

1521/205
1601/205
ELECTRICAL INSTALLATION II ESTIMATING
AND TENDERING, INDUSTRIAL MACHINES
AND CONTROLS
Oct./Nov. 2016
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC
TECHNOLOGY
(POWER OPTION)
MODULE II**

ELECTRICAL INSTALLATION II ESTIMATING
AND TENDERING, INDUSTRIAL MACHINES AND CONTROLS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have a non-programmable electronic calculator/mathematical tables for this examination.

This paper consists TWO sections: A and B

*Answer any **THREE** questions from Section A and **TWO** questions from section B in the answer booklet provided.*

All questions carry equal marks.

Maximum marks for each part of a question are as shown.

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) (i) Explain the term 'wiring system' as used in electrical installation works.
 (ii) State **four** factors considered when selecting a particular wiring system for a building. (7 marks)
- (b) (i) List **four** merits of using plastic conduits.
 (ii) State **three** IEE regulation requirements when installing conduits in normal installations. (7 marks)
- (c) Describe the following types of wiring systems:
 (i) Catenary system;
 (ii) Earthed-concentric system. (6 marks)

2. (a) (i) State **four** types of electricity tariffs applicable to consumers.
 (ii) A factory consumes 1,200,000 units of electricity per year. In addition to this, there is a maximum demand (MD) of 1200 KVA. The units charge is Ksh. 16 each and the maximum demand is Ksh 110 per KVA. If the consumer's power factor is 0.6; determine the overall charge per unit. (12 marks)

*Md x L.F. x annual charge
 1200 x*

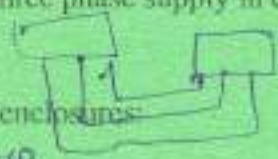
*two part
 one peak
 unit rate
 domestic
 power load*

- (b) Explain the effects:
 (i) low power factor.
 (ii) high power factor. (2 marks)

*→ improved voltage
 → large size of conductor used*

$$\frac{12,000,000 = L.F. \times 1200 \times 0.36 \times 24}{1200 \times 0.6 \times 24} = \frac{1200 \times 110 \times 24}{1200 \times 0.6 \times 24}$$

- (c) Draw a labelled wiring diagram of a three phase supply in correct sequence at consumer's intake point. (6 marks)



3. (a) Explain the following types of motor enclosures:
 (i) open machine;
 (ii) screen ventilated. (4 marks)

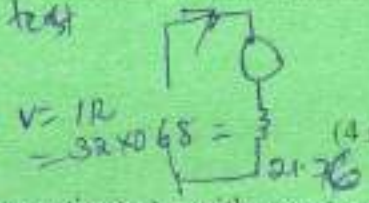
*- open drip
 - Totally enclosed ventilated fan*

- (b) Describe the principles of operation of a three phase a.c. induction motor. (4 marks)

- (c) A 400 V d.c. shunt motor has armature resistance of 0.68 Ω and full load armature current of 32A. (4 marks)

- Armature resistance test

- (i) Sketch the equivalent circuit of the motor;
 (ii) Determine the back emf developed.



$$V = IR = 32 \times 0.68 = 21.76$$

- (d) Draw a labelled circuit diagram of a direct on line automatic starter with remote control for a three phase induction motor. (8 marks)

4. (a) (i) State **two** advantages of electronic speed control of motors.
 (ii) With aid of a diagram, explain the operation of electromagnetic contactors. (10 marks)
- (b) Outline **four** tests carried out on electrical machines after installation. (4 marks)
- (c) Describe the following terms as used in electrical machines installation:
 (i) mounting;
 (ii) coupling. (6 marks)
5. (a) State **four** objectives of purchasing. (4 marks)
- (b) Outline **six** principles of estimating. (6 marks)
- (c) Explain the following in relation to estimating:
 (i) Overhead costs;
 (ii) Prime cost sums;
 (iii) Provisional sums. (6 marks)
- (d) State **four** types of tendering that can be adopted by an organisation. (4 marks)

$250 \times 4 = 1000$
 $265 \times 24 = 6360$

OPEN

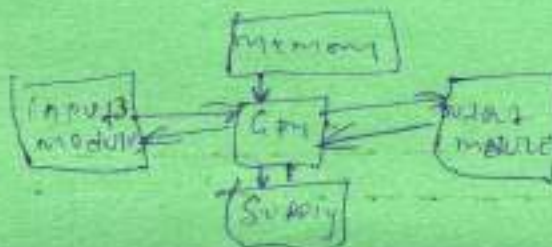
SECTION B

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

6. (a) State **three** main types of hazards encountered in electrical installations in hazardous areas. **EXPLOSIVE COLLISION** (3 marks)
- (b) (i) Distinguish between a caravan and caravan site.
 (ii) State **three** important requirements of an electrical installation of a caravan. (5 marks)
- (c) Name **four** construction materials which cause corrosion. (4 marks)
- (d) With aid of a diagram, explain the operation of a continuous ringing bell. (8 marks)
7. (a) Outline **four** tests carried out on completed industrial control panels. (4 marks)
- (b) Using a 5×7 dot matrix, show how alphanumeric characters A, B are displayed. (4 marks)
- (c) (i) Draw a labelled block diagram of a programmable logic controller (PLC).
 (ii) Explain the functions of a central processing unit in PLC. (9 marks)

A B A B A B
 B A B A B A

distribution
 copy



- (d) Figure 1 shows an LED display circuit. Create the equivalent ladder logic circuit. (3 marks)

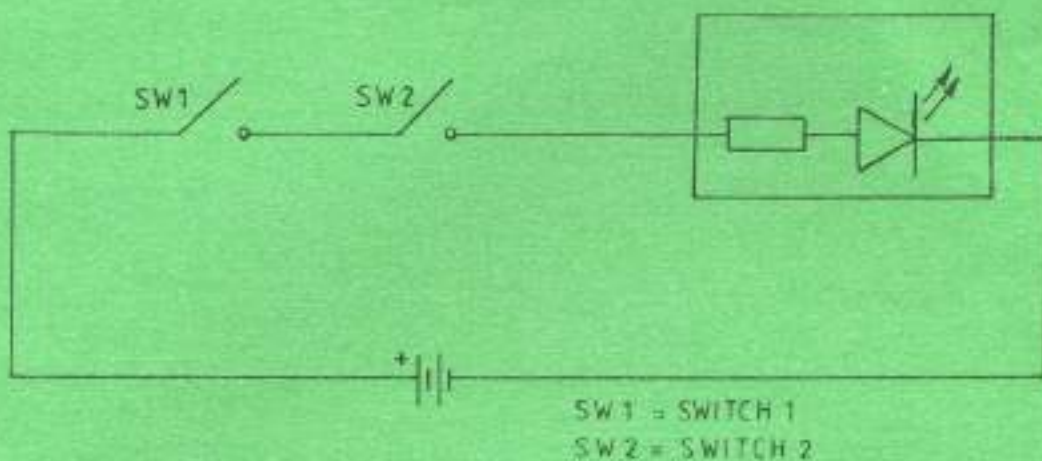
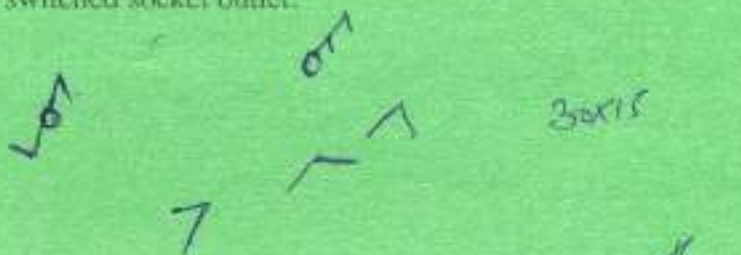


Fig. 1

8. (a) Explain each of the following terms as used in illumination:
- (i) utilization factor;
 - (ii) room index;
 - (iii) glare. (6 marks)
- (b) A hall measuring 30 m × 15 m is illuminated by lamps mounted 5 m above the working plane. Assuming the space height ratio is unity:
- (i) estimate the number of lamps required to illuminate the hall;
 - (ii) sketch the arrangement of the lamps. (10 marks)
- (c) Draw installation symbols for each of the following:
- (i) 1 gang 2 way switch;
 - (ii) single switched socket outlet. (4 marks)



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