
CHUKA



UNIVERSITY

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EMBU CAMPUS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF

MATH 301: LINEAR ALGEBRA II

STREAMS: SB

TIME: 2 HOURS

DAY/DATE: THURSDAY 06/12/2018

2.30 P.M – 4.30 P.M

INSTRUCTIONS

- Answer question one and any other two questions

$$\begin{bmatrix} 1 & 5 & 0 \\ 2 & 4 & -1 \\ 0 & -2 & 0 \end{bmatrix}$$

- a) Compute the determinant of
marks] [5

b) Let $A = \begin{bmatrix} 1 & 1 \\ -i & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2+2i \\ 3-i & 4 \end{bmatrix}$

- i) $A + 3iB$ [3 marks]
ii) $B^2 + A^2$ [4 marks]

c) Let $u = (-i, 2, 1+3i)$ and $v = (1-i, 0, 1+3i)$ find

- i) $u \cdot v$ [3 marks]
ii) $\|u\|$ [3 marks]
iii) $d(u, v)$ [3 marks]

- d) Show that the vectors $u = (i, 1)$ and $v = (1, i)$ in C^2 are orthogonal with respect to Euclidean inner product . [3m marks]

$$\begin{bmatrix} 2 & 1+i \\ 1-i & 3 \end{bmatrix}$$

e) Find the Eigen values of the matrix [5 marks]

f) Define a linear transformation $T: \mathfrak{R}^2 \rightarrow \mathfrak{R}^2$ by $T(x) = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} -x_2 \\ x_1 \end{bmatrix}$ find

the images under T of $u = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$, $v = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ and $u+v = \begin{bmatrix} 6 \\ 4 \end{bmatrix}$ [6 marks]

QUESTION TWO 20MARKS

a) Apply Gram-Schmidt process to transform the basis vectors $u_1 = (i, i, i)$, $u_2 = (0, i, i)$ and $u_3 = (0, 0, i)$ into orthonormal basis [8 marks]

b) Find the value of k for which $u = (2i, i, 3i)$ and $v = (i, 6i, k)$ are orthogonal [4 marks]

c) Solve the system [8 marks]

$$\begin{aligned} x_1 - 2x_2 + x_3 &= 0 \\ 2x_2 - 8x_3 &= 8 \\ -4x_1 + 5x_2 + 9x_3 &= -9 \end{aligned}$$

QUESTION THREE 20MARKS

a) Find the standard matrix A for the dilation transformation $T(x) = 3x$ for x in \mathfrak{R}^2 [5marks]

$$A = \begin{bmatrix} 1 & i & 1+i \\ -i & -5 & 2-i \\ 1-i & 2+i & 3 \end{bmatrix}$$

b) Show that A is a Hermitian matrix [5 marks]

$$A = \begin{bmatrix} 6 & -2 & -1 \\ -2 & 6 & -1 \\ -1 & -1 & 5 \end{bmatrix}$$

c) Diagonalize matrix
marks]

[10

QUESTION 4 20MARKS

a) Find the Euclidean Norm of v if $v = (2i, 0, 2i + 1, -1)$
marks]

[4

$$A = \begin{bmatrix} 4 & -1 & 6 \\ 2 & 1 & 6 \\ 2 & -1 & 8 \end{bmatrix}$$

b) Let $A = 2$. The Eigen value of $A = 2$. Find the basis for corresponding Eigen space

[10 marks]

$$x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$A = \begin{bmatrix} 4 & 0 \\ 0 & 3 \end{bmatrix}$$

c) Let x compute $x^T Ax$ for the matrix
marks]

[6

