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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.

- I. (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)

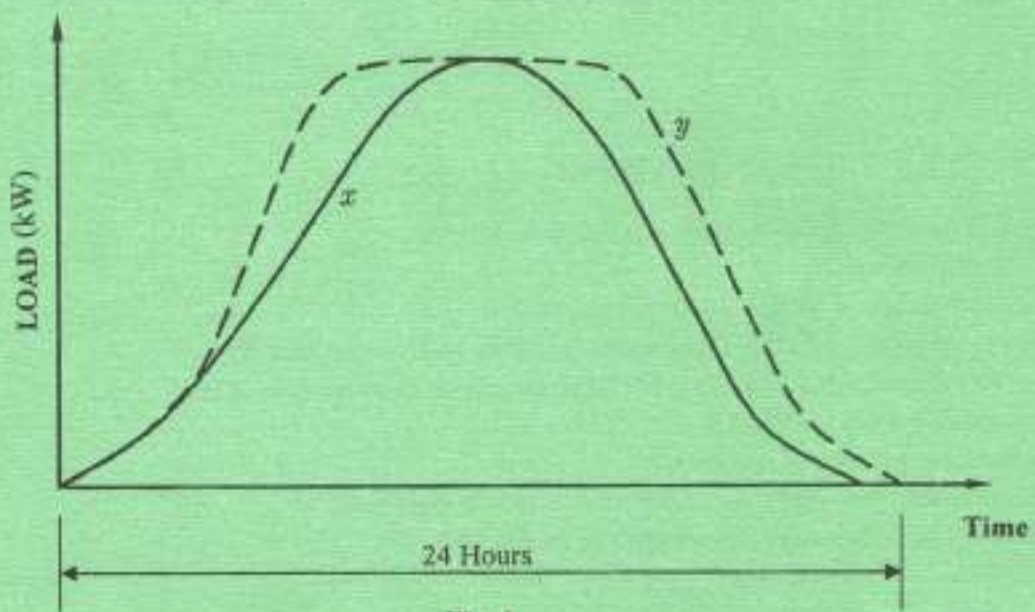


Fig. 1

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.
 (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)

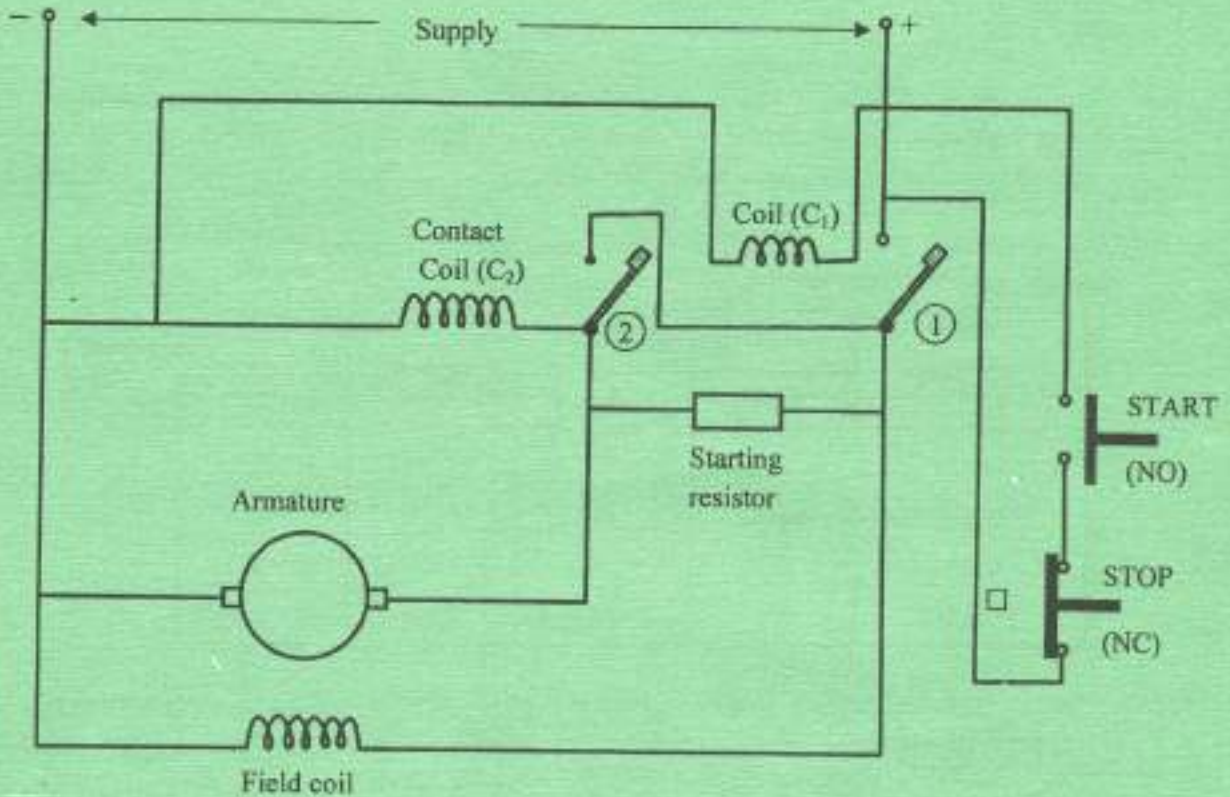


Fig. 2

- (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 electronic device that* (3 marks)
 (b) (i) Explain the function of a data logger when used in instrumentation systems. *used to record a signal in a computer*
 (ii) State five component parts of a data logger. *- Amplifier, - Microcontroller, - High speed, - memory, - power supply* (8 marks)
 (c) List four advantages of using a motor control panel. *easy to operate, safety, no need for manual, no noise* (4 marks)
 (d) Explain the operation of a three phase induction motor. *- It is a motor that converts electrical energy into mechanical energy* (5 marks)

5. (a) Distinguish between Arc lamps and Discharge lamps as used in illumination engineering. *Discharge lamp on case is closed light source light is not connected directly to the supply* (4 marks)
- (b) State three properties of a good lighting scheme. *It has all protective gear, size of light cable rating & in 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

$$\frac{18 \times 43 \times 330}{0.6 \times 0.85} = \frac{x}{20 \times 430}$$

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 = 450

- (i) most economical alternative;
- (ii) spacing between the lamps as well as between the lamps and the adjacent walls. *43 / 2 = 21.5*
22 = 2 x 11 (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 & is used for a short time.*
- (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 - presence of damp, shock - installation must be special designed for safety work*
- (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 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 limit of current flowing*

(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.

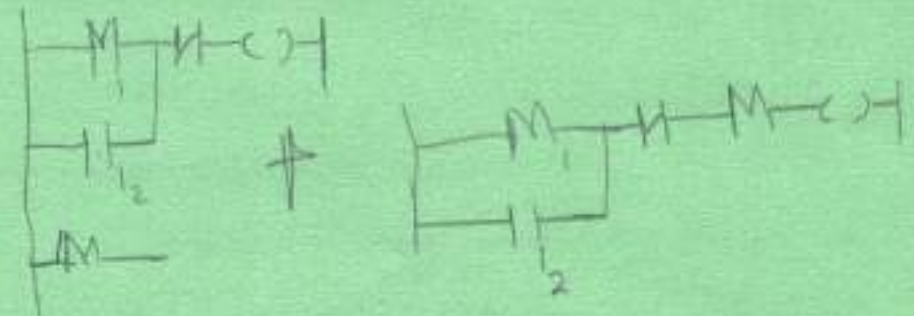
Input contacts & output contacts (5 marks)

(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 with the estimate.*
- (ii) site visits and programme; *- do to know how of the site & site program for estimate to able to know with appropriate.*
- (iii) regulations. *It help to plan & work site how to work program.*

- (b) (i) State **four** factors that affect the pricing of an estimate. *- design & quality cost, - quantity, price, - material & power.*
- (ii) Explain the purpose of Bills of Quantities in an estimate. (6 marks)



0 = X_1
 1 = I_2
 2 = M_2
 3 = M_1

(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

Handwritten notes:
 1st 1, 2
 2nd 1, 2, 3, 4, 5, 6, 7, 8
 3rd 1, 2, 3, 4, 5, 6, 7, 8
 4th 1, 2, 3, 4, 5, 6, 7, 8
 5th 1, 2, 3, 4, 5, 6, 7, 8
 6th 1, 2, 3, 4, 5, 6, 7, 8
 7th 1, 2, 3, 4, 5, 6, 7, 8

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