Name: _____ Index No. _____

2601/105 2603/105
2602/105
ELECTRICAL AND SOLAR INSTALLATION
TECHNOLOGY
June/July 2015
Time: 3 hours

Candidate's Signature: _____

Date: _____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

# DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING
# (POWER OPTION)
# (TELECOMMUNICATION OPTION)
# (INSTRUMENTATION OPTION)
# MODULE I

ELECTRICAL AND SOLAR INSTALLATION TECHNOLOGY

**3 hours**



## INSTRUCTIONS TO THE CANDIDATE

*Write your name and index number in the spaces provided above.*
*Sign and write the date of the examination in the spaces provided above.*
*You should have an electronic calculator and drawing instruments for this examination.*
*This paper consists of **TWO** sections **A** and **B**. Answer **FIVE** questions as follows:*
*Answer any **THREE** questions from section **A** and any **TWO** questions from section **B** in the spaces provided in this question paper.*
*All questions carry equal marks.*
*Do **NOT** remove any pages from this booklet.*
***Candidates should answer the questions in English.***

**For Examiner's Use Only**

| Section | Question | Maximum Score | Candidate's Score |
|---|---|---|---|
| A | | 20 | |
| | | 20 | |
| | | 20 | |
| B | | 20 | |
| | | 20 | |
| | | Total Score | |

**This paper consists of 20 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**

2015

## SECTION A

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

1. (a) State **three**:

(i) advantages of the grid system;

(ii) authorities involved in power production.

(6 marks)

(b) With aid of a labelled diagram, explain how a hydroelectric power station operates.

(8 marks)

(c) Draw labelled circuits diagrams of power distributions systems.

(i) D.C three wire;

(ii) A.C two phase three wire. (6 marks)

2. (a) (i) Complete the following cable abbreviations and state an application for each.

(I) P.C.P

(II) MIMS

(ii) Outline the procedure for making a married joint. (8 marks)



(b) (i) Describe the 'vertical rising mains' trunking wiring system.

(ii) Outline the procedure of laying an underground cable.

(9 marks)

(c) Explain the 'horizontal cabling' system structure. (3 marks)

3. (a) (i) Define 'fire alarm system'.

(ii) Explain the purpose of a fire alarm system. (6 marks)

(b) (i) With aid of a circuit diagram, explain the operation of a closed intruder alarm system;

(ii) State **three** advantages of the system in (b)(i). (10 marks)

(c) Draw a labelled diagram of a trembler bell. (4 marks)

4. (a) Name **two** electrical measuring instruments and state the quantity they measure. (2 marks)

(b) Draw a labelled diagram of a 6-way consumer unit and indicate the ratings and cable sizes of each of the following final circuits.

(i) lighting circuit;

(ii) ring circuit;

(iii) water heater;

(iv) cooker circuit. (8 marks)

(c) With aid of a circuit diagram describe the procedure for carrying out polarity test on a dead circuit. (6 marks)

(d) Distinguish between a simmerstat and a thermostat. (4 marks)

5. (a) Define the following terms as used in electrical circuit protection:

(i) fusing factor;

(ii) fusing current. (2 marks)

(b) (i) State **four** advantages of circuit breakers over fuses.

(ii) Draw a labelled diagram of a high breaking capacity fuse. (9 marks)

(c) With aid of a labelled diagram, show how an earth loop impedance test is carried out. (9 marks)

2015

## SECTION B: MATERIALS

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

6. (a) Define the following solar energy terminologies:

(i) radiation;

(ii) solar constant. (4 marks)

(b) Explain the following solar energy harvesting devices and state one application of each:

(i) simple reflector;

(ii) parabolic dishes. (6 marks)

(c) Explain the reason for tracking and tilting of solar devices. (3 marks)

(d) With the aid of a labelled diagram, describe the constructional and working principle of flat plate collector in solar water heating. (7 marks)

7. (a) Define the following in relation to solar installation:

(i) array;

(ii) appliance. (2 marks)



(b) (i) State **two** factors that determine the output of a solar cell.

(ii) Distinguish between monocrystalline and polycrystalline solar cells. (8 marks)

(c) Explain the:

(i) low voltage disconnect in a charge controller;

(ii) difference between a voltage converter and an voltage inverter. (10 marks)

8. (a) State **two**:

(i) tests carried out in a solar installation;

(ii) precautions when handling lead-acid batteries. (4 marks)

(b) Describe **two** methods of measuring the state of charge of a battery. (4 marks)

(c) Table 1 represents a troubleshooting guide for solar installation.

Complete the table to indicate the possible causes and remedies for each problem. (6 marks)

Table 1

| | Problem | Cause(s) | Remedy(s) |
|---|---|---|---|
| (i) | Solar module has low or no power output | | |
| (ii) | Battery gets easily discharged | | |
| (iii) | No current is flowing to battery from the charge controller | | |

(d) Table 2 shows a 12V d.c. solar domestic system for lamps and appliances. The ratings and number of hours per day are as shown. Determine the:

(i) daily energy requirement for each lamp/appliance and fill the table; .

(ii) total daily energy requirement for the whole system;

(iii) system daily ampere hours, assuming no losses.

(6 marks)

Table 2

| Lamp/appliance | Number | Rating (watts) | Number of hours of use/day (Hrs) | Daily energy requirement (watt hours) |
|---|---|---|---|---|
| Indoor lights | 4 | 6 | 3 | |
| Outdoor lights | 1 | 8 | 1 | |
| 14' colour T.V | 1 | 70 | 3 | |
| Radio | 1 | 10 | 3 | |
| Phone charger | 1 | 5 | 1 | |
| | | | Total | |
| | | | Daily energy | |
| | | | Requirement | |