Tribhuvan University
Institute of Science and Technology
2079

Bachelor Level / second-semester / Science   Full Marks: 80

Computer Science and Information Technology(MTH163)   Pass Marks: 32

Mathematics II   Time: 3 Hours

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Group A

Attempt any THREE questions (3 x 10 = 30).

Reduce the system of equations into echelon form and solve:

$x_1 - 2x_2 - x_3 + 3x_4 = 0$

1

$-2x_1 + 4x_2 + 5x_3 - 5x_4 = 3$

$3x_1 - 6x_2 - 6x_3 + 8x_4 = 2$

Define linear transformation of a matrix A.

Let A = $\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 7 \end{bmatrix}$, v = $\begin{bmatrix} -2 \\ 1 \end{bmatrix}$, c = $\begin{bmatrix} 3 \\ 2 \\ 4 \end{bmatrix}$, v = $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$

2

and define a tranformation T:$R^2 \to R^2$ by T(x) = Ax then

a. find T(v)

b. find x $\in R^2$ whose image under T is c.

3
$$C = \begin{bmatrix} 0.5 & 0.4 & 0.2 \\ 0.2 & 0.3 & 0.1 \\ 0.1 & 0.1 & 0.3 \end{bmatrix}$$

and the final demand is 50 units for manufacturing, 30 units for agriculture and 20 units for service. Find the production level x that will satisfy this demand.

4
Find the equation $y = a_0 + a_1 x$ of the least square line that best fits the data points (0, 1), (1, 1), (1, 1), (2, 2), (3, 2).

Group B

Attempt any TEN questions (10 x 5 = 50).

5
When a linear system of equation is consistent? Find the values of h and k for which the system: $2x_1 - x_2 = h$; $-6x_1 + 3x_2 = k$ is consistent?

6
Determine the column of the matrix A are linearly independent, where

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

7
When two column vector in R^2 are equal? Give an example. Computer u + 3v, u − 2v, where

$$u = \begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix}, v = \begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix}$$

The column of $I_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ are $(e_1) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, and $e_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. Suppose T is a linear transformation from R^2 into R^3 such that

$$T(e_1) = \begin{bmatrix} 5 \\ 1 \\ -2 \end{bmatrix} \text{ and } T(e_2) = \begin{bmatrix} 0 \\ -1 \\ 8 \end{bmatrix}$$

find a formula for the image of an arbitrary x in R^2. That is, find T(x) for x in R^2.

9   Find the eigenvalues of the matrix $\begin{pmatrix} 6 & 3 & -8 \\ 0 & -2 & 0 \\ 1 & 0 & -3 \end{pmatrix}$

10   Define null space of a matrix A. If

$$A = \begin{bmatrix} -1 & -3 & 2 \\ -5 & -9 & 1 \end{bmatrix}, \text{ and } v = \begin{bmatrix} 5 \\ -3 \\ -2 \end{bmatrix}$$

11   Verify that 1^k, $(-2)^k$, 3^k are linearly independent signals.

12   Evaluate the determinant of the matrix

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

13   Define unit vector. Find a unit vector v of u = (0, -2, 2, -3) in the direction of u.

14   Define group. Show that the set of integers is not a group with respect to subtraction operation.

15   Define ring. Show that set of positive integers with respect to addition and multiplication operation is not a ring.