



TECHNICAL UNIVERSITY OF MOMBASA
School of Engineering and Technology
DEPARTMENT OF MEDICAL ENGINEERING

DIPLOMA IN MEDICAL ENGINEERING
DIPLOMA IN TECHNOLOGY IN MEDICAL ENGINEERING
DIPLOMA IN REFRIGERATION & AIR CONDITIONING

DME/SEP2020/J + S-FT
DTME/SEP2020/J + S-FT
DRAC/SEP2020/J + S-FT

AMA 2250
ENGINEERING MATHEMATICS III

END SEMESTER EXAMINATION
SERIES: APRIL 2022
TIME: 2 HOURS

INSTRUCTIONS

You should have the following for this examination

- Answer booklet
- Scientific calculator
- SMP Advanced tables
- Examination pass
- Student ID

This paper consists of **FIVE** questions

Answer Question **ONE** (**compulsory**) and any other **TWO** questions

Question1

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

- i) $Z_1 + Z_2$
- ii) $Z_1 - Z_2$
- iii) $Z_2 + Z_1$
- iv) show the results in the argand diagram

(10 marks)

(b) Determine the angles between the following vectors $A = 2i - j + k$, $B = i - 3j - 5k$ and $C = 3i - 4j - 4k$

(10 marks)

Question2

(a) i) Matrice A and B are such that $3A - 2B = \begin{bmatrix} 2 & 1 \\ -2 & 3 \end{bmatrix}$ and $-4A + B = \begin{bmatrix} -1 & 2 \\ -4 & -4 \end{bmatrix}$ determine A and B

ii) Given that $A = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 0 & 1 & 2 \\ 3 & 4 & 5 \\ 6 & 7 & 8 \end{bmatrix}$ show that

- i. $A + (B + C) = (A + B) + C$
- ii. $(A+B)' = A' + B'$

(10 marks)

(b) Use matrices to solve

$$3a + 4b - 2c = 2$$

$$-2a + 2b + 2c = 15$$

$$7a - 5b + 4c = -2b$$

(10 marks)

Question3

(a) Express the roots of $(-14 + j3)^{-2/5}$ into polar form

(10 marks)

(b) convert the following into corresponding polar and rectangle form

i) $4 < 30^\circ$

ii) $7 < -145^\circ$

iii) $3 + j4$

iv) $3-j4$

(10 marks)

Question4

(a) Use Gaussian elimination to solve the following simultaneous equations

$$6.2x + 7.9y + 12.6z = 18$$

$$7.5x + 4.8y + 4.8z = 6.39$$

$$13x + 3.5y - 13z = -17.4$$

(10 marks)

(b) The relationship between displacement s , velocity v and acceleration a of a piston is given by the equations below

$$s + 2v + 2a = 4$$

$$3s - v + 4a = 25$$

$$3s + 2v - a = -4$$

use matrices to determine the values of s, v and a

(10 marks)

Question5

(a) Given that $\vartheta = 2x^3y^2z^4$ determine $\text{div grad } \vartheta$ and show that $\text{div grad } \vartheta = \nabla^2\vartheta$

(10 marks)

(b) Determine $\nabla \cdot A$ at $1, -1, 1$ given that $A = x^2zi - 2y^3z^2j + xy^2zk$

(10 marks)