

1601/105

1602/105

ELECTRICAL AND SOLAR  
INSTALLATION TECHNOLOGY

Oct./Nov. 2016

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

*This paper consists of TWO sections; A and B.*

*You should have the following for this examination:*

*answer booklet;*

*drawing instruments.*

*Answer any THREE questions from section A and any TWO questions from section B.*

*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.**

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

(a) List **three** authorities which are involved in power production and distribution in Kenya. (3 marks)

(b) (i) State **three** advantages of a.c system over d.c system.

(ii) Draw a labelled circuit diagram of a three phase four wire system and show the distribution of both single and three phase supply. (7 marks)

(c) With the aid of a diagram show the parts of a hydro-electric power station. (10 marks)

2. (a) Distinguish between 'current rating' and 'fused current' as used in circuit protection. (2 marks)

(b) Explain the term "discrimination" as used in circuit protection. (2 marks)

(c) Explain the following:

(i) direct earthing; *This is the earthing that takes place when the wires are connected to earth.*

(ii) earth concentric wiring. *This is the earthing that it takes place in the concentric starting construction in underground.* (4 marks)

(d) (i) State **two** reasons for earthing an electrical installation. *due to domestic protection, due to circuit protection.*

(ii) Draw a labelled diagram of a current operated earth leakage circuit breaker. (12 marks)

3. (a) State **two** properties of the following materials:

(i) copper; *it is less dangerous, it rebels*

(ii) aluminium. *it has no* (4 marks)

(b) With aid of a diagram, outline the procedure of making a brittania joint. (8 marks)

(c) Distinguish between a conductor and an insulator. (4 marks)

(d) (i) List **two** factors that determine current carrying capacity of electric cables. *conductor; this is the maximum length of electrical wire that can be used for the resistor but copper wire.*

(ii) Determine the cross-sectional area of a copper wire 20 m in length with a resistance of  $0.25 \Omega$ . Take resistivity of copper as  $0.02 \times 10^{-8} \Omega \text{m}$ . (4 marks)

$$0.25 \times 20 = 5 \text{ } 2$$

$$0.25 \times 20 = 5$$

$$20 \text{m}$$


$$R = 0.25 \Omega$$

$$L = 20 \text{m}$$

4. Draw circuit diagrams of the following d.c. motors:
- shunt;
  - series;
  - compound wound. (6 marks)
- (b) Describe the following parts of a d.c. machine:
- armature;
  - poles;
  - yoke. (9 marks)
- (c) Draw a labelled diagram of a single phase a.c. capacitor start induction motor. (5 marks)
5. (a) State **three** IEE regulation requirements regarding
- 13 A socket outlets;
  - installation at consumers intake point. (6 marks)
- (b) With aid of a labelled diagram show how two lamps can be controlled by two single pole switches independently using two joint boxes. (4 marks)
- (c) Draw a labelled diagram of a consumer unit and indicate cable sizes and fuse ratings for the following outgoing final circuits:
- lighting circuit;
  - cooler unit;
  - water heater;
  - 13 A socket wired in ring. (6 marks)
- (d) List the tests carried out on a completed installation. (4 marks)

3 phase or 110V and show distribution.

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

6. (a) State **two** sources of:
- renewable energy;
  - non-renewable energy. (4 marks)
- (b) Explain the following terms as used in solar systems.
- irradiance;
  - isolation. (4 marks)
- (c) (i) List **four** factors that determine the output of a pv solar module.
- (ii) Explain the effects of 'shading' on a pv solar module. (6 marks)
- (d) Draw an I-V curve, and on it show the following:
- maximum rated power ( $P_m$ );
  - maximum power current ( $I_{mp}$ );
  - maximum power voltage ( $V_{mp}$ );
  - short circuit current ( $I_{sc}$ );
  - open circuit voltage ( $V_{oc}$ ). (6 marks)
7. (a) Describe the following accessories used in solar electric installation:
- consumer unit;
  - socket outlet. (4 marks)
- (b) (i) With aid of a labelled diagram describe the construction of a solar cell. 
- (ii) Outline the correct sequence of connecting and disconnecting a PV solar module, battery and load from the charge controller. (6 marks)
- (c) Explain the following conditions which occur in the solar batteries:
- sulphation;
  - stratification. (4 marks)
- (d) With aid of circuit diagrams, distinguish between series and shunt type charge controller. (6 marks)

8. (a) (i) List **three** tools or materials used in carrying out maintenance installations.   
 (1) pliers  
 (2) multimeter  
 (3) tester
- (ii) Outline the maintenance carried out on a PV solar module.   
 (1) checking the cable & solar whether they are suitable  
 (2) testing (7 marks)
- (b) Explain 'total daily system energy requirement' as used in sizing PV solar systems. (2 marks)
- (c) Describe **three** factors considered during sizing of:
- (i) an inverter. (1)  
 (ii) a charge controller. (1) (6 marks)
- (d) Outline **five** checks carried out during testing and commissioning of a solar installation. (5 marks)

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