



# UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

## FIRST SEMESTER EXAMINATIONS, NOV/DEC. 2018

COURSE NO: MA 175

COURSE NAME: BASIC LINEAR ALGEBRA

CLASS: MA I

Unihubgh.com

TIME: 3 HOURS

Name: \_\_\_\_\_ Index Number: \_\_\_\_\_

*Answer ONLY three (3) questions. All questions carry equal marks. All working must be clearly done in the Answer Booklet provided.*

### Question 1

a. If  $(x + iy)^{1/3} = a + ib$ , where  $x, y, a, b \in R$ . Show that  $\frac{x}{a} - \frac{y}{b} = -2(a^2 + b^2)$ .

b. Solve the equation  $\log(x-1) + \log(x+8) = 2\log(x+2)$

c. Express as a sum of partial fractions  $\frac{3+6x+4x^2-2x^3}{x^2(x^2+3)}$

d. Simplify  $\frac{(\cos 2\theta + i\sin 2\theta)^4}{(\cos \theta - i\sin \theta)^3}$

e. Find the eigenvalues of the matrix  $A = \begin{bmatrix} 4 & 0 & 1 \\ -1 & -6 & 2 \\ 5 & 0 & 0 \end{bmatrix}$

### Question 2

a. Simplify  $\frac{(x^2\sqrt{y})(\sqrt{x}\sqrt[3]{y^2})}{(x^5y^3)^{1/2}}$  and evaluate when  $y = 27$

b. Use the inversion algorithm to find the inverse of  $A = \begin{bmatrix} -1 & -3 & 3 & -1 \\ 1 & 1 & -1 & 0 \\ 2 & -5 & 2 & -3 \\ -1 & 1 & 0 & 1 \end{bmatrix}$

c. If  $Z = R + j\omega L + \frac{1}{j\omega C}$ , express  $Z$  in  $(a + jb)$  form when  $R = 10$ ,  $L = 5$ ,  $C = 0.04$  and

$\omega = 4$ .

d. Solve  $2[(3v+t)-4] \times [(3v+t)+4]$

e. Complete the square for the quadratic equation  $4t^2 - 5t + 7 = 0$

### Question 3

a. Evaluate

i)  $\frac{2}{(1+j)^4}$

ii)  $j\left(\frac{1+3j}{1-2j}\right)^2$

b. If  $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ , show that  $A^2 - 4A - 5I = 0$

c. Express  $(1+i\sqrt{3})^{10}$  in the form  $x+iy$ :

d. Given  $a = \frac{1}{2-\sqrt{3}}$  and  $b = \frac{1}{2+\sqrt{3}}$ , find  $a^2 + b^2$ .

e. Solve the equation  $\log(x^2 - 3) - \log x = \log 2$

### Question 4

a. Find the quotient of the complex numbers  $z = 1+i$  and  $w = \sqrt{3} - i$  in polar form where  $z$  is the dividend.

b. If  $\left[ A + 3 \begin{bmatrix} 1 & -1 & 0 \\ 1 & 2 & 4 \end{bmatrix} \right]^T = \begin{bmatrix} 2 & 1 \\ 0 & 5 \\ 3 & 8 \end{bmatrix}$ , find the matrix  $A$ .

c. Express  $\frac{x^2+1}{x^2-3x+2}$  as a sum of partial fractions.

d. Show that  $A - A^T$  is skew-symmetric.

e. Find  $x, y$  if  $(x - j2y) - (y - jx) = 2 + j$

*Examiner: Monica V. Crankson*