in a battery charging room.

(5 marks)

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