

1521/204

1601/204

**MICROELECTRONICS, ELECTRICAL
PRINCIPLES II, ELECTRICAL MAINTENANCE
AND FAULT DIAGNOSIS**

June/July 2021

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

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

**MICROELECTRONICS, ELECTRICAL PRINCIPLES II,
ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS**

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Non-programmable electronic calculator/Mathematical tables;

Answer booklet.

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

*Answer **TWO** questions from section A, **TWO** questions from section B and **ONE** question from section C in the answer booklet provided.*

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.

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Turn over

SECTION A: ELECTRICAL PRINCIPLES II

Answer TWO questions from this section.

1. (a) Define each of the following as used in a.c waveforms:
- (i) frequency;
 - (ii) form factor.
- (4 marks)
- (b) Draw an a.c sinusoidal waveform over one and half cycles, indicating its amplitude and periodic time.
- (5 marks)
- (c) Explain the function of each of the following with reference to analogue electrical indicating instruments:
- (i) deflection device;
 - (ii) control device;
 - (iii) damping device.
- (6 marks)
- (d) The instantaneous values of two alternating currents are given by:
- $$i_1 = 30 \sin \omega t \text{ ampere;}$$
- $$i_2 = 15 \sin \left(\omega t + \frac{\pi}{3} \right) \text{ ampere.}$$
- Determine the sum of the currents i_1 and i_2 at 60° .
- (5 marks)

2. (a) (i) With the aid of a labelled diagram, describe the operation of repulsion type moving-iron instrument.
- (ii) State one merit of the instrument in a(i).
- (7 marks)
- (b) Figure 1 shows an a.c circuit. Determine the currents I_L , I_R and I_S .
- (7 marks)

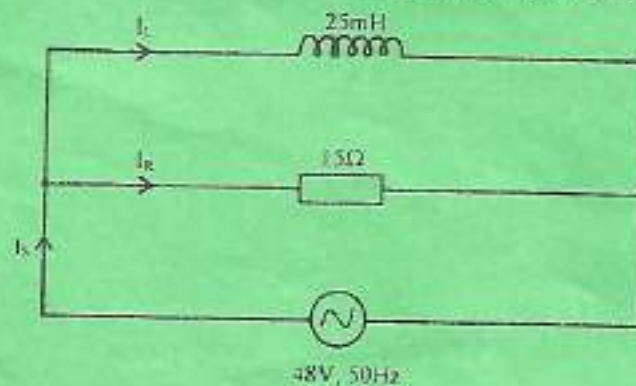


Fig. 1

- (c) Figure 2 shows a d.c circuit.

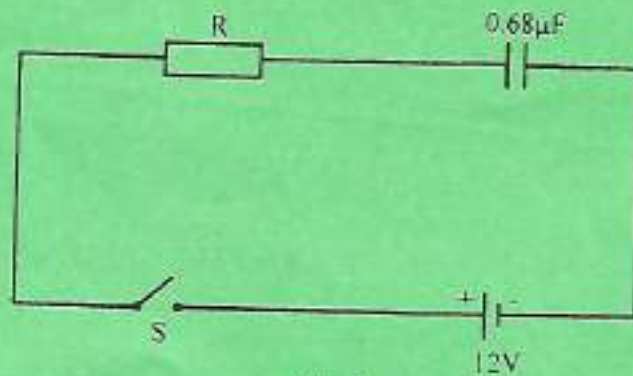


Fig. 2

If the time constant for the circuit is 18 ms, determine the:

- (i) resistance of the resistor, R;
- (ii) capacitor voltage after 9 ms upon closing switch S.

(6 marks)

3. (a) Draw the waveforms and phasor diagram of a purely capacitive a.c circuit. (6 marks)

- (b) Figure 3 shows a d.c inductive circuit.

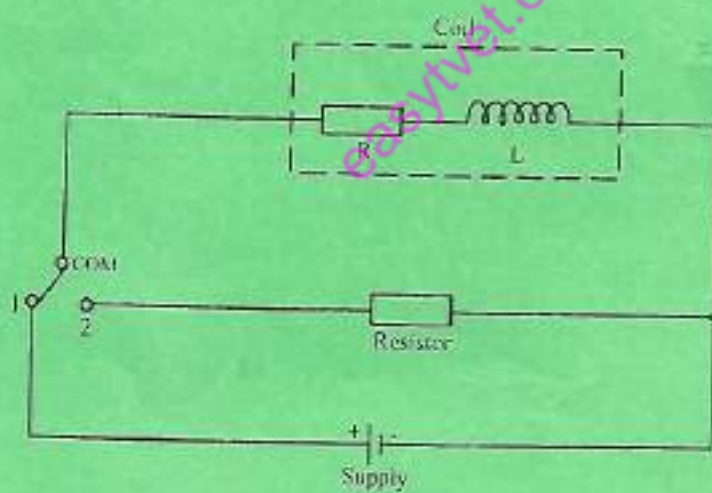


Fig. 3

Handwritten calculations:

$$Z = \sqrt{R^2 + X_L^2}$$

$$= \sqrt{12^2 + 35^2}$$

$$= 37.819$$

Handwritten calculations:

$$V_P = V_L$$

$$V_P = I_P \times Z$$

$$= 0.25 \times 37.819$$

$$= 9.4547$$

Handwritten calculations:

$$I_L = \frac{V_P}{X_L}$$

$$= \frac{9.4547}{35}$$

$$= 0.27013$$

Explain the circuit operation when the switch stay in position 1 for a while then moved to position 2. (5 marks)

- (c) Differentiate between line voltage and phase voltage as applied to 3-phase supply system. (2 marks)

- (d) A delta-connected load consists of three identical coils each of resistance 42Ω and inductive reactance 35Ω . The phase current is 8 A . Determine the:
- (i) phase impedance;
 - (ii) phase voltage;
 - (iii) line current.

(7 marks)

SECTION B: ELECTRICAL MAINTENANCE AND FAULT DIAGNOSIS

Answer *TWO* questions from this section.

4. (a) Outline **four** checks and inspections done on electrical machines. ^{Handwritten: 4 checks} (4 marks)
- (b) State **three** causes and remedies for D.C motor chattering brushes during operation. _{Handwritten: Wrong connection} (6 marks)
- (c) An electric water pump overheats during its operation. State **three** possible causes and remedies for overheating. (6 marks)
- (d) Outline the procedure of assembling a motor after repair. (4 marks)
5. (a) Describe the following maintenance activities:
- (i) overhaul: ^{Handwritten: This is a major maintenance procedure carried out by the machine manufacturer to restore the machine to its original condition.}
 - (ii) scheduling. ^{Handwritten: to schedule the timing}
- (4 marks)
- (b) Explain each of the following types of maintenance:
- (i) corrective;
 - (ii) predictive.
- (4 marks)
- (c) State **four**:
- (i) merits of planned maintenance;
 - (ii) tests carried out in repair and maintenance of electrical installations and for each case name **one** measuring instrument used.
- (8 marks)
- (d) Draw a labelled lead-lag diagram for a discharge lamp. (4 marks)

6. (a) State **three** causes of each of the following faults in a fluorescent fitting:
- (i) lamp fails to start and there is no end glow; *When fluorescent tube is not glowing, lamp might be defective. Starter might be blown out.*
- (ii) lamp flashes 'ON' and 'OFF'. *Lamp tube might be faulty. Starter may not generate.* (6 marks)
- (b) Explain the function of each of the following parts of a discharge lamp:
- (i) capacitor;
- (ii) choke. (4 marks)
- (c) Draw a labelled diagram of a high pressure mercury vapour lamp. (5 marks)
- (d) A three phase induction motor fails to start when connected to the power supply. State **five** possible causes for the fault. *per connection* (5 marks)

SECTION C: MICROELECTRONICS

Answer **ONE** question from this section.

7. (a) State **three** uses of the accumulator in a computer during arithmetic and logic operations. (3 marks)
- (b) Write the following 8085 microprocessor pin acronyms in full and in each case state the pin function:
- (i) WR;
- (ii) ALE;
- (iii) IO/M. (6 marks)
- (c) Draw a labelled block diagram of a general purpose microprocessor system. (6 marks)
- (d) A $32\text{ K} \times 8$ RAM memory is implemented using $4\text{ K} \times 8$ RAM chips. Determine the number of:
- (i) $4\text{ K} \times 8$ chips required;
- (ii) address lines for each $4\text{ K} \times 8$ chip;
- (iii) bits in each word. (5 marks)

8. (a) Explain 'computer software'. (2 marks)
- (b) Table 1 shows assembly language instructions and their corresponding machine code. Complete the table. (4 marks)

Table 1

Assembly language instruction	Machine code (Hex)
MOV B, M	71
LDAX D	45
MOV M, A	77
MOV A, B	A7
STAX D	
HLT	76

- (c) Figure 4 shows an 8-bit microprocessor memory mapping. The starting address for RAM is 0000H.



Fig. 4

If the memory is continuous, determine the address range for the:

- (i) RAM.
- (ii) ROM. (8 marks)
- (d) Write an 8085 instruction to:
- (i) load 2030H data into register pair HL;
- (ii) add contents of register B to the contents of accumulator and store the result in the accumulator;
- (iii) logically AND contents of accumulator with the contents of memory and store result in the memory. (6 marks)