

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

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.

All questions carry equal marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 4 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 the precautions to be observed when connecting the following to electrical power:
- plugs and sockets;
 - edison screw type lamp holder. (4 marks)
- (b) Draw the following final circuits:
- a lighting circuit with three lamps such that lamp L_1 and L_2 are connected in parallel and controlled by a one-way switch S_1 and lamp L_3 looped in from same circuit and controlled by switch S_2 only;
 - a radial circuit comprising three socket outlets. (6 marks)
- (c) (i) State the IEE regulation requirements regarding consumer units.
(ii) Draw a labelled wiring diagram showing the correct sequence at a single phase consumer's intake point. (10 marks)
2. (a) State the functions of the following power authorities:
- Rural Electrification Authority (REA);
 - Kenya Generating Company (KENGEN). (4 marks)
- (b) Explain the functions of the following in a hydro-generating station:
- penstock;
 - turbine;
 - intake or control gates;
 - generator. (8 marks)
- (c) Draw a single line diagram showing a typical transmission and distribution network in Kenya from a generating station to the consumer, indicating voltage levels at each stage. (8 marks)
3. (a) State **three** properties of the following materials used in electrical cables:
- copper;
 - brass;
 - rubber. (9 marks)
- (b) Explain the difference between a 'joint' and a 'termination' as used in electrical cables. (4 marks)
- (c) (i) Explain the precautions to be observed when stripping cables.
(ii) Outline the procedure of terminating a flexible cord to a ceiling rose. (7 marks)

4. (a) Describe the characteristics of the following fuses:
- (i) cartridge fuse;
 - (ii) high rupturing capacity fuse. (6 marks)
- (b) State:
- (i) **two** reasons for earthing an installation;
 - (ii) **three** ways earthing is achieved for circuits operating at a voltage exceeding extra low voltage. (7 marks)
- (c) With the aid of a labelled circuit diagram, describe the 'earth fault loop path'. (7 marks)
5. (a) Draw labelled circuit diagrams for the following d.c. generators:
- (i) separately excited;
 - (ii) series;
 - (iii) shunt. (6 marks)
- (b) With aid of a labelled diagram describe any three constructional parts of a d.c. machine. (10 marks)
- (c) Outline the procedure for dismantling a three phase motor for maintenance purposes. (4 marks)

SECTION B

Answer any TWO questions from this section.

6. (a) State **two**:
- (i) forms of energy conversion which are derived from the sun;
 - (ii) applications for each type of energy in (a)(i) above. (4 marks)
- (b) With aid of a labelled diagram, distinguish between diffuse and direct solar radiation. (8 marks)
- (c) With the aid of a labelled diagram, explain the operation of an indirect-solar drier for crop drying. (8 marks)
7. (a) State **two**:
- (i) advantages of using solar electric power over other conventional systems;
 - (ii) factors that determine the amount of electrical energy produced by a solar module. (4 marks)

- (b) (i) List **four** factors that are considered when choosing a solar wiring system.
- (ii) Describe the following accessories when used for solar installation:
- I. socket outlets;
 - II. a.c. and d.c. switches. (10 marks)
- (c) Draw a labelled wiring diagram showing parts of a solar PV installation system. (6 marks)
8. (a) State **two**:
- (i) tests carried out on a solar installation;
 - (ii) sets of information required when given a task to troubleshoot or maintain a solar installation. (4 marks)
- (b) Describe how the following solar appliances are maintained regularly to ensure that they have long life and good performance:
- (i) lamps;
 - (ii) batteries. (6 marks)
- (c) Explain the meaning of the following:
- (i) total daily system energy requirement;
 - (ii) system voltage. (4 marks)
- (d) (i) Explain why it is important to estimate a load carefully during planning and sizing a solar installation system.
- (ii) A 12 V d.c. solar electric system in a house constitutes the following loads:
- I. four 8 W lamps to be lit for 3 hours daily;
 - II. 40 W television set to be on for 2 hours daily.
- Determine the ampere hours the system consumes per day. (6 marks)

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