5. (a) Find the divergence and curl of vector field $\vec{F} = (3x^2)i + 2zj - xk$. (7)

(b) What is positive definite matrix? Is the following matrix positive definite? (8)

$$\begin{bmatrix} 6 & -3 & 0 \\ -3 & 6 & -3 \\ 0 & -3 & 6 \end{bmatrix}.$$

6. (a) Find the eigen values and vectors for the following matrix A : (7)

$$A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

(b) Show that the following matrix is diagonalizable : (8)

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

7. (a) Determine if the following set of vectors are linearly independent or independent : (7)

[1, 1, 1, 1], [0, 1, 1, 1], [0, 0, 1, 1], [0, 0, 0, 1]

(b) Prove that the vectors

$$\vec{x} = 2\hat{\imath} + 4\hat{\jmath} + 6\hat{k}, \vec{y} = 6\hat{\imath} - 4\hat{\jmath} + 2\hat{k}$$

and $\vec{z} = 2\hat{\imath} - 12\hat{\jmath} - 10\hat{k}$ form a linearly dependent system. (8)

(200)

[This question paper contains 4 printed pages.]

Your Roll No..............

Sr. No. of Question Paper : 785 I

Unique Paper Code : 6202451103

Name of the Paper : Mathematics for Computing

Name of the Course : **Bachelors of Vocation ((Software Development) IT/ITES)**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections. **Section A** is compulsory. Each question is of **5** marks.
3. Attempt any **four** questions from **Section B**. Each question is of **15** marks.

Section A

1. (a) Find the value of y for which the given vectors $(1, -2, \gamma)$, $(2, -1, 5)$, and $(3, -5, 7\gamma)$ are linearly independent. (5)

(b) Define a convex set. Show that C = {x: 5x + 6}

$\in \mathbb{R}$ is convex, but not strictly convex. (5)

(c) Find the characteristic polynomial of the following matrix : (5)

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$

(d) Find the dot product and cross product of the vectors $\vec{a} = 12\hat{\imath} - 2\hat{\jmath} + 6\hat{k}$, and $\vec{b} = 12\hat{\imath} + c\hat{\jmath} - 6\hat{k}$. (5)

(e) Show that the vectors (3,0,2), (7,0,9) and (4,1,2) form a basis for E^3. (5)

(f) Find the rank of the matrix A : (5)

$$A = \begin{bmatrix} 1 & 3 & -2 \\ 2 & -1 & 4 \\ 1 & -11 & 14 \end{bmatrix}$$

Section B

2. (a) Find the inverse of the following matrix : (5)

$$B = \begin{bmatrix} 2 & -1 & -3 \\ 3 & -4 & -2 \\ 5 & 2 & 4 \end{bmatrix}$$

(b) For what values of λ and μ. do the system of equations (10)

$$2x + 2y + 2z = 12$$
$$2x + 4y + 6z = 20$$

$$2x + 4y + 2\lambda z = 2\mu$$

have (i) no solution, (ii) unique solution, and (iii) more than one solution.

3. (a) Apply Gram-Schmidt orthonormalization process to obtain an orthonormal basis for the subspace of P_4 generated by the vectors (1,1,1,1,1), (–2,–1,0,1,2) and (4,1,0,1,4). (7)

(b) If the system of equations (8)

$$x - ky - z = 0,$$
$$kx - y - z = 0,$$
$$x + y - z = 0$$

has a non-zero solution, then find the possible values of k.

4. (a) Verify the Cayley Hamilton Theorem for the matrix (7)

$$C = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$$

(b) Use gram Schmidt process to obtain orthonormal basis for $R^3(R)$ with standard inner product space, given vectors $\alpha_1 = (1,0,1)$, $\alpha_2 = (1,0,-1)$, and $\alpha_3 = (0,3,4)$. (8)