

2521/204 2602/204
2601/204 2603/204
**ENGINEERING DRAWING AND
CIRCUIT ANALYSIS**
Oct./Nov. 2022
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 a 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 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.

SECTION A: CIRCUIT ANALYSIS

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

1. (a) Distinguish between a salient pole rotor and a cylindrical rotor construction in relation to three phase synchronous machine. (4 marks)
 - (b) Outline **four** merits of having a stationary armature and a rotating field systems in three phase alternators. (4 marks)
 - (c) Draw the V-characteristic curves of a synchronous motor. (4 marks)
 - (d) (i) Explain the function of a centrifugal switch on a single phase motor.
 - (ii) With aid of a labelled diagram, explain the operation of a shaded pole motor. (8 marks)
2. (a) Distinguish between the constructional features of a wound rotor and a squirrel cage rotor of a three phase induction motor. (4 marks)
 - (b) (i) **Figure 1** shows three single turn coils, AA', BB' and CC' spaced 120 apart on a stator.

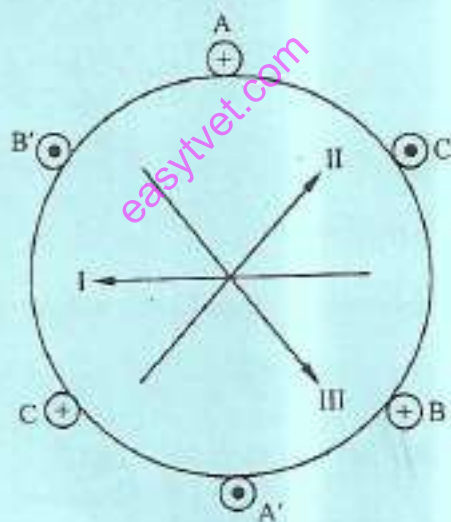


Fig. 1

Draw the resultant waveforms for current developed in each coil.

- (ii) Sketch the Torque-slip characteristics curve of a 3-phase induction motor. (6 marks)

(c) Describe each of the following stepper motors,

- (i) variable reluctance;
- (ii) hybrid stepper motor.

(6 marks)

(d) Table 1 shows the truth table for a 2-phase ON mode stepper motor. Complete the table.

(4 marks)

Table 1

A	B	C	Step angle
+	+		
0	+		
+	0		
+	+		

3. (a) (i) State 'Nortons Theorem'.

(ii) **Figure 2** shows an electric circuit. Using Nortons Theorem. Determine the current flowing in the $10\ \Omega$ resistor

(11 marks)

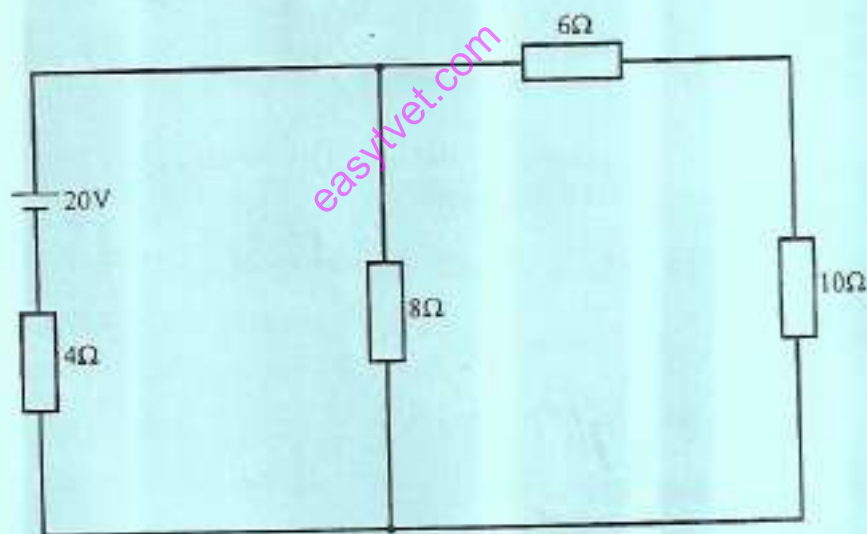


Fig. 2

(b) State three causes of transients in electric circuits

(3 marks)

- (c) A D.C circuit consists of a resistor R connected in series with a $0.5 \mu\text{F}$ capacitor and has a time constant 10 ms .
Determine the:

- (i) Value of resistor;
 - (ii) Capacitor voltage 10 ms after connecting the circuit to a 20 V supply.
- (6 marks)

4. (a) Describe each of the following parts of a D.C machine:

- (i) armature.
 - (ii) yoke.
- (4 marks)

- (b) (i) Explain the term 'back e.m.f' as used in D.C motors.
- (ii) Draw the equivalent schematic diagrams of each of the following D.C machines
- (I) series motor;
 - (II) short shunt compound motor.

(6 marks)

- (c) Draw a labelled circuit diagram of one watt meter method used to measure power in a three phase star connected balanced load.
- (3 marks)

- (d) Three 20Ω resistor are connected in star to a 415 V 50 Hz 3 phase supply. Determine the total power dissipated by the resistors.
- (7 marks)

5. (a) Define a 'complex wave'.
- (2 marks)

- (b) A complex voltage is represented by:

$$V = (20 \sin \omega t + 6 \sin 3 \omega t + 4 \sin 5 \omega t) \text{ volts}$$

Determine the voltage's:

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

(8 marks)

(c) Explain the following iron losses with reference to transformers:

- (i) Hysteresis
- (ii) Eddy current

(4 marks)

(d) Draw a labelled diagram of a core type three phase star-delta connected transformer.

(6 marks)

SECTION B: ENGINEERING DRAWING

Answer any TWO questions from this section.

6. (a) Draw a power circuit diagram of a forward-reverse starter of a three phase induction motor.

(8 marks)

(b) Draw a circuit diagram of a class B push and pull amplifier.

(7 marks)

(c) Draw the following electrical symbols;

- (i) Cooker control unit;
- (ii) Consumer unit;
- (iii) Three gang one way switch;
- (iv) Buzzer;
- (v) Transformer.

(5 marks)

7. (a) Construct a parallelogram given that sides $AB = 90$ mm, $AC = 70$ mm and angle $CAB = 60^\circ$.

(6 marks)

(b) Construct a triangle given base $AB = 80$ mm vertical angle $CAB = 95^\circ$ and the height as 40 mm.

(6 marks)

(c) Construct a parabola inside a rectangle of 80 mm by 40 mm.

(8 marks)

8. (a) Figure 5 shows a view of an object.

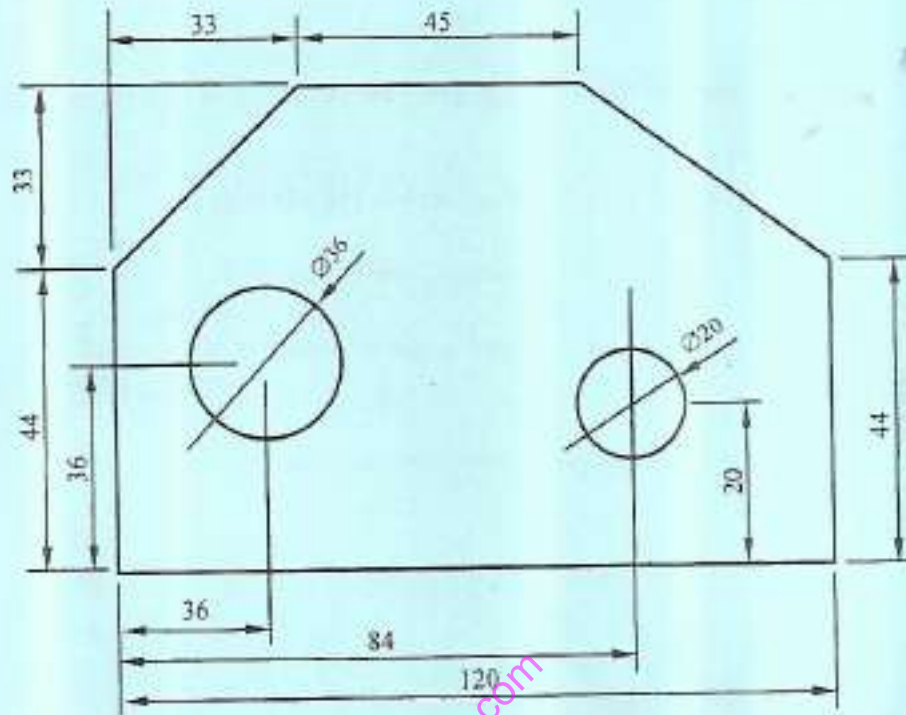


Fig. 3

Using Autocad software:

- Copy the given view indicating the shown dimensions;
- Print and hand over the hard copy.

(20 marks)

THIS IS THE LAST PRINTED PAGE.