

1601/105
1602/105
ELECTRICAL AND SOLAR
INSTALLATION TECHNOLOGY
June/July 2019
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.

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 5 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

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

1. (a) State two properties of each of the following materials used in electrical cables:
 - (i) copper;
 - (ii) rubber.

(4 marks)
 - (b) With the aid of a sketch, outline the procedure of soldering a married joint. (7 marks)
 - (c) The sheath of a cable is labelled $\frac{6}{1.12}$ mm. Determine the size of the cable. (4 marks)
 - (d) (i) Draw a labelled diagram of a PVC TWE cable.
 - (ii) Explain how the cable in d(i) is manufactured. (5 marks)
2. (a) (i) State the role of Kenya Power Company.
 - (ii) Draw a labelled diagram of a Hydro-electric power station. (8 marks)
 - (b) Draw the following electrical power distribution systems:
 - (i) D.C two wire system;
 - (ii) A.C two wire system.

(6 marks)
 - (c) For each of the following stages of a typical transmission and distribution network in Kenya, indicate the voltage levels:
 - (i) generation;
 - (ii) transmission;
 - (iii) secondary transmission;
 - (iv) high voltage distribution;
 - (v) low voltage distribution;
 - (vi) consumer voltage.

(6 marks)

3. (a) Outline **four** IEE regulations requirements regarding earthing arrangements which must satisfy an electrical installation to be safe. (4 marks)
- (b) Draw a labelled diagram of a current operated earth leakage circuit breaker. (8 marks)
- (c) Explain the following terms as used in protection of electrical installations:
- (i) short circuits;
 - (ii) over circuit. (4 marks)
- (d) Outline **four** advantages of circuit breakers over fuses. (4 marks)
4. (a) Outline **three** IEE regulations requirements regarding:
- (i) ceiling roses;
 - (ii) 13A socket outlets. (6 marks)
- (b) Explain **three** reasons for carrying out polarity test in electrical installations. (6 marks)
- (c) Explain the function of a thermostat in electrical heating. (2 marks)
- (d) Draw a labelled diagram of an instantaneous water heater. (6 marks)
5. (a) Describe the following parts of a DC machine:
- (i) armature;
 - (ii) commutator. (4 marks)
- (b) Draw circuit diagrams of the following D.C machines:
- (i) D.C series motor;
 - (ii) separately excited generator. (4 marks)
- (c) With the aid of a labelled diagram, explain the construction of a shaded pole motor. (6 marks)
- (d) Explain the function of following in an a.c single phase induction motor;
- (i) centrifugal switch;
 - (ii) capacitor;
 - (iii) rotor. (6 marks)

SECTION B

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

6. (a) Define the following as used in solar systems:
- (i) solar irradiance;
 - (ii) insolation.
- (4 marks)
- (b) With the aid of a labelled diagram, explain the 'green house' effect as used in harvesting solar energy. (6 marks)
- (c) (i) State **two** advantages of solar box cooker.
- (ii) Explain how solar concentrators and reflectors help achieve solar harvesting. (4 marks)
- (d) Outline **three** major applications of solar electricity in remote areas. (6 marks)
7. (a) (i) Explain the term 'trouble shooting'.
- (ii) Outline **three** information and system records that can be of use during maintenance of solar electric systems. (8 marks)
- (b) State **three** possible causes of a P.V solar module that is not producing any output to the battery during a normal sunny day. (3 marks)
- (c) Outline **three**:
- (i) factors considered when sizing a P.V solar system.
 - (ii) effects of under sizing a P.V solar system. (6 marks)
- (d) The total daily system energy requirement of a 12 V d.c system is 240 Wh. Determine the total daily system ampere hour requirement. (3 marks)

8. (a) State:
- (i) **two** factors considered when selecting the type of a wiring system.
 - (ii) **three** types of wiring systems used in solar electric installations. (5 marks)
- (b) Describe the following accessories used in solar electric installation:
- (i) ceiling roses;
 - (ii) socket outlets. (4 marks)
- (c) Explain **three** factors to be considered when installing each of the following devices:
- (i) solar battery;
 - (ii) P.V solar module. (6 marks)
- (d) Draw a labelled diagram of a shunt charge controller. (5 marks)

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