KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER, 2018/2019 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF (BSC) IN COMPUTER SCIENCE, ECONOMICS&MATHEMATICS AND EDUCATION SCIENCE

MATH 211: LINEAR ALGEBRA I

STREAM: Y2S1 **TIME: 2.00-4.00 PM**

EXAMINATION SESSION: JAN-APRIL **YEAR: 9/04/2019**

VENUE:AUDIT **COPIES: 70**

INSTRUCTIONS:

Attempt Question ONE and any other TWO Questions

QUESTION ONE (20 MARKS)

a) Solve the following system.

$$-2x_1 + 3x_2 = 1$$

$$6x_1 - 9x_2 = 2$$ **(4Mks)**

b) Evaluate each of the following for the given matrix

$$A = \begin{bmatrix} -7 & 3 \\ 5 & 1 \end{bmatrix}$$

i. A^2 (2mks)

ii. A^3 (2mks)

iii. $P(A)$ where $p(x) = -6x^3 + 10x - 9$ **(5mks)**

c) Find the determinant and the inverses of the following matrices

(i) $A = \begin{bmatrix} 3 & 9 & 2 \\ 0 & 0 & 0 \\ -4 & -5 & 1 \end{bmatrix}$ **(7mks)**

(d) Given the vectors A=2i+3j+k and B=i+2i+4k find

i) A.B (3mks)

ii) AXB **(3mks)**

e). Suppose B = $\begin{bmatrix} 4 & x+2 \\ 2x-3 & x+1 \end{bmatrix}$ is symmetric. Find x and B (4mks)

QUESTION TWO (20MARKS)

a) Define an orthogonal matrix. (2marks)

b) Find the diagonal and trace of the following square matrix. (4marks)

A = $\begin{bmatrix} 2 & -5 & 8 \\ 3 & -6 & -7 \\ 4 & 0 & -1 \end{bmatrix}$

c) Let A = $\begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$ and let f(x) = $2x^3 - 4x + 5$ and g(x) = $x^2 + 2x + 11$.

Find, (i) A^2 (ii) A^3 (iii) f(A) (iv) g(A) (9marks)

c) Given that B = $\begin{pmatrix} 5 & 1 \\ 3 & 4 \end{pmatrix}$, find the inverse of matrix B and show that $B^{-1}B = BB^{-1} = 1$ (5marks)

QUESTION THREE (20 MARKS)

a) Given the system of linear Equations below solve the system by

(i) Gauss-Jordan elimination method **(10 mks)**

(ii) Cramer's Rule **(10 mks)**

$$4x_1 - 8x_2 - 4x_3 = 4$$

$$x_1 + x_2 + 3x_3 = 3$$

$$2x_1 - 2x_2 + 2x_3 = 2$$

Comment briefly on your answer

QUESTION FOUR (20 MARKS)

a) Let A = $\begin{bmatrix} \mathbf{5} & \mathbf{2} \\ \mathbf{0} & \boldsymbol{k} \end{bmatrix}$. Find all numbers k for which A is a root of the polynomial,

f(x) = x^2 -7x +10 (4marks)

a) Given that A = $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ $and\ B = \begin{pmatrix} 1 & 1 \\ 0 & 2 \end{pmatrix}$ determine C = 2(B +A) – (2A + 2B + B) (6marks)

b) Given that **a** = $\begin{pmatrix} \mathbf{3} \\ \mathbf{2} \\ \mathbf{7} \end{pmatrix}$ **and b** = $\begin{pmatrix} \mathbf{2} \\ \mathbf{4} \\ \mathbf{-2} \end{pmatrix}$ find

(i) **a . b** (4marks)

(ii) **a x b** (6marks)

QUESTION FIVE (20 MARKS)

a) What is a vector space?. State any of its two axioms. (3mks)

b) Given that V = $R^3$and w = (a,b,0); a,b are real numbers. Determine if W is a subspace of R^3 (5mks)

c) Given that V = P_3 w = (P(x) =$a_1x + a_2x^2 + a_3x^3$). Determine if W is a subspace of P_3

(5mks)

d). $If\ A = \begin{bmatrix} 4 & 0 \\ 1 & -2 \end{bmatrix}$ then prove that $A^2 - 2A - 8I = 0$ where zero is a null matrix (5mks)

e). Find k so that vector **u** and **v** are orthogonal for u=(9, 9k, -27) and v = (18, -45, 36) (2mks)