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; Bachelor of Science.	
QUALIFICATION CODE: 07BAMS; 07BOSC	**LEVEL: 5**
COURSE: LINEAR ALGEBRA 1	**COURSE CODE:** LIA502S
DATE: JULY 2019	**SESSION: SEMESTER 1 2019**
DURATION: 3 Hours	**MARKS: 93**

SUPPLEMENTARY/SECOND OPPORTUNITY QUESTION PAPER	
EXAMINER(S)	**Dr IKO AJIBOLA**
MODERATOR:	**Mr B OBABUEKI**

THIS QUESTION PAPER CONSISTS OF 3 PAGES
(Excluding this front page)

INSTRUCTIONS

1. Answer ALL the questions.
2. Write clearly and neatly.
3. Number the answers clearly.

ATTACHMENT

1. None

QUESTION 1 (24 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 If $u = \begin{bmatrix} -4 \\ 3 \\ 5 \end{bmatrix},\ v = \begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix}, w = \begin{bmatrix} 3 \\ -1 \\ -2 \end{bmatrix}$ Find

1.2.1 $5u - 2v + 2w$ [4]

1.2.2 $-2u + 4v - 3w$ [4]

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

1.3.1 $\cos\theta$, *where* θ is the angle between u and v; [2]

1.3.2 $proj(u, v)$, the projection of u unto v [3]

1.3.3 $d(u, v)$, the distance between u and v [4]

QUESTION 2 (25 marks)

2.1 Rewrite the linear system in standard form.

$$\begin{aligned} 2x + 4z + 1 &= 0 \\ 2z + 2w - 2 &= x \\ -2x - z + 3w &= -3 \\ y + z + t &= w + 4 \end{aligned}$$

[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

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

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 $\begin{aligned} x-2y-z&=1\\ -x+y&=0\\ y-z&=2\end{aligned}$ as a vector equation. [4]

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]

3.3 The sum of three numbers is twenty short of a hundred. The second number is twenty eight less than the sum of the first and the third numbers. The first number is six less than the third. Model this word problem as a system of linear equations and solve the system, using row operations, to determine the values of each of the three numbers. [8]

QUESTION 4(17 marks)

4.1 Write the vector v = (4, 9, 19) as a linear combination of

$$u_1 = (1,-2,3),\ \ u_2 = (3,-7,10),\ \ u_3 = (2,1,9).$$ [10]

4.2 Use Cramer's rule to find the value of x_2 in the following system of linear equations

$$\begin{aligned} 2x_1 + 3x_2 - x_3 &= -3 \\ x_1 - 2x_2 + 4x_3 &= 1 \\ 3x_1 + 2x_2 + x_3 &= -2 \end{aligned}$$ [7]

QUESTION 5 (10 marks)

Use appropriate definition to investigate whether the polynomials

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

END OF EXAMINATION