1601/103
1602/103
MATHEMATICS I
June/July 2017
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/calculator.*

*Answer any* ***FIVE*** *of the* ***EIGHT*** *questions in the answer booklet provided.*

*All questions carry equal marks.*

*All necessary working must be clearly shown.*

*Maximum marks for each part of a question are as indicated.*

***Candidates should answer all 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) Simplify the following expressions leaving your answer with positive indices:

(i) $\frac{2^{-4}\times 3^{2}\times 5^{-3}}{2^{3}\times 3^{4}\times 5^{-2}}$

(ii) $\frac{\left(6x^{-\frac{2}{3}}y^{-\frac{1}{3}}\right)8Z^{-\frac{1}{2}}}{12x^{-\frac{4}{3}}y^{\frac{1}{12}}Z^{\frac{1}{4}}}$

(6 marks)

(b) Solve the equation:

$\frac{16^{2x}\times 8^{x}}{4^{x}}=64$ (4 marks)

(c) If $x=\frac{4}{9}$ and $y=\frac{16}{49}$, find:

(i) $\frac{4}{7}\,y^{-\frac{3}{2}}$

(ii) $\left(\frac{x}{y}\right)^{-\frac{1}{2}}$

(6 marks)

(d) Solve the equation:

$\log(x+6)-\log(x-3)=1$

(4 marks)

2. (a) Given the matrices:

$A=\begin{pmatrix}2 & 1\\ 0 & 3\end{pmatrix}$ and $B=\begin{pmatrix}1 & 2\\ -2 & 4\end{pmatrix}$,

determine:

(i) $A+B$

(ii) $AB$

(iii) $B^{-1}$

(7 marks)

(b) Solve the equation:

$\begin{vmatrix}2-3x & -1\\ 4x & 4\end{vmatrix}=0$ (4 marks)

(c) Use the inverse matrix method to solve the simultaneous equations:

$3x+2y=18$

$5x-4y=8$

(9 marks)

3. (a) In a geometric progression, the sum of the third and fourth terms is 108. If the sum of the fourth and fifth terms is 324, determine the: 

(i) common ratio;

(ii) first term;

(iii) $12^{th}$ term.

(10 marks)

(b) The fourth term of an arithmetic progression is 14 and the sum of the first six terms is 69. Determine the:

(i) first term;

(ii) common difference;

(iii) sum of the first sixteen terms.

(10 marks)

4. (a) Convert:

(i) $65_{10}$ to binary.

(ii) $1100110101_2$ to denary.

(6 marks)

(b) Find the sum to infinity of a geometric progression whose first term is 3 and the common ratio is $\frac{1}{4}$. (4 marks)

(c) Two forces $F_1$ and $F_2$ in newtons acting on a simple mechanical system satisfy the equations:

$$F_1 + 3F_2 = 11$$
$$4F_1 - F_2 = 5$$

Use Cramer's rule to determine the values of the forces.

(10 marks)

5. (a) Given the data

42, 60, 85, 28, 11, 10, 12, 14, 17, 15, 22, 31, 85, 72, 12, determine the:

(i) first quartile;

(ii) third quartile;

(iii) interquartile range.

(7 marks)

(b) The lengths of 100 electrical conduits in meters selected from a workshop were recorded as in Table 1 below.

Table 1

| Length (m) | 10-14 | 14-18 | 18-22 | 22 - 26 | 26 - 30 | 30 - 34 | 34 - 38 |
|---|---|---|---|---|---|---|---|
| Number of conduits | 6 | 10 | 20 | 38 | 16 | 6 | 4 |

Determine the median and the :

(i) actual mean;

(ii) standard deviation of the distribution, using an assumed mean of 24.

(13 marks)

6. (a) Given the numbers:

24, 32, 48 and 56, Find the:

(i) L.C.M.

(ii) G.C.D.

(5 marks)

(b) Solve the following equations:

(i) $3^{2x+4} = 9^{3x-2}$

(ii) $2^{2x-3} = \sqrt{64}$

(7 marks)

(c) Solve the equations:

(i) $\log_x 81 = \log_2 16$

(ii) $2^{x-1} = 3^{x+1}$

(8 marks)

7. (a) Convert $0.\dot{2}\dot{3}$ to a fraction. (4 marks)

(b) Given that

$M = \begin{pmatrix} x-2 & 4 \\ 2 & x \end{pmatrix}$ is singular matrix, determine the:

(i) possible values of x;

(ii) Write down two possible matrices M.

(6 marks)

(c) A man travelled $\frac{1}{3}$ of his journey by road, $\frac{4}{5}$ of the remainder by air, and the rest by rail. If the total distance travelled was 1,200 km, determine the distances he covered in each case. (6 marks)



(d) An electrical device has an initial value of Ksh 8,000. If it depreciates at a rate of 12% per annum, determine using geometric progression, its value after 8 years. (4 marks)

8. (a) Solve the equations:

(i) $(4^{4x})(2^{-2x})=64$

(ii) $\log_2 x^2 + \log_2 4 = 4$

(8 marks)

(b) The third, fourth and fifth terms of a geometric progression are t + 3, t + 8 and t + 18 respectively. Determine the:

(i) common ratio;

(ii) first term;

(iii) sum of the first 12 terms.

(12 marks)

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