**TECHNICAL UNIVERSITY OF MOMBASA**

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

DIPLOMA IN MEDICAL ENGINEERING

AMA2250: ENGINEERING MATHEMATICS III

END OF SEMESTER EXAMINATION

**SERIES:** DECEMBER 2016

**TIME:** 2HOURS

**DATE:** 11 Dec 2016

**Instructions to Candidates**

You should have the following for this examination
-*Answer Booklet, examination pass and student ID*
This paper consists of **FIVE** questions.
Attempt question ONE (Compulsory) and any other TWO questions.
**Do not write on the question paper.**

**Question ONE (COMPULSORY)**

(a) Calculate the product [A][B][C] by

i). finding $[T] = [A][B]$ and then $[T][C]$, and

ii). finding $[T] = [B][C]$ and then $[A][T]$ where:

$$[A] = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}, \quad [B] = \begin{bmatrix} 6 & 5 \\ 4 & 3 \\ 2 & 1 \end{bmatrix}, \quad [C] = \begin{bmatrix} -1 & -2 \\ -3 & -4 \end{bmatrix}$$

iii). Calculate [A][B] of the two matrices given above and then take the transpose of product matrix. Is it equal to the product of $[B]^T[A]^T$? (18 marks)

(b) Prove that the triangle formed by the points $(-3; 5; 6)$; $(-2; 7; 9)$ and $(2; 1; 7)$ is a $30°$; $60°$; $90°$ triangle. (12 marks)

**Question TWO**

(a) Define the following terms as used in matrices:

i). Null Matrix

ii). Transpose Matrix

iii). Identity matrix

iv). Singular matrix (4 marks)

(b) For the system of equations

$x_1 + 2x_2 + 3x_3 = 14$
$x_1 + 3x_2 + 4x_3 = 19$
$x_1 + 4x_2 + 3x_3 = 18$

compute the unknowns $x_1$, $x_2$ and $x_3$ using the inverse matrix method. (16 marks)

**Question THREE**

(a) Use Cramer's rule to solve the equations:

$3x + 2y - z = 0$
$2x - y + z = 1$
$x - y + 2z = -1$ (12 marks)

(b) If $p = 2i + j - k$ and $q = i - 3j + 2k$ determine:

(i) $p \bullet q$      (ii) $p + q$      (iii) $|p + q|$      (iv) $|p| + |q|$      (8 marks)

**Question FOUR**

(a) If $p = 4i + j - 2k$, $q = 3i - 2j + k$ and $r = i - 2k$ find

i). $(p - 2q) \times r$

ii). $p \times (2r \times 3q)$                                       (12 marks)

(b) Find the direction cosines of $3i + 2j + k$ hence show that $cos^2\alpha + cos^2\beta + cos^2\gamma = 1$

(8 marks)

**Question FIVE**

(a) Evaluate, in polar form $2\angle30° + 5\angle-45° - 4\angle120°$         (8 marks)

(b) Given $Z_1 = 2 + j4$ and $Z_2 = 3 - j$ determine

i). $Z_1 + Z_2$,

ii). $Z_1 - Z_2$,

iii). $Z_2 - Z_1$ and show the results on an Argand diagram     (12 marks)