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:

   (i) plugs and sockets;
   (ii) edison screw type lamp holder. (4 marks)

   (b) Draw the following final circuits:

   (i) 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;
   (ii) 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:

   (i) Rural Electrification Authority (REA);
   (ii) Kenya Generating Company (KENGEN). (4 marks)

   (b) Explain the functions of the following in a hydro-generating station:

   (i) penstock;
   (ii) turbine;
   (iii) intake or control gates;
   (iv) 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:

   (i) copper;
   (ii) brass;
   (iii) 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) catridge fuse;
(ii) high rapturing 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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