

1601/103
1602/103
MATHEMATICS I
June/July 2022
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:

Answer booklet;

Mathematical tables/Non-programmable scientific calculator.

This paper consists of EIGHT questions.

Answer any FIVE questions 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 5 printed pages.

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

1. (a) Evaluate the expressions:

(i) $\frac{2}{3} \text{ of } \left\{ \left(\frac{1}{5} + \frac{1}{3} \right) \div \left(\frac{1}{2} - \frac{1}{7} \right) \right\}$

(ii) $\frac{27^{\frac{2}{3}} \times 16^{-\frac{1}{2}}}{\left(\frac{1}{9}\right)^2 \times \left(\frac{1}{2}\right)^3}$ (7 marks)

(b) Solve the equations:

(i) $\log_{10}(x^2 - 10) - \log_{10} 2 = 2$

(ii) $\log_{10}(x + 7) - \log_{10}(x - 2) = 1$ (7 marks)

(c) Simplify:

(i) $\log_4\left(\frac{1}{8}\right) + \log_2\left(\frac{1}{4}\right) + \log_{\frac{1}{27}}\left(\frac{1}{3}\right)$

(ii) $\frac{\log_{10} 81 - 2 \log_{10} 3}{\log_{10} 16 - 2 \log_{10} 2}$. Correct to 2 decimal places. (6 marks)

2. (a) Solve the equations:

(i) $6^{3x+2} = 30$. Correct to 4 decimal places.

(ii) $3^{x+2} \times \left(\frac{1}{9}\right)^{x-3} = \frac{1}{81}$ (6 marks)

(b) Convert:

(i) 10011001_2 to a denary member.

(ii) 49_{10} to a binary number. (4 marks)

(c) Figure 1 shows a d.c network. Use inverse matrix method to determine the values of the currents I_1 and I_2 . (10 marks)

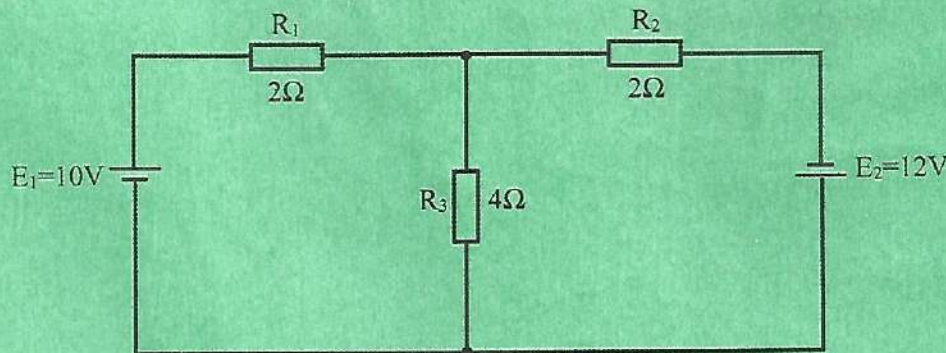


Fig. 1

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

(i) $2A + 5B$

(ii) $A(BB^T)$ (9 marks)

(b) (i) Given the matrix $C = \begin{bmatrix} 5 & 3 \\ 2 & 5 \end{bmatrix}$, determine C^{-1} .

(ii) Hence solve the equations.

$$5I_1 + 3I_2 = 25$$

$$2I_1 + 5I_2 = 29$$

(8 marks)

(c) Solve for x ;

$$\begin{vmatrix} (x+2) & 3 \\ 3 & (x-2) \end{vmatrix} + \begin{vmatrix} 3 & 1 \\ 2 & 2 \end{vmatrix} = 0$$

(3 marks)

4. (a) Simplify the expressions:

(i) $(x^4y^3)^{\frac{1}{2}} \times (x^{\frac{1}{2}}y^{\frac{1}{4}})^3 \div (xy^2)^{\frac{1}{3}}$

(ii) $\frac{(mn^2)^3}{(m^{\frac{1}{2}}n^{\frac{1}{4}})^4}$

(9 marks)

(b) The current I amperes in an a.c. circuit is given by $I = \frac{V}{\sqrt{R^2 + X^2}}$. Evaluate the resistance R ohms when $X = 11$ ohms, $V = 250$ volts and $I = 12.77$ amperes. Correct to 2 decimal places. (6 marks)

(c) Evaluate the resistance R_T , of a parallel circuit given by $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ when $R_1 = 5\Omega$, $R_2 = 7\Omega$ and $R_3 = 12\Omega$ correct to 2 decimal places. (5 marks)

5. (a) In a geometric progression, the first term is 16 times the fifth term and the third term is 16. Determine the:

(i) tenth term;

(ii) sum of the first twelve terms. (10 marks)

(b) The third and the sixth terms of a geometric progression are 54 and 1458 respectively. Determine the:

(i) common ratio; $\frac{1_1 + 1_2}{1_1}$

(ii) first term. (5 marks)

$V = IR$
 $I = \frac{V}{R}$
 $R = \frac{V}{I}$

$\frac{179}{422} = 0.424$

321 60 35

$1 \frac{1}{2}$

$\frac{57}{36}$
 $\frac{36}{93}$

90

- (c) Four technicians shared Ksh 1800 to buy tools. The amount was shared in such a way that their shares formed a geometric progression. Given that the largest share was 8 times the smallest share, determine the individual shares. (5 marks)
6. (a) The sum of the first two terms of an Arithmetic Progression is 3 and the seventh term is 40. Determine the:
- first term;
 - common difference;
 - sum of the first 40 terms. (6 marks)
- (b) The seventeenth term of an Arithmetic Progression is 14 and the sum of the first 25 terms of the progression is 200. Determine the:
- first term;
 - number of terms of the series that are less than 100. (10 marks)
- (c) A craftsman is planning to save for the next 48 months. He plans to save Ksh 300 initially and each successive month thereafter to save an extra Ksh 5 compared to the previous month. Determine the:
- amount he will save on the twelfth month;
 - total amount he will have saved at the end of the period. (4 marks)
7. (a) Table 1 shows the distribution of measurements of 100 pieces of wire.

Table 1

Measurements	Frequency
40 - 43	5
44 - 47	10
48 - 51	12
52 - 55	35
56 - 59	28
60 - 63	10

40 41 42 43

Determine the following correct to 2 decimal places:

- mode;
- mean;
- standard deviation.

(10 marks)

- (b) Table 2 gives the distribution of weights of 60 students in a class.

Table 2

Weights	Frequency
50 - 59	4
60 - 69	6
70 - 79	10
80 - 89	12
90 - 99	13
100 - 109	5

Calculate the:

- (i) median;
- (ii) 9th decile;
- (iii) 60th percentile. (10 marks)

8. (a) The second, third and ninth terms of an Arithmetic progression are three consecutive terms of a geometric progression. Determine the common ratio of the progression. (10 marks)

- (b) Express as a single logarithm to the base 2.

- (i) $2 \log_2 x + 3 \log_4 y - 2 \log_8 z$
- (ii) $2 \log_2 x + 3 \log_2 y - 5 \log_2 z$ (7 marks)

- (c) Given the matrix $A = \begin{bmatrix} 2 & 0 \\ 1 & 2 \end{bmatrix}$, determine:

- (i) A^3
- (ii) $|A|A$. (3 marks)

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