1) Question **No.1** is Compulsory
2) Answer **any three** out of the remaining questions.
3) Assume suitable data wherever required.
4) Figures to the **right** indicate **full** marks.

Time **3 Hours** **Total Marks** **80**

Q. 1 Answer any four 20

a) Characteristic equation

b) Column space of a matrix

c) Eigen value

d) Linear transformation

e) Jordan Canonical form

Q. 2 a) Determine if the following homogenous system has a non-trivial solution 10

$3x_1 + 5x_2 - 4x_3 = 0$

$-3x_1 - 2x_2 + 4x_3 = 0$

$6x_1 + x_2 - 8x_3 = 0$

b) What do you mean by linear independence of vectors? Determine whether the vectors $u_1 = (2,3,1,4)$, $u_2 = (-1,1,2,3)$, $u_3 = (4,0,-1,1)$ are linearly independent or not. 10

Q.3 a) What do you by basis vector? Determine whether $B = \left\{ \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \right\}$a basis for is R^3. 10

b) Identify whether the following statements are true or false. Justify your answers.

i) If 4 is an eigen value of a matrix, then 4 is also an eigen value of A^T. 3

ii) The eigen values of a 2x2 matrix A are 5 and -1. The matrix A is diagonalizable 4

iii) Eigen vectors of A and A^2 are same. 3

Q.4 a) What is orthogonal projection? Using this concept explain the process of Gram Schmidt and its geometric interpretation. 10

b) What is diagonalization? Using the concept of diagonalization, obtain 10

A^{11} ,where $A = \begin{bmatrix} -1 & 7 & -1 \\ 0 & 1 & 0 \\ 0 & 15 & -2 \end{bmatrix}$

Q.5 a) Obtain solution of the dynamic system 10

$$\dot{x} = Ax$$

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

b) Briefly explain how change of basis matrix can be obtained. 10

Q.6 Write short notes 20

a) Pseudo inverse of matrix

b) One to one mapping and onto mapping

c) Quadratic form

d) Significance of singular values

****