KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: MATH 211

COURSE TITLE: LINEAR ALGEBRA I

STREAM: Y2S1

DAY: WEDNESDAY

TIME: 9.00 -11.00P.M

DATE: 08/12/2010

INSTRUCTIONS:

1.Question **ONE** is compulsory.

2. Attempt question ONE and any other TWO

PLEASE TURNOVER

QUESTION ONE (30 MARKS)

a) Clearly explain the solution to a linear equation and hence find the solution to the equation $x_1 - x_2 + x_3 = 9$ (3 marks)

b) Solve the following system of equation by row-reduction

$$2x + y = 3$$
$$x - 4y = -7$$
(4 marks)

c) Given the matrices $A=\begin{bmatrix} 0 & 9 \\ 2 & -3 \\ -1 & 1 \end{bmatrix}$ $B=\begin{bmatrix} 8 & 1 \\ -7 & 0 \\ 4 & -1 \end{bmatrix}$ $C=\begin{bmatrix} 2 & 3 \\ -2 & 5 \\ 10 & -6 \end{bmatrix}$

Compute 3A + 2B – 1/2C (3 marks)

d) Determine the angle between the following vectors **a** = (9,-2) and **b** = (4,18) (5 marks)

e) An isosceles triangle has vertices $P(2,3,5)$ $Q(-1,0,-2)$ $R(-4,1,z)$ Find the value of z. (5 marks)

f) Show that the vectors $\underline{u} = (1,2,3)$, $\underline{v} = (2,5,7)$ and $\underline{w} = (1,3,5)$ are linearly independent. (5 marks)

g) Find the Eigen values of $A = \begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$ (5 marks)

QUESTION TWO (20 MARKS)

a) State the conditions necessary for a matrix to be in a canonical form (3 marks)

b) Find the rank of the matrix (3 marks)

$$B = \begin{bmatrix} 9 & 3 & 1 & 0 \\ 3 & 0 & 1 & -6 \\ 1 & 1 & 1 & 1 \\ 0 & -6 & 1 & 9 \end{bmatrix}$$

c) Show that the vectors $\underline{v_1} = 2a - 3b + c$, $\underline{v_2} = 3a - 5b + 2c$ and $\underline{v_3} = 4a - 5b + c$ are linearly dependent where a, b and c are constants. (6 marks)

d) Compute the inverse of the following matrix using the Gauss Jordan elimination method

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

QUESTION THREE (20 MARKS)

a) Suppose that **u** = (u_1,u_2,u_3) and **v** = (v_1,v_2,v_3) are two vectors in 3- space show that $\underline{u} \bullet \underline{v} = u_1v_1 + u_2v_2 + u_3v_3$ (7 marks)

b) Calculate the scalar triple product of the vectors $\underline{u} = (3,-1,6)$, $\underline{v} = (2,4,3)$ and $\underline{w} = (5,-1,2)$ (5 marks)

c) Show that u = (3,0,1,0,4,-1) and v = (-2,5,0,2,-3,-18) are orthogonal and verify that the Pythagorean Theorem holds (8 marks)

d) Evaluate A^3 given that $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ (3 marks)

QUESTION FOUR (20 MARKS)

a) Show that the following vectors lie on the same plane $\underline{u} = (1,4,-7)$, $\underline{v} = (2,-1,4)$ and $\underline{w} = (0,-9,18)$ (4 marks)

b) Given **u**=(6,-2,8) and **v**=(4,0,2) compute **u** x **v** each of the following (5 marks)

c) Find the angle between the vectors p = 4i + 6j + 8k and q = 8i – 6j + 4k (5 marks)

QUESTION FIVE (20 MARKS)

a) Solve the following system of equation using Cramer's rule (10 marks)

$$-2x_1 + x_2 - x_3 = 4$$
$$x_1 + 2x_2 + 3x_3 = 13$$
$$3x_1 + x_3 = -1$$

b) Find the Eigen values and the corresponding Eigen vectors of the matrix (10 marks)

$$B = \begin{bmatrix} 3 & 2 \\ 3 & -2 \end{bmatrix}$$