Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– 1st / 2nd • EXAMINATION – SUMMER 2013

Subject Code: Maths-II **Date: 05-06-2013**
Subject Name: 110009
Time: 02:30 pm – 05:30 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a Let u =(4,1,2,3) and v = (0,3,8,-2).Evaluate following as directed. **04**
1. Find the norm of u + v.
2. Find the Euclidean inner product of u and v.
3. Find the Euclidean distance between u and v.
4. Find 2u – 3v.

(b) Find the inverse of A= $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$. **05**

(c) If A = $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$, Prove that $A^2 - 13A + 12 = 0$. **05**

Q.2 (a) Define symmetric and skew symmetric matrix. Express A = $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ as the sum of the symmetric and the skew symmetric matrix. **07**

(b) Determine whether W= { (a,b,c) / $a^2 + b^2 < 1$ } is a subspace of R^3. **03**

(c) Show that the set of vectors {(2, 1, 1),(1, 2, 2),(1, 1 ,1)} is linearly independent in R^3. **04**

Q.3 (a) Find the eigenvalues and eigenvectors of A = $\begin{bmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$. **07**

(b) Find the least square solution of the linear system Ax = b given by $x_1 - x_2 = 4, 3x_1 + 2x_2 = 1, -2x_1 + 4x_2 = 3$ and find the orthogonal projection of b on the column space of A. **07**

Q.4 (a) Define linear transformation. Find which of the following function are linear transformations. **07**
1. T : $R^3 \to R^3$, Defined by T(x ,y , z) = (x^2 , y , x + y).
2. T : $R^2 \to R^2$, Defined by T(x ,y) = (x ,- y).

(b) Let R^3 have the Euclidean inner product. Use the Gram-Schidt process to transform the basis S = { (1 , 0 ,-1) , (2 , 1, 1) , (0 , -1 , 3) into an orthonormal basis. **07**

Q.5 (a) Let V be the set of all positive real number with the operations x + y = x y and k x = x^k , k ∈ R. Show that the set V is a vector space. **07**

(b) Let v_1 = (1 , 2 ,1) , v_2 = (2, 9 , 0) and v_3 = (3 , 3 , 4) **07**
1. Show that the set S = { v_1 , v_2 , v_3 } is a basis for R^3.
2. Find the coordinate vector of v = (5 ,-1 , 9) with respect to S.

Q.6 (a) Solve x + y + 2z = 8, – x – 2y + 3z = 1, 3x – 7y + 4z = 10 by Gauss-Jordan elimination. **07**

(b) Find a basis for the null space, the row space and the column space of A = $\begin{bmatrix} 1 & -1 & 3 \\ 5 & -4 & -4 \\ 7 & -6 & 2 \end{bmatrix}$. **07**

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Q.7 **(a)** Consider the basis S = {v_1,v_2} for R^2,where $v_1 = (-2,1)$ and $v_2 = (1,2)$ and Let $T : R^2 \rightarrow R^3$ be the linear transformation such that $T(v_1) = (-1,2,0)$ and $T(v_2) = (0, -3,5)$.Find a formula for $T(x_1,x_2)$ and use that formula to find $T(x_1,x_2)$. **07**

(b) Define: Real inner product space. Let the vector space P_2 have the inner product space $< p,q > = \int_{-1}^{1} p(x)q(x)\,dx$ then **07**

1. Find $\|p\|$ for $p = 1, q = x$.
2. Find d (p, q) if $p = x, q = x^3$.

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