TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE OF:

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY (BSIT 13)

ICS 2211: NUMERICAL LINEAR ALGEBRA

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2014
TIME ALLOWED: 2 HOURS

<u>Instructions to Candidates:</u>
You should have the following for this examination
- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FOUR** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

$$A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & 4 \\ 1 & 2 & 1 \end{pmatrix}$$

a) Given matrix
- **(i)** Calculate the matrix of cofactors A **(5 marks)**
- **(ii)** Find adj A **(2 marks)**
- **(iii)** Find the inverse of matrix A i.e. A^{-1} **(3 marks)**

$$A=\begin{pmatrix}6 & 4 & 3\\ -2 & 3 & -1\\ 1 & -1 & 2\end{pmatrix} \qquad B=\begin{pmatrix}2 & 1 & 1\\ 2 & 5 & 7\\ 3 & 1 & 1\end{pmatrix}$$

b) If and

(i) Compute AB and BA **(2 marks)**

(ii) Is AB = BA? Give your reason **(2 marks)**

$$|A| \neq 0 \qquad |A^{-1}| = \frac{1}{|A|}$$

c) IF A is invertible then and . Prove **(4 marks)**

d) By Gauss' elimination method, solve the following systems of equations

$$2x-4y+6z=20$$
$$-2x+5+2z=-18$$
$$3x-6y+z=22$$

(6 marks)

$$x+2y-z=3$$
$$-x-y+z=-5$$
$$-2x+3y=-2$$

e) Use Cramer's rule to solve: **(6 marks)**

Question Two

a) Solve the following system of equations by inverse method:

$$x+3y+2z=3$$
$$x+2y-z=10$$
$$2x+4y+2z=8$$

(12 marks)

$$\frac{dx}{dt}=6x-3y \quad \frac{dy}{dt}=2x+y$$

b) Solve the system , **(8 marks)**

Question Three

a) Consider the system of equations:

$$20x+y-2z=17$$
$$3x+20y-z=-18$$
$$2x-3y+20z=25$$

$x_o = y_o = z_o = 0$

Use the Jacobi iterative process to solve the system of equations given that , for FOUR iterate only giving your answer correct to 3.d.p **(3 marks)**

b) Use Gauss seidel iterative technique to find the approximate solution to:

$$-2x + y + 5z = 15$$
$$4x - 8y + z = -22$$
$$4x - y + z = 7$$

show that:

Perform FOUR iterates only with $(x_0, y_0, z_0) = (1, 2, 2)$ **(10 marks)**

Question Four

$$B = \begin{pmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{pmatrix}$$

Consider the given matrix

$$\lambda_{1,}\ i = 1,2,3$$

a) Determine the Eigen values **(5 marks)**

b) Find the corresponding Eigen vectors V_j: j = 1, 2, 3 **(12 marks)**

c) Show that the obtained Eigen vectors in (b) above the linearly independent **(3 marks)**

Question Five

a) A manufacturer process requires three difference inputs viz A, B and C. A sandal soap of first type requires 30 gm of A, 20gm of B and 6gm of C, while this data for the second type of soap is 25, 5 and 15 respectively. The maximum availability of A, B and C are 6,000, 3,000 and 3,00 respectively. The selling price of the sandal soap of the first and second type are $14 and $15, respectively. The profit is proportional to the amount of soaps proportional to the amount of soaps manufactured. How many soaps of first and second kind should be manufactured to maximize the profit. Assume that the market has unlimited demand **(5 marks)**

b) Reduce the matrix:

$$\begin{pmatrix} 1 & 2 & 3 & 1 \\ 2 & 1 & 2 & 0 \\ -1 & -2 & -1 & 0 \\ 1 & -1 & 3 & 3 \end{pmatrix}$$

to echelon form **(8 marks)**

c) Use the decomposition method of solve the system.

$$x_1 + x_2 + x_3 = 1$$
$$4x_1 + 3x_2 - x_3 = 6$$
$$3x_1 + 5x_2 + 3x_3 = 4$$

(7 marks)