NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BAMS	**LEVEL:** 5
COURSE CODE: LIA502S	**COURSE NAME:** LINEAR ALGEBRA 1
SESSION: JANUARY 2020	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 84

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINERS	DR IKO AJIBOLA
MODERATOR:	MR BENSON OBABUEKI

INSTRUCTIONS

1. Answer ALL the questions in the booklet provided.
2. Show clearly all the steps used in the calculations.
3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 4 PAGE (including this front page)

QUESTION 1 (16 marks)

1.1 If $u = 2i - 3j + k,\ v = 3i + j - 2k,\ w = i + 5j + 3k$ are vectors in R^3, find

1.1.1 $u + v$. [3]

1.1.2 $2u - 3v + 4w$ [4]

1.2 Suppose $u = (1, -2, 3)$ and $v = (2, 4, 5)$ Find:

1.2.1 $\cos\theta, where\ \theta$ is the angle between u and v; [2]

1.2.2 $proj(u, v)$, the projection of u unto v [3]

1.2.3 $d(u, v)$, the distance between u and v [4]

QUESTION 2 (25 marks)

2.1 Rewrite the following linear system in standard form.

$$2x + 4z + 1 = 0$$
$$2z + 2w - 2 = x$$
$$-2x - z + 3w = -3$$
$$y + z + t = w + 4$$

[2]

Find:

2.1.1 The coefficient matrix. [2]

2.1.2 The vector of constants [2]

2.1.3 The augmented matrix. [2]

2.1.4 The associated homogeneous system [2]

2.2 Determine whether the vector

$$U=\begin{bmatrix}0\\2\\1\end{bmatrix} \textit{ is a linear combination of } v_1=\begin{bmatrix}-1\\1\\0\end{bmatrix},\ v_2=\begin{bmatrix}2\\0\\1\end{bmatrix},\ v_3=\begin{bmatrix}1\\1\\1\end{bmatrix}$$ [10]

2.3 If $D=\begin{bmatrix}2-3i & 5+8i\\ -4 & 3-7i\\ -6-i & 5i\end{bmatrix}$ Find D^H the Hermitian matrix of D. [5]

QUESTION 3 (17 marks)

3.1 Write the vector V=(1,-2,5) as a linear combination of the vectors $u_1=(1,1,1),\ u_2=(1,2,3),\ u_3=(2,-1,1)$. [12]

3.2 Show that $V=\left\{\begin{bmatrix}x\\y\\0\end{bmatrix}, x,y\in R\right\}$ is a subspace of R^3. [5]

QUESTION 4(16 marks)

4.1 List out the four essential steps you will use in finding the inverse of a 3X3 Matrix A. [4]

4.2 Using the steps listed in (4.1) obtain the inverse of $A=\begin{bmatrix}2 & -1 & 3\\ 1 & -2 & 1\\ 0 & -1 & 2\end{bmatrix}$ [12]

QUESTION 5 (10 marks)

Use appropriate definition to investigate whether the polynomials

$p_1(t) = 2t^2 + 3t + 4, \quad p_2(t) = t^2 - 3t, \quad p_3(t) = 4t - 5$ are linearly dependent or linearly independent. [10]

END OF EXAMINATION