TECHNICAL UNIVERSITY OF MOMBASA

A Centre of Excellence

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS AND PHYSICS

SEPTEMBER 2018 SERIES EXAMINATION

UNIT CODE: AMA 4250 UNIT TITLE: ALGEBRA II

BTME/BTMA

SPECIAL/SUPPLIMENTARY EXAMINATION

TIME ALLOWED: 2HOURS

INSTRUCTIONTO CANDIDATES:

You should have the following for this examination

- Mathematical tables
- Scientific Calculator

This paper consists of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

QUESTION 0NE (30 MARKS COMPULSORY)

a) Find the inverse of the matrix M where M = $\begin{pmatrix} 3 & 2 \\ 2 & 5 \end{pmatrix}$ and hence solve the matrix equation MX = C in which X = $\begin{pmatrix} x \\ y \end{pmatrix}$ and C= $\begin{pmatrix} 10 \\ 3 \end{pmatrix}$. (5 marks)

b) Convert $C9_{16}$ in hexadecimal to its decimal equivalent. (2 marks)

c) Solve for x, y and z if
x (5i + j) + y (j + k) + zk = 5i +3j – k. (3 marks)

d) Find the equation of the plane passing through (3, -1, 7) and perpendicular to the vector **a** = (4, 2, -5). (4 marks)

e) Let **u** = 2i – 3j + 4k, **v** = 3i + j – 2k and **w** = i + 5j + 3k.
Find;
2u – 3v + 4w. (3 marks)

f) Find **u**.**v** where u = (2, -5, 6) and v = (8, 2, -3). (3 marks)

g) If **A** = 3i – 2j + 4k and **B** = 2i – 3j – 2k. Find **A** x **B.** (3 marks)

h) Find x for which $\begin{vmatrix} x & 3 \\ 2 & (2x+1) \end{vmatrix} = 4$ (4 marks)

i) Evaluate $\begin{vmatrix} 1 & 4 & -3 \\ -5 & 2 & 6 \\ -1 & -4 & 2 \end{vmatrix}$ (3 marks)

QUESTION TWO (20 MARKS)

a) Determine the values of a so that **A** = ai – 2j + k and **B** = 29i + aj – 4k are orthogonal. (3 marks)

b) Let **u** = (1, -3, 4) and **v** = (3, 4, 7). Find
i. d (u, v) the distance between **u** and **v**. (3 marks)
ii. Cos θ, where θ is the angle between **u** and **v** (2 marks)

c) Solve the following systems of equations.

$2x_1 - x_2 = 7$

$-x_1 + 2x_2 - x_3 = 1$

$x_2 + 2x_3 = 1$

Using Gausi – Seidel method of iteration and perform the first five iterations. (8 marks)

d) Resolve the velocity vector of 20mls at an angle of -30° to the horizontal and vertical components. (4 marks)

QUESTION THREE (20 MARKS)

a) Convert the following binary numbers into their hexagonal equivalent.
(i) 11010110_2 (2 marks)
(ii) 1100111_2 (2 marks)

b) Perform the binary addition 1001 + 10110 (2 marks)

c) Convert the hexadecimal numbers into its decimal equivalent.

$1A4E_{16}$ (2 marks)

d) Use crammers rule to solve

$$2y - 4z + 6w = 20$$
$$3y - 6z + w = 22$$
$$-2y + 5z - 2w = -18$$

(8 marks)

e) Express w = (1, -2, 5) as a linear combination of vectors.

$V_1 = (1, 1, 1)$

$V_2 = (1, 2, 3)$

$V_3 = (2, -1, 1)$ (4 marks)

QUESTION FOUR (20 MARKS)

a) Find the solution to the following system of equations

a. $83x + 11y - 4z = 95$
b. $7x + 52y + 13z = 104$
c. $3x + 8y + 29z = 71$

Using Jacobi iterative method for the first five iterations. (13 marks)

b) Find the angle between the following pairs of planes.

$2x - y + 2z = 3$, $3x + 6y + 2z = 0$. (3 marks)

c) Find the equation of the plane passing through the point (1, 2, -1) and perpendicular to the planes $x + y - 2z = 5$ and $3x - y + 4z = 12$. (4 marks)

QUESTION FIVE (20 MARKS)

a) Given $A = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$ show that $(AB)^T = B^T A^T$ (6 marks)

b) Determine the values of x for which the determinant of A is zero where;

$$A = \begin{bmatrix} x-2 & 4 & 3 \\ 1 & x+1 & -2 \\ 0 & 0 & x-4 \end{bmatrix}$$ (5 marks)

c) Use logic gates to represent these expressions and draw the corresponding truth tables.

j) $\sim p \vee q$ (4 marks)

Ii) $(x \vee y) \wedge \sim x$ (5 marks)