1521/205
1601/205
ELECTRICAL INSTALLATION II,
ESTIMATING AND TENDERING,
INDUSTRIAL MACHINES
AND CONTROLS
Oct./Nov. 2017
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 the following for this examination:
Answer booklet;
Mathematical tables/Scientific calculator.
*This paper consists of **EIGHT** questions in **TWO** sections: **A** and **B**.*
*Answer **FIVE** questions choosing **THREE** questions from section **A** and **TWO** questions from section **B**.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
Candidates should answer the questions in English.

This paper consists of 7 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

SECTION A

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

1. (a) (i) Define 'Power-factor'.

(ii) Illustrate how a delta capacitor bank is connected to correct the power-factor of a three phase induction motor.

(6 marks)

(b) State **two** factors which determine the selection of a synchronous motor for power factor correction. (2 marks)

(c) (i) A power consumer has an annual energy consumption of 860,000 units and a maximum load of 450 kW at 0.75 power factor lagging. The tariff is Sh. 6 per annum of KVA of maximum demand plus Sh. 0.50 per unit. Determine the annual charge of electricity.

(ii) Figure 1 shows load curves for consumers x and y. With reason, state between the two consumers who has a better load factor.

(12 marks)

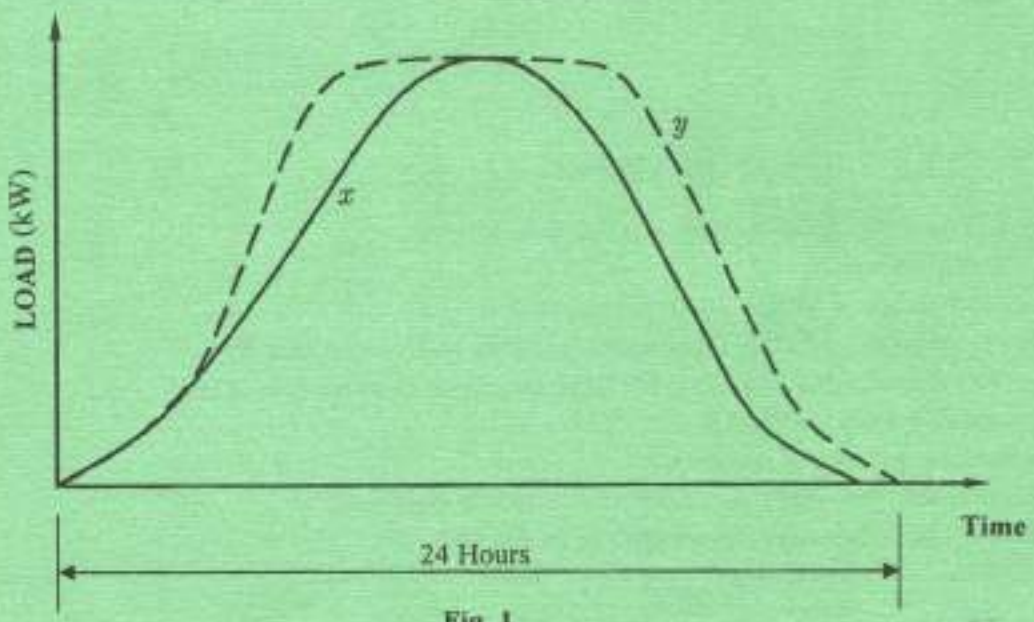


Fig. 1

2. (a) (i) State **three** characteristics of M.I.C.S cables.

(ii) Outline **two** conditions observed when installing a catenary wiring system.
(5 marks)

(b) Describe the following wiring systems:

(i) trunking;
(ii) ducting.
(4 marks)

(c) Use table 1 provided to determine the approximate size of trunking necessary to accommodate 25 cables of 1/1.78 mm size and 7 cables of 7/1.70 size, all PVC insulated. (Assume a space factor of 45%). (6 marks)

Table 1

Cable size	Factor		Capacity	Trunking
	PVC	Rubber		
1/1.13	14	13	1000	38 x 38
1/1.38	18	17	1350	50 x 38
7/1.35	51	58	3600	100 x 50
7/1.70	71	74	4050	75 x 75

(d) Draw a labelled wiring diagram of a three-phase supply system feeding a three phase motor and one single phase domestic consumer. (5 marks)

3. (a) Draw a circuit diagram of a d.c shunt motor connected to drive a load. (4 marks)

(b) Figure 2 shows a contactor control circuit of a d.c. motor:

(i) State the purpose of the circuit.

(ii) Explain the operation of the circuit.

(6 marks)

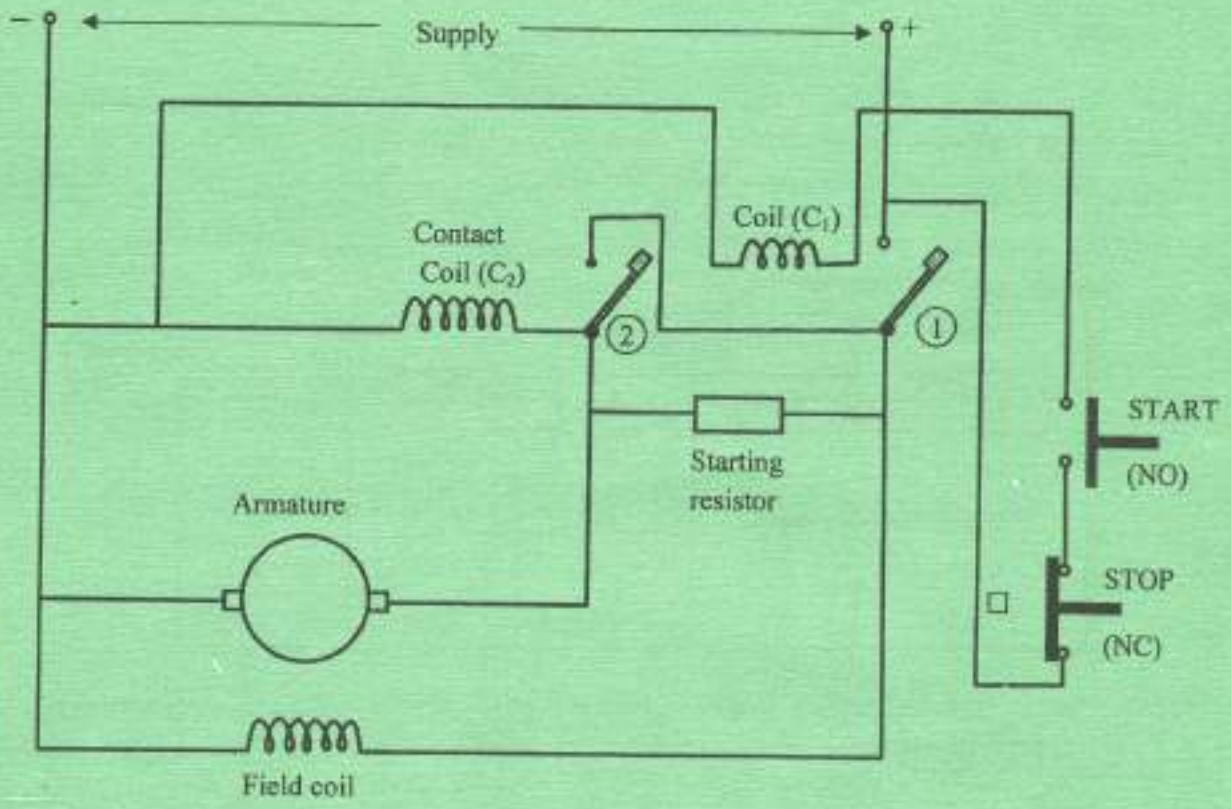


Fig. 2

(c) (i) State **three** IEE regulation requirements for electric motors.

(ii) Outline the procedure for carrying out routine inspection and tests on a three-phase induction motor.

(10 marks)

4. (a) Define an instrumentation system. (3 marks)

(b) (i) Explain the function of a data logger when used in instrumentation systems.

(ii) State **five** component parts of a data logger. (8 marks)

(c) List **four** advantages of using a motor control panel. (4 marks)

(d) Explain the operation of a three phase induction motor. (5 marks)

5. (a) Distinguish between Arc lamps and Discharge lamps as used in illumination engineering. (4 marks)

(b) State **three** properties of a good lighting scheme. (3 marks)

(c) An office measuring 18 m by 43 m requires an illumination at desk level of 330 lux. The mounting height of the lamps above the desk level is 2 m. There are two alternatives available:

Alternative 1

80-Watts fluorescent lamps giving 4800 lumens.

Alternative 2

150 Watts Tungsten filament lamps giving 1950 lumens. Taking utilization and maintenance factors as 0.6 and 0.85 respectively, determine the:

(i) most economical alternative;

(ii) spacing between the lamps as well as between the lamps and the adjacent walls. (10 marks)

(d) Draw a labelled lead-lag circuit used to minimise the stroboscopic effect in single phase a.c circuits. (3 marks)

SECTION B

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

6. (a) (i) Define a 'temporary-installation'.

(ii) State **four** IEE regulation requirements for temporary installations. (11 marks)

(b) (i) Explain the adverse conditions faced by an electrician when carrying out installation works in agricultural farms.

(ii) List **three** recommended electrical installation tests necessary to be carried out in a hazardous area. (6 marks)

(c) Describe a 'flame proof' equipment. (3 marks)

7. (a) Explain the following when used as control devices for electric motors:

(i) linked switch;
(ii) switch fuse;
(iii) limit switch.

(6 marks)

(b) State:

(i) **three** advantages of using Programmable Logic Controllers (PLC) over electrical relays for industrial motor control;

(ii) **two** types of 'contacts' used in PLC.

(5 marks)

(c) Two motors M_1 and M_2 are such that motor M_1 is started by pressing switch I_2 while motor M_2 is started by pressing switch I_3. When motor M_2 starts, motor M_1 should remain off. Draw the ladder diagram for this operation. (9 marks)

8. (a) Explain the importance of the following elements of estimating:

(i) labour and materials;

(ii) site visits and programme;

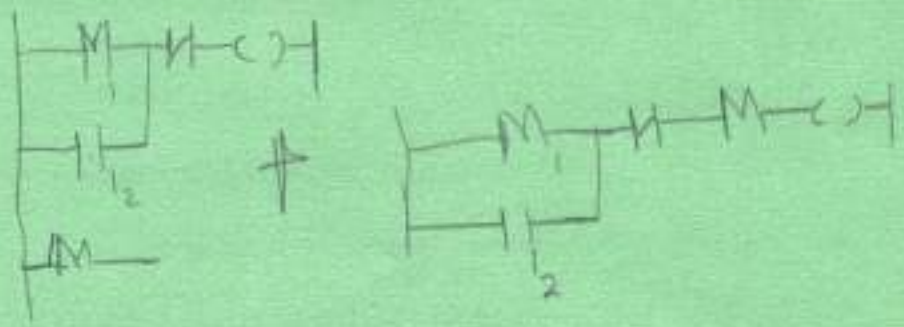
(iii) regulations.

(6 marks)

(b) (i) State **four** factors that affect the pricing of an estimate.

(ii) Explain the purpose of Bills of Quantities in an estimate.

(6 marks)



(c) Figure 3 shows a pictorial chart of progress in project development of electrical wiring works. Summarise the status of the project. (8 marks)

Room Numbers

FLOOR	1	2	3	4	5	6	7	8
Ground								
1st								
2nd								
3rd								
4th								
5th								
6th								
7th								

Fig. 3

Key

Conduit laid

Conduit laid and wiring completed

Conduit laid, wiring completed and accessories fitted

Conduit laid, wiring completed, accessories fitted, instalation inspected and testsed

No work carried out

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