KENYA MEDICAL TRAINING COLLEGE
FACULTY OF REHABILITATIVE SCIENCES
DEPARTMENT OF MEDICAL ENGINEERING

FINAL QUALIFYING EXAMINATION
FOR
CERTIFICATE IN MEDICAL ENGINEERING TECHNOLOGY

PAPER: MATHEMATICS

DATE: 21st February 2022 **TIME: 3 HOURS (9:00AM – 12:00 PM)**

INSTRUCTIONS

1. This paper consists of:
   - Section 1 (10 Short Answer Questions)
   - Section 2 (3 Long Answer Questions)
2. Attempt **ALL** Questions
3. Write the **EXAMINATION NUMBER** given on all the answer sheets provided and on the question paper.
4. Ensure that all examination answer scripts are handed in at the end of the examination
5. Ensure you sign the examination register provided

EXAMINATION NUMBER .....

MATHEMATICS

SECTION 1 **ANSWER ALL QUESTIONS** **40 MARKS**

1. (a) Express the following denary number in binary form: 245_{10} (2 marks)
   (b) Express the following denary decimal in octal form: 0.526_{10} (2 marks)
2. Express 384.426_{10} in duodecimal form. (4 marks)
3. Find the logarithm of $log_{3.4}\ 0.293$ correct to three decimal places. (4 marks)
4. Find the coordinates of midpoints of the following:

   (a) A(4,2) and B(6,10) (2 marks)

   (b) A(-5,6) and B(3,2) (2 marks)

5. The radius of a circle is 3cm. Find the angle contained by a sector of area $18cm^2$ (4 marks)
6. If matrix $A = \begin{pmatrix} 2 & 4 \\ 1 & -3 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & -7 \\ 4 & -5 \end{pmatrix}$. Find the single matrix $A \cdot B$ (4 marks)
7. Express (3, -7) in polar coordinates (4 marks)
8. Find the centroid of a triangle whose coordinates are A(1,2), B(3,7) and C(2,3) (4 marks)
9. Use factorisation method to solve the quadratic equation $x^2 - 6x + 9 = 0$ (4 marks)
10. Using binomial expansion, find the expansion of $(1.003)^{10}$ correct to 6 decimal places. (4 marks)

SECTION 2 **ANSWER ALL QUESTIONS** **60 MARKS**

1. (a) Differentiate $y = x^2$ from the first principles and find the gradient of the curve at $x = 3$ (8 marks)
   (b) Use matrix to solve the following simultaneous equations:

   $$\frac{10}{a} - \frac{4}{b} = 3$$

   $$\frac{6}{a} + \frac{8}{b} = 7$$

   (12 marks)
2. (a) In a geometric progression, the fifth term is 8 times the second term and the sum of the 6^{th} and 8^{th} terms is 160.

   Determine: (i) The common ratio (4 marks)
   (ii) The first term (4 marks)
   (iii) The sum of the fourth to tenth terms, inclusive (4 marks)

   (b) Find the value of the mean, median and mode of the following set of data:
   52, 51, 52, 59, 60, 58, 54, 53 and 50 (5 marks)

   (c) Integrate $\int \left(r + \frac{1}{r}\right)^2 dr$ (3 marks)
3. (a) If $sin\theta = \frac{8}{17}$. Find the value of the other five trigonometric ratios. (7 marks)
   (b) A cone has a radius of $4.86cm$ and perpendicular height of $10.58cm$.

   Find: (i) Volume (3 marks)
   (ii) Total surface area (5 marks)

   (c) Integrate $\int \left(\frac{r^3+2r-1}{r^2}\right) dr$ (5 marks)