2521/204 2602/204
2601/204 2603/204
ENGINEERING DRAWING AND CIRCUIT ANALYSIS
June/July 2023
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (POWER OPTION) (TELECOMMUNICATION OPTION) (INSTRUMENTATION OPTION)

MODULE II

ENGINEERING DRAWING AND CIRCUIT ANALYSIS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;
Mathematical tables/Non-programmable scientific calculator;
Drawing instruments;
Drawing paper size A2;
Computer installed with Auto CAD, electronic CAD software and printer.

*This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.*
*Answer any **THREE** questions from section **A** and any **TWO** questions from section **B** in the answer booklet and drawing papers provided.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
All drawing dimensions are in mm.
Candidates should answer the questions in English.

This paper consists of 8 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: CIRCUIT ANALYSIS

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

1. (a) **Figure 1** shows an A.C circuit.

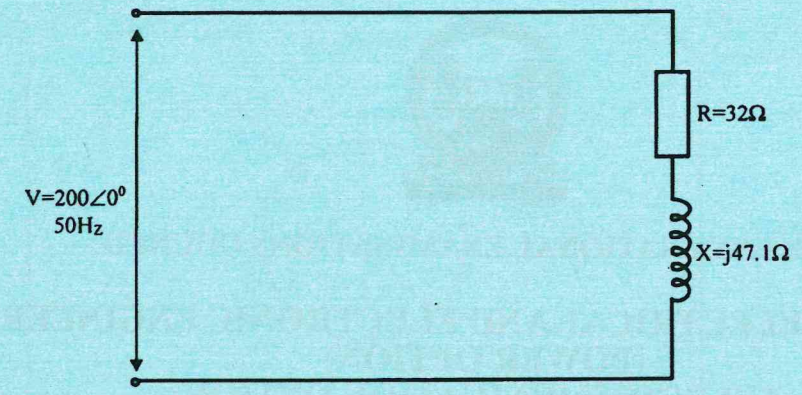

Fig. 1

Determine in polar from the:

(i) impedance of the circuit;
(ii) supply current;
(iii) p.d across the coil.

(6 marks)

(b) Draw a labelled diagram of:

(i) a single phase R-C series circuit;
(ii) phasor diagram of the circuit in b(i)

(4 marks)

(c) Sketch the curves for each of the following d.c transient in R-C circuit:

(i) growth of p.d across the capacitor;
(ii) discharge of current in the resistor.

(4 marks)

(d) A 0.4 μF capacitor is connected in series with 10 MΩ resistor across a 400 V d.c supply. Determine the:

(i) time constant;
(ii) initial charging current;
(iii) time taken for the p.d across the capacitor to grow to 320 V.

(6 marks)

2. (a) Describe the constructional features of the following induction motor rotors:

(i) squirrel cage;

(ii) wound rotor.

(4 marks)

(b) (i) Draw the torque-slip characteristic curve for a 3 phase induction motor.

(ii) A four-pole three phase induction motor operated at 415 V 50 Hz a.c supply runs at a speed of 1430 rev/min. Determine its slip. (6 marks)

(c) (i) Outline **three** conditions to be met before a three phase machine can be synchronized to the supply.

(ii) State **two** merits of a three phase synchronous motor.

(5 marks)

(d) Draw an equivalent circuit diagram of a three phase generator. (5 marks)

3. (a) (i) Explain **two** transformer losses;

(ii) With the aid of a labelled circuit diagram, explain the open circuit test of a single phase transformer.

(9 marks)

(b) (i) List any **two** types of special machines;

(ii) Explain why a single phase induction motor is not self starting.

(4 marks)

(c) (i) Draw a labelled schematic diagram of a capacitor start motor.

(ii) State **two** merits of the motor in c(i).

(7 marks)

4. (a) Draw a labelled constructional diagram of a D.C machine. (4 marks)

(b) **Figure 2** shows the schematic diagram of a D.C motor. The motor has friction and windage losses of 1.5 kW.

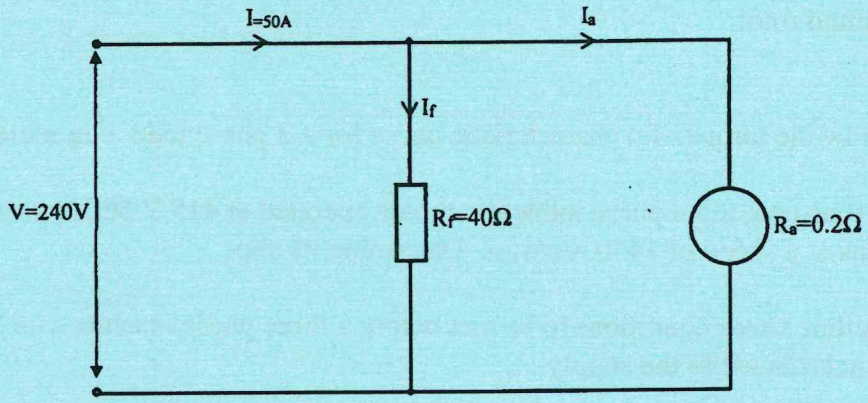

Fig. 2

(i) Name the type of the motor.

(ii) Determine the:

(I) field current;
(II) armature current;
(III) efficiency of the motor.

(6 marks)

(c) (i) State **two** merits of three phase systems.

(ii) **Figure 3** shows three phase unbalanced connected loads. The supply voltage is 415 V at 50 Hz. Determine the phase currents. (7 marks)

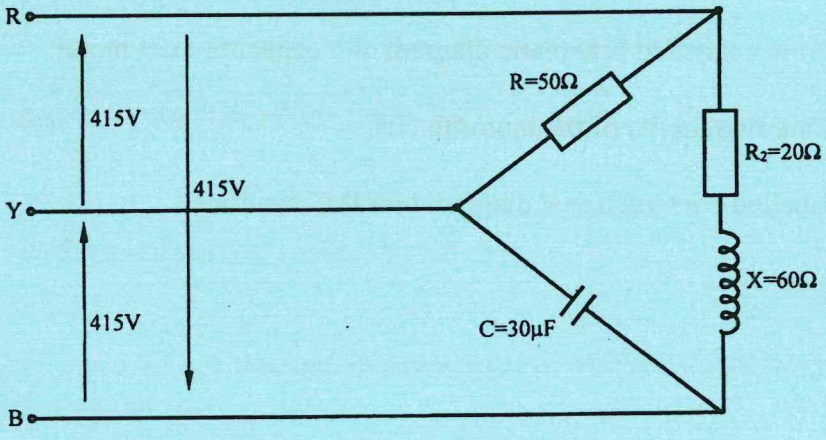

Fig. 3

(d) Draw a labelled circuit diagram of one wattmeter method, for measuring power in a balanced three phase load. (3 marks)

5. (a) Name **four** types of two port networks. (4 marks)

(b) **Figure 4** shows a two port network. Obtain the Z parameters for the network. (8 marks)

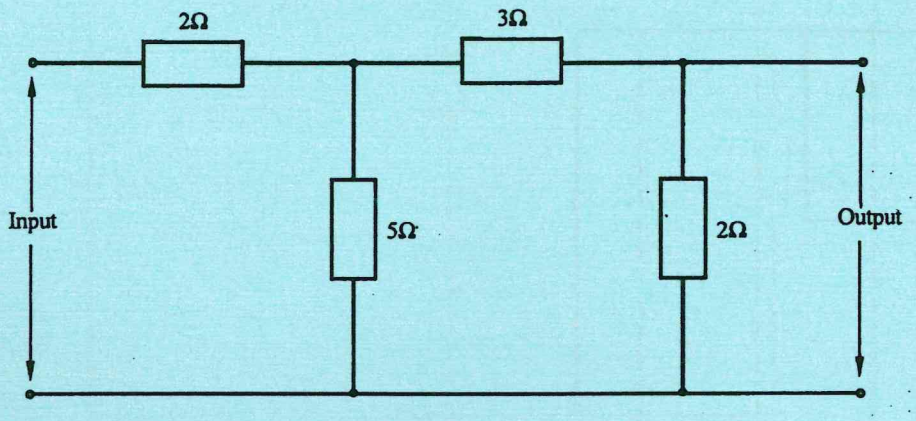

Fig. 4

(c) A complex voltage is represented by:

$$V = (20\cos\omega t + 6\sin 3\omega t + 2\sin 5\omega t) \text{ volts.}$$

Determine the:

(i) r.m.s value;
(ii) mean value;
(iii) form factor.

(8 marks)

SECTION B: ENGINEERING DRAWING

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

6. (a) Construct an octagon in a square of sides 90 mm. (4 marks)

(b) Draw a circle to pass through points ABC where AB = 70 mm and BC = 90 mm while angle ABC is 70°. (6 marks)

(c) **Figure 5** shows three views of a block drawn in third angle projection. Draw an oblique view taking corner X as the lowest point. (10 marks)

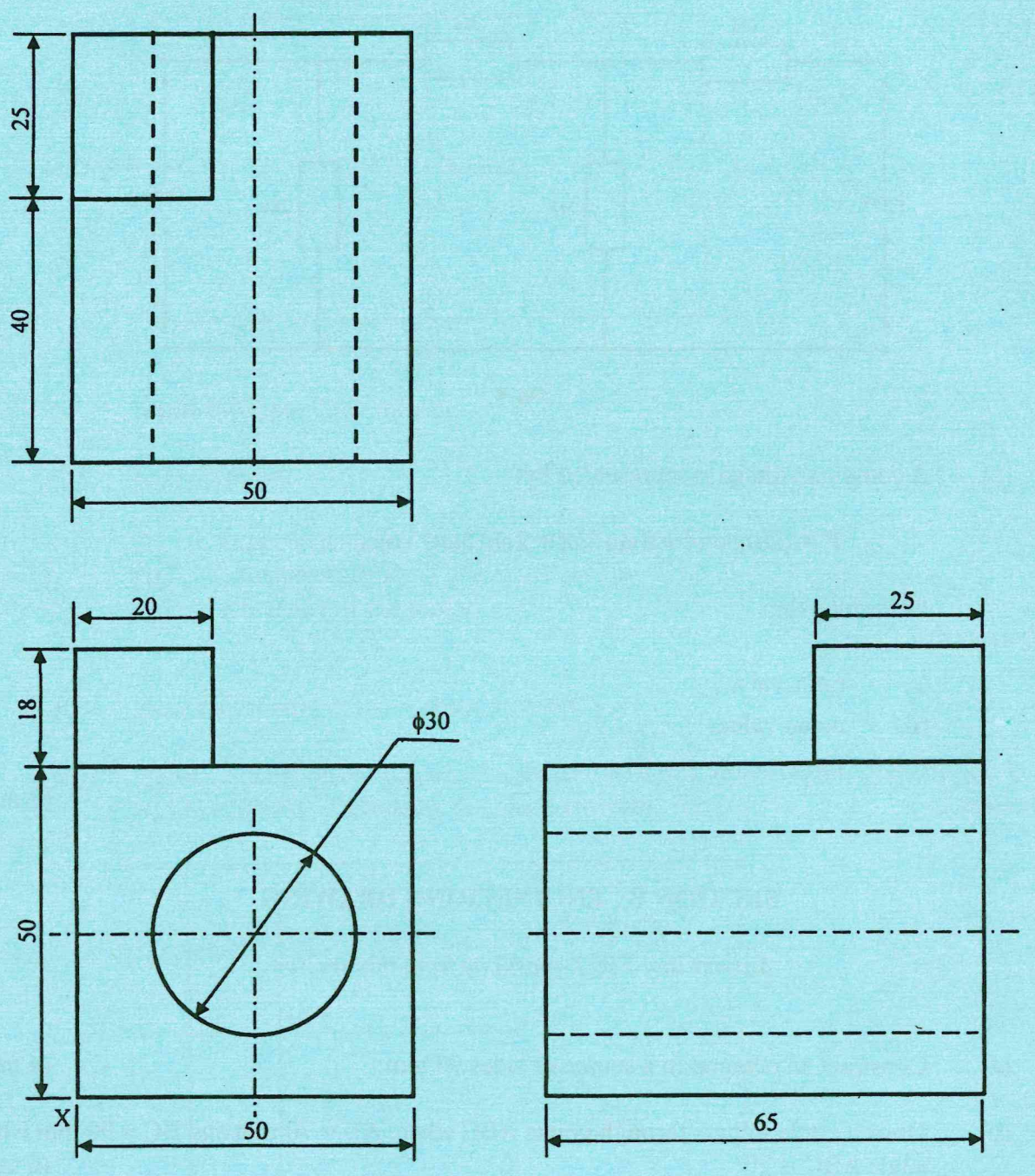

Fig. 5

7. (a) **Figure 6** shows an electronics circuit.

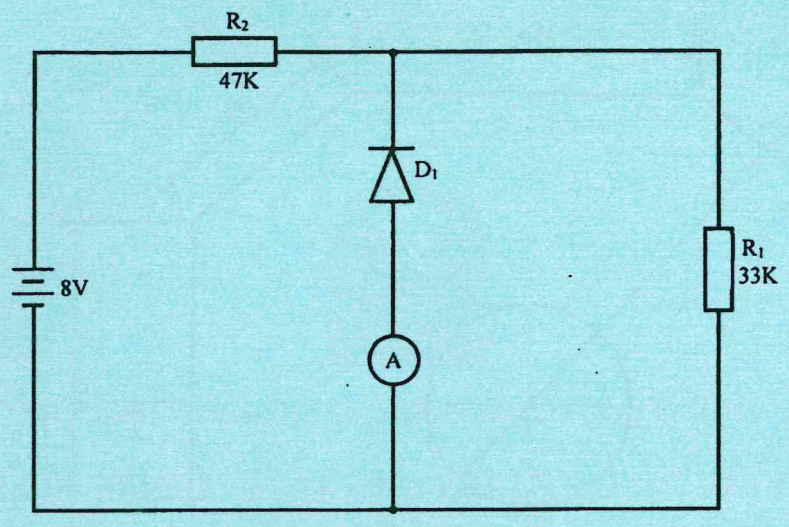

Fig. 6

Using any computer software:

(i) Draw the circuit;

(ii) Insert your name and index number, print and hand over hard copy of a(i).

(10 marks)

(b) **Figure 7** shows one view of an object.

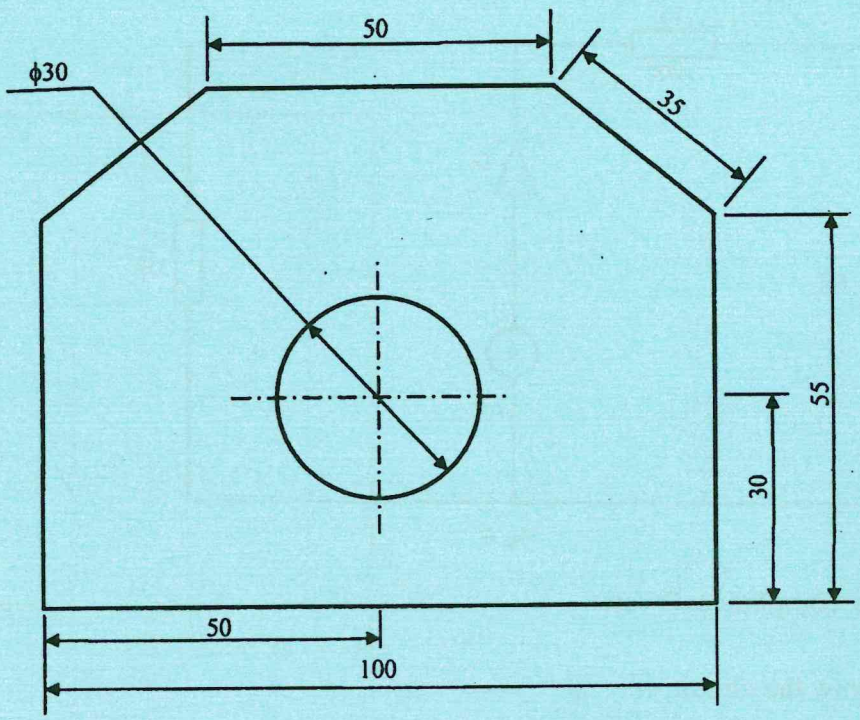

Fig. 7

(i) Using Auto CAD software, create the drawing:
(ii) Insert **five** dimensions.

Insert your name, index number, print and hand over the hard copy. (10 marks)

8. (a) Draw the power and control circuit diagram of a direct on line three phase induction motor starter. (10 marks)

(b) Draw the following electrical and electronics symbols:

(i) two way switch;
(ii) switched socket outlet;
(iii) twin fluorescent lamp;
(iv) heater;
(v) emergency lamp;
(vi) varactor diode;
(vii) fuse;
(viii) variable resistor;
(ix) light dependent resistor;
(x) microphone.

(10 marks)

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