

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.**

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)

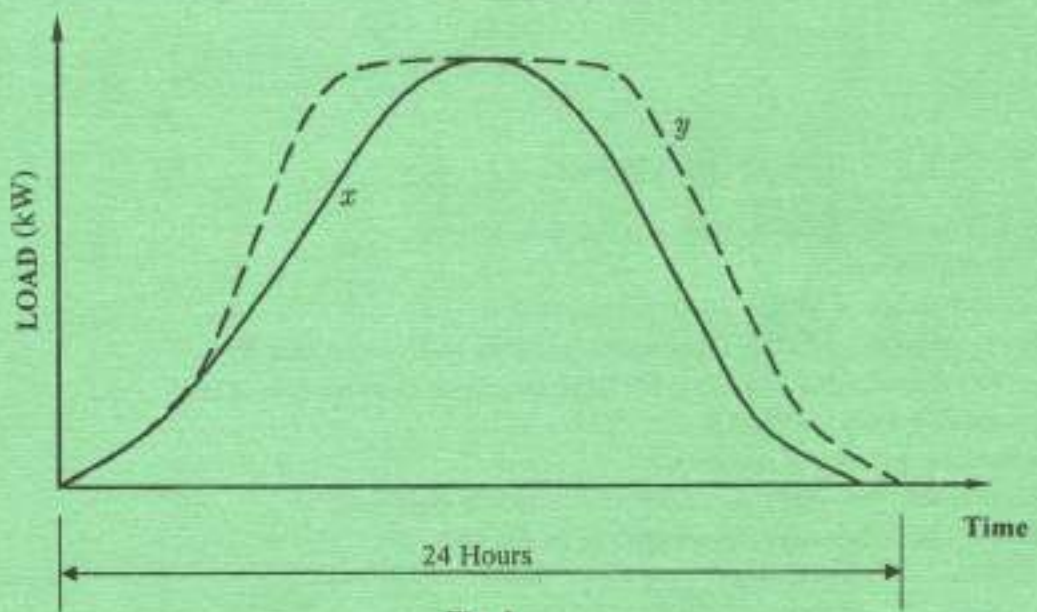


Fig. 1

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)

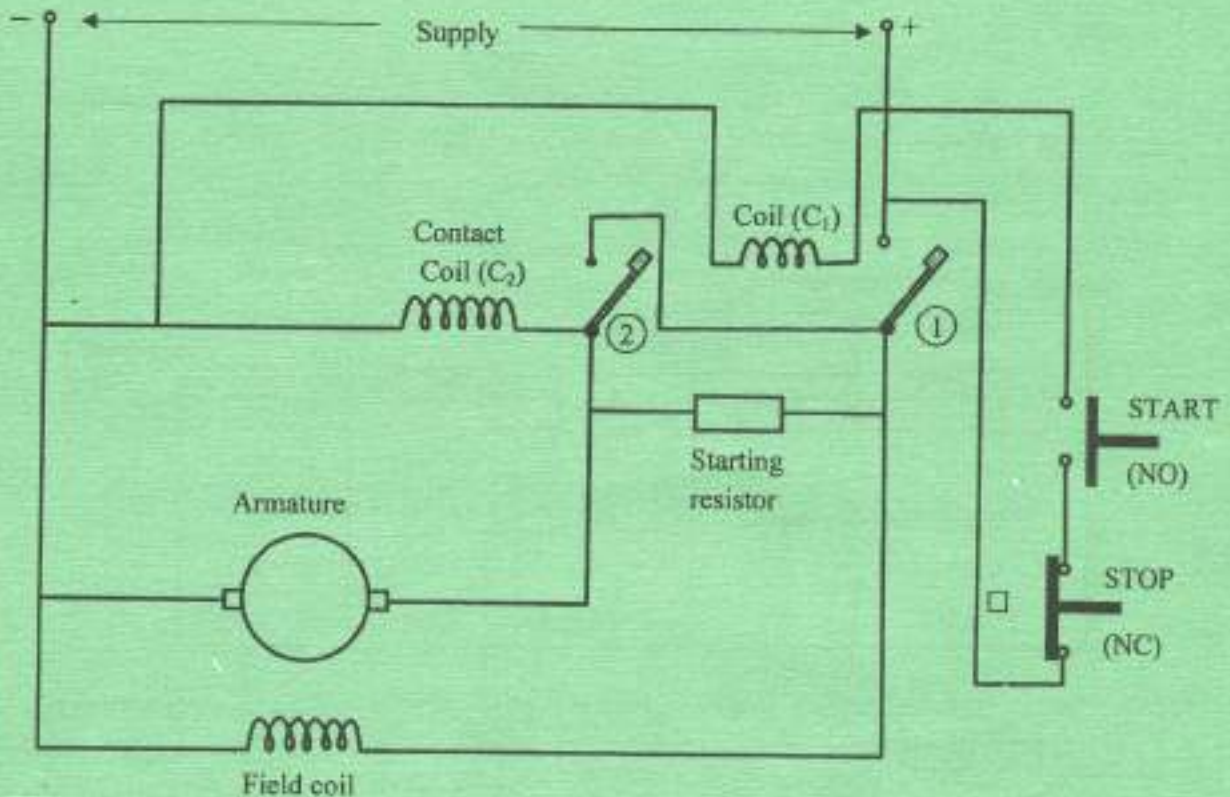


Fig. 2

- (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. *- It is a collective device that measures, records, and displays data from a process, machine, or system.* (3 marks)
- (b) (i) Explain the function of a data logger when used in instrumentation systems. *- It is a device that records data from a process, machine, or system.*
- (ii) State **five** component parts of a data logger. *- Amplifier, A/D converter, memory, display, and printer.* (8 marks)
- (c) List **four** advantages of using a motor control panel. *- Easy to install, easy to operate, easy to maintain, and easy to replace.* (4 marks)
- (d) Explain the operation of a three phase induction motor. *- It is a motor that runs on three-phase AC supply. It consists of a stator and a rotor. The stator is connected to the supply and the rotor is connected to the load.* (5 marks)

5. (a) Distinguish between Arc lamps and Discharge lamps as used in illumination engineering. *Discharge lamp on one is filled with inert gases and on the other contains a metal to be vaporized* (4 marks)
- (b) State three properties of a good lighting scheme. *It has all protective gear, the light color rating & the correct type of lamp.* (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

$$\frac{18 \times 43 \times 330}{0.6 \times 0.85} = \frac{x}{20 \times 4800}$$

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: *20 (150 = 1950)*

- (i) most economical alternative;
- (ii) spacing between the lamps as well as between the lamps and the adjacent walls. *43 ÷ 18 = 2.2 = 2 - 43 ÷ 2 = 21.5* (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'. *It is a wiring system that is not permanent installed e.g. food comp. tent.*
- (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. *presence of explosive animal or crop products, oil, dung, straw, etc.*
- (ii) List three recommended electrical installation tests necessary to be carried out in a hazardous area. *earth continuity, insulation resistance test, earth continuity test* (6 marks)
- (c) Describe a 'flame proof' equipment. *This equipment can't explode when it is on or can't burn* (3 marks)
7. (a) Explain the following when used as control devices for electric motors:
- (i) linked switch;
- (ii) switch fuse; *over current & trip*
- (iii) limit switch. *for purpose of current limiting*

(6 marks)

(b) State:

- (i) **three** advantages of using Programmable Logic Controllers (PLC) over electrical relays for industrial motor control; *A plc is easy program. It can carry multiple task compared to relay.*
- (ii) **two** types of 'contacts' used in PLC. *Input contacts & output contacts*

(5 marks)

- (c) Two motors M_1 and M_2 are such that motor M_1 is started by pressing switch I_1 while motor M_2 is started by pressing switch I_2 . 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:

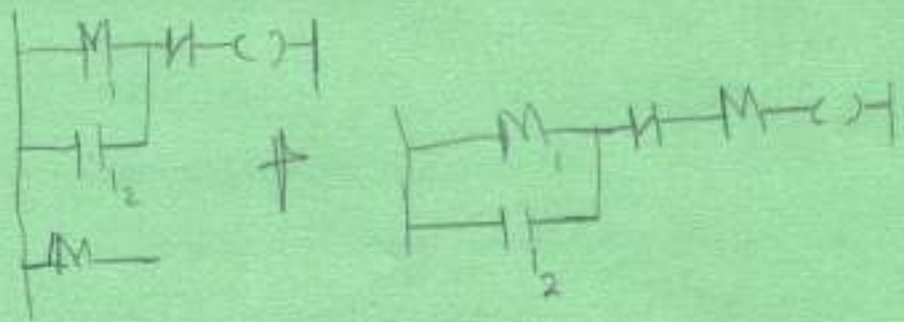
- (i) labour and materials; *make available labour materials to estimate cheap*
- (ii) site visits and programme; *do to know how of the site & site program for estimate to able to know what's appropriate*
- (iii) regulations. *It help to plan & make sure how to work program*

(6 marks)

(b) (i) State **four** factors that affect the pricing of an estimate. *- drop & gut cost, - quantity, - price, - location & time*

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

(6 marks)



0 = X_1

1 = I_1

2 = M_1

3

- (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								
1 st								
2 nd								
3 rd								
4 th								
5 th								
6 th								
7 th								

Fig. 3

Key



Conduit laid



Conduit laid and wiring completed



Conduit laid, wiring completed and accessories fitted



Conduit laid, wiring completed, accessories fitted, installation inspected and tested



No work carried out

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