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ELECTRICAL INSTALLATION II, ESTIMATING
AND TENDERING, INDUSTRIAL MACHINES
AND CONTROLS

June/July 2019

Time: 3 hours

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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:

A non-programmable scientific calculator/mathematical tables;

Answer booklet.

*This paper consists of **THREE** sections: **A**, **B** and **C**.*

*Answer **TWO** questions from section **A**, **ONE** question from section **B** and **TWO** questions from section **C**.*

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 6 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Answer **TWO** questions from this section.

1. (a) Explain each of the following types of wiring systems:
- (i) HSOS;
 - (ii) Earthed concentric wiring. (4 marks)
- (b) (i) Distinguish between block rate and two part tariff;
- (ii) A capacitor rated 20 KVAR is used to correct the power factor of a single phase 240 V, 50Hz circuit. Determine the capacitance of the capacitor. (9 marks)
- (c) (i) State **three** IEE regulation requirements for conduit installations in flame-proof areas;
- (ii) Name **four** construction materials which cause corrosion. (7 marks)
2. (a) (i) State **three** merits of mineral insulated copper sheathed cables.
- (ii) List **two** precautions observed when using paper insulated lead sheathed cables. (5 marks)
- (b) Table 1 shows rating factors and estimated minimum size of trunking for specified number of cables of given sizes. Using the table, determine the size of trunking necessary to accommodate the following:
- (i) 20 cables of 1.78 mm size rubber insulated and 6 cables of 1.35 mm size pvc insulated;
 - (ii) 60 cables of 1.38 mm size and 120 cables of 1.04 mm size all pvc insulated. (10 marks)

Table 1

Cable Size	Factor			Trunking size
	Rubber	PVC	Capacity	
1/1.13	13	14	1000	38 x 38 mm
1/1.38	17	18	1350	50 x 38 mm
1/1.78	21	21	1800	50 x 50 mm
7/0.85	23	24	2000	75 x 38 mm
7/1.04	33	33	2700	75 x 50 mm
7/2.14	100	88	4050	150 x 38 mm
19/1.53	179	162	5400	150 x 50 mm
19/1.78	-	-	7200	100 x 100 mm

- (c) With aid of a circuit diagram, explain the operation of a bell-relay. (5 marks)

3. (a) Figure 1, shows a types of wiring system.

(i) Identify the wiring system.

(ii) State **one** application of this type of wiring.

(2 marks)

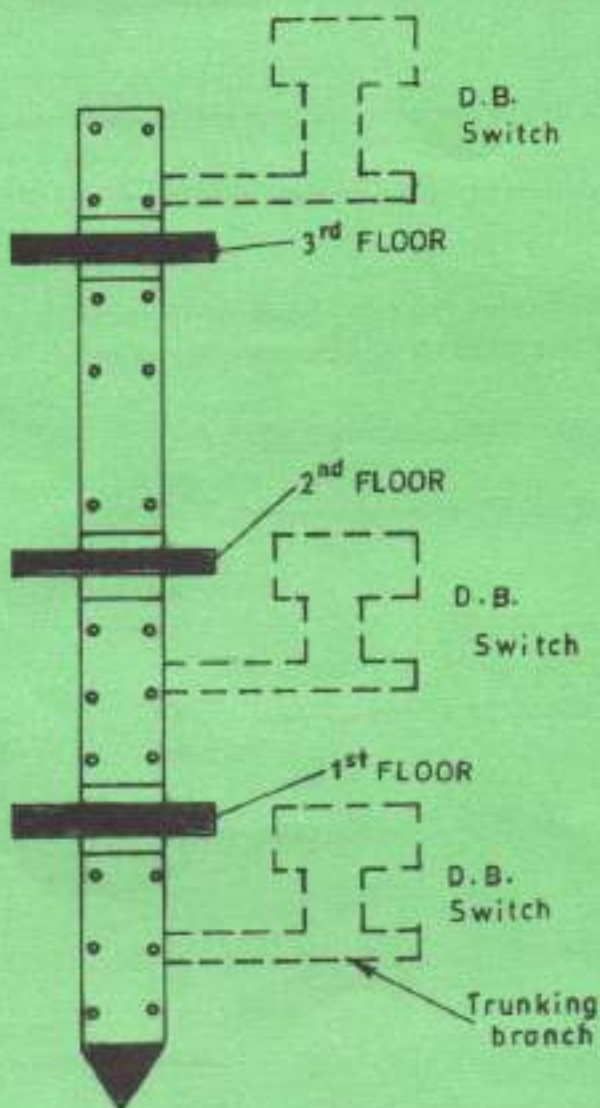


Figure 1

(b) (i) State the conditions that are necessary for corrosion to take place.

(ii) With aid of a diagram, explain the sacrificial anode method of cathodic protection

(8 marks) *

(c) Outline **three** reasons why farm and horticultural installations are categorized as special installations.

(3 marks)

(d) (i) State **two** demerits of the open type fire alarm system.

(ii) List **three** types of indicator elements used in electric bells. ^

(iii) Explain the reason why automatic fire detectors should be installed away from direct sunlight, hot pipes or heating appliances.

(7 marks)

SECTION B: ESTIMATING AND TENDERING

Answer *ONE* question from this section.

4. (a) Define Luminous Intensity with respect to illumination and state standard unit. (2 marks)
- (b) With aid of a diagram, derive the inverse square law of illuminance. (7 marks)
- (c) Outline **three** steps considered when planning interior lighting of a workshop. (3 marks)
- (d) Single energy saving lamps are fixed 400 cm above the working plane to illuminate a staff room measuring 16 x 12 m. If the space height ratio is 1;
- (i) Estimate the number of lamps required;
- (ii) Using a scale drawing, show the locations of the lamps. (8 marks)
5. (a) (i) Explain the term 'contract'.
- (ii) Outline **six** essentials of a valid contract. (8 marks)
- (b) Explain the following remedies for breach of contract:
- (i) quantum merit;
- (ii) specific performance;
- (ii) injunction. (6 marks)
- (c) Name **four** contract documents for a building project. (4 marks)
- (d) List **two** ways of terminating a contract entered between two parties. (2 marks)

SECTION C: INDUSTRIAL MACHINES AND CONTROLS

Answer **TWO** questions from this section.

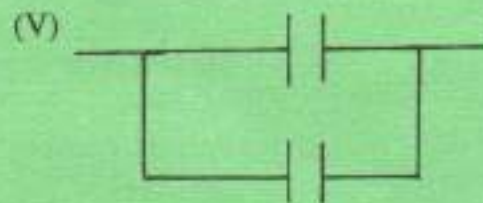
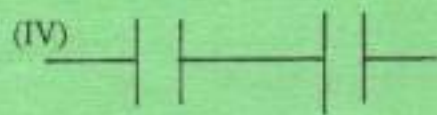
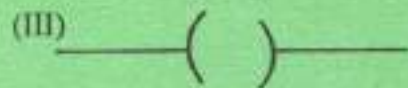
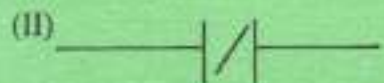
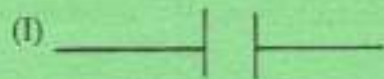
6. (a) State the function of each of the following in a d.c machine:
- (i) stator;
 - (ii) rotor. (2 marks)
- (b) (i) Explain the need for motor enclosures;
- (ii) Name two types of motor enclosures. (4 marks)
- (c) Outline the sequence of lining up a belt-drive between two machines. (4 marks)
- (d) (i) Draw a labelled diagram of a three-stud d.c plate starter.
- (ii) Explain the functions of:
 - (I) thermal overload coil;
 - (II) No-volt release coil. (10 marks)
7. (a) Compare Induction to Synchronous motors with regard to the factors indicated in table 2. (4 marks)

Table 2

Factor	Induction motor	Synchronous motor
Speed		
Starting		
Power factor		
Maintenance cost		

- (b) Draw a labelled diagram of a pony motor method of starting a three phase synchronous motor. (7 marks)
- (c) (i) Explain the procedure of reversing a three phase motor rotation.
- (ii) State two methods of speed control for a three phase Induction motor. (4 marks)

- (d) (i) Draw a labelled block diagram of an instrumentation system. (5 marks)
- (ii) State **two** advantages of the magnetic tape recorder. (3 marks)
8. (a) State **three** tests carried out on a motor control panel upon installation. (3 marks)
- (b) (i) List **two** output devices used in programmable logic controllers (PLC). (11 marks)
- (ii) State the **four** stages of operation of a PLC.
- (iii) State the meaning of the following symbols used in PLC ladder programming.



- (c) Draw a labelled Torque versus armature (curve) characteristic for a d.c series motor. (4 marks)
- (d) State **two** applications of the shaded pole single phase induction motor. (2 marks)

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