

1601/103
1602/103
MATHEMATICS I
June/July 2023
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC TECHNOLOGY
(POWER OPTION)
(TELECOMMUNICATION OPTION)

MODULE I

MATHEMATICS I

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Non programmable scientific calculator/Mathematical tables;

Answer booklets.

This paper consists of EIGHT questions.

Answer any FIVE questions in the answer booklet provided.

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 5 printed pages.

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

1. (a) Evaluate

(i) $\frac{16^{\frac{3}{2}} + 8^{\frac{2}{3}}}{27^{\frac{2}{3}} + 25^{\frac{3}{2}}}$

(ii) $\frac{\log_3\left(\frac{1}{27}\right) + \log_{27}\left(\frac{1}{3}\right)}{\log_2\left(\frac{1}{8}\right) + \log_8\left(\frac{1}{2}\right)}$ (11 marks)

(b) Express in the simplest form:

(i) $\frac{12(x^3y^2z)^4}{(4x^2y^6)^2}$

(ii) $\frac{\sqrt{25x^4y^8}}{\sqrt[3]{8x^6y^9}}$ (4 marks)

(c) Solve the equations:

(i) $32t^{\frac{3}{2}} - \frac{1}{t} = 0$

(ii) $\frac{2^{-x}}{4^x} = 8\sqrt{2}$ (5 marks)

2. (a) Given the matrices $A = \begin{bmatrix} 4 & 1 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ -3 & 5 \end{bmatrix}$.

Determine:

(i) $\det(4A + 3B)$

(ii) $A^T B$

(iii) $(AB)^{-1}$. (11 marks)

(b) (i) Two forces F_1 and F_2 in newtons acting on a mechanical system satisfy the simultaneous equations:

$$2F_1 + F_2 = 7$$

$$4F_1 + 3F_2 = 17$$

Use a matrix method to determine the values of F_1 and F_2 .

(ii) Solve the equation $\begin{vmatrix} x & 2 \\ 3 & x \end{vmatrix} = \begin{vmatrix} 2 & 0 \\ 0 & 5 \end{vmatrix}$ (9 marks)

$\begin{vmatrix} 2 & -1 \\ -3 & 5 \end{vmatrix} = 3$
 $2 + 4 = 2 + 3$
 $21 - 21 = 11 - 11/2$
 $-2 + 11/2$

3. (a) Table 1 shows the number of hours worked in a given week by 50 technicians.

Table 1

Hours	Frequency
1 - 10	8
11 - 20	14
21 - 30	12
31 - 40	9
41 - 50	7

Determine the:

- (i) median;
- (ii) mean;
- (iii) standard deviation.

(10 marks)

- (b) Table 2 shows the marks scored by 48 students in a test.

Table 2

Marks	Frequency
10 - 12	5
13 - 15	6
16 - 18	10
19 - 21	20
22 - 24	5
25 - 27	2

- (i) Draw a histogram to represent this data.

- (ii) Use the histogram to estimate the mode.

(10 marks)

4. (a) Given the matrices

$$A = \begin{bmatrix} 2 & x \\ 3 & 1 \end{bmatrix}, B = \begin{bmatrix} 2 & 1 \\ 1 & 4 \end{bmatrix} \text{ and } C = \begin{bmatrix} (3x+2) & 7 \\ (7+x) & 7 \end{bmatrix} \text{ where } x \text{ is a constant.}$$

Determine the:

- (i) expression for AB in terms of x ;

- (ii) value of x given that $B^T A^T = C$.

- (iii) matrices A and C .

(8 marks)

- (b) **Figure 1** shows a resistive network. Determine the values of the currents I_1 and I_2 in amperes. (12 marks)

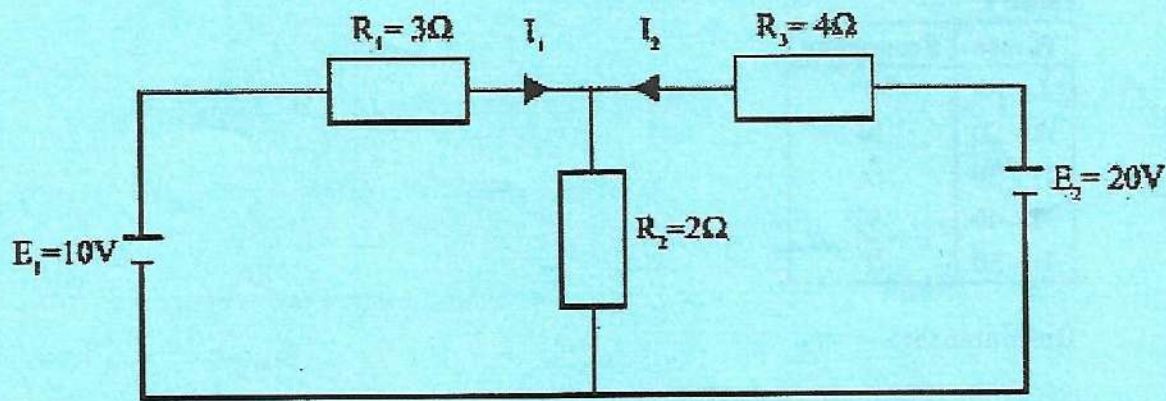


Fig. 1

5. (a) The sum of the 3rd, 4th and 5th terms of an arithmetic progression is 24. The sum of the 9th, 10th and 11th terms of the same progression is 60. Determine the:
- first term;
 - common difference;
 - twentieth term. (10 marks)
- (b) A college assembly hall is in the shape of a trapezium. There are 13 students in the first row, 15 in the second, 17 in the third row and so on. Given that there are 47 students in the last row. Determine the total:
- number of rows;
 - number of students;
 - number of students in the tenth row. (10 marks)
6. (a) The common ratio of a geometric progression is $\frac{1}{2}$ and sum of its first three terms is 98. Determine the:
- first term;
 - tenth term;
 - sum of the first six terms. (13 marks)
- (b) An employee deposits Ksh 10,000 in the first year of his employment. He wishes to accumulate this to Ksh 25,000 in five years. Calculate the compound interest rate per annum. (7 marks)
7. (a) Determine the:
- LCM of 24, 36 and 48.
 - GCD of 12, 18 and 20. (4 marks)

(b) Convert:

(i) 1011_2 to a denary number.

(ii) 67_{10} to a binary number.

(4 marks)

(c) (i) Simplify:

$$0.\dot{2}\dot{7} + 0.\dot{6}\dot{4} \div 0.5\dot{3}$$

giving your answer as a fraction.

(ii) Use a scientific calculator to evaluate $\sqrt{\frac{(0.023\pi)^2 + (0.789)^3}{(2 \times 10^{-3})^2 - (0.06)^3}}$.

(iii) **Figure 2** shows a resistive network. Determine the total equivalent resistance.

(12 marks)

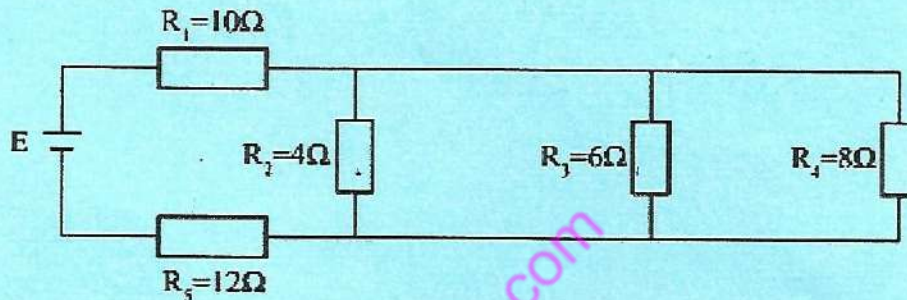


Fig. 2

8. (a) Solve the equations:

(i) $\frac{2 + \log_2 x}{2 - \log_2 x} = 3$

(ii) $x^{\log_{10} 3} + 3(x^{\log_{10} 3}) = 36$

(iii) $6^{x+2} \times 2^{1-x} = \frac{8}{3}$

(12 marks)

(b) (i) Simplify $\frac{1}{3}$ of $(\frac{1}{2} + \frac{1}{3}) + \frac{1}{4} \times \frac{1}{5} \div \frac{2}{3}$.

(ii) A man spent $\frac{1}{3}$ of his salary on food. He spent $\frac{1}{5}$ of the rest on fees. If he saved Ksh 8000, compute his salary.

(8 marks)

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