APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH DEGREE EXAMINATION

Electronics & Communication Engineering

(Telecommunication Engineering)

04EC6801—Applied Linear Algebra

Max. Marks : 60 Duration: 3 Hours

PART A

Answer All Questions

Each question carries 3 marks

1. Show that the vectors are (1,1,1), (1,2,3) and (2,-1,1) are linearly independent.
2. Find the pseudo inverse of matrix $A=\begin{bmatrix} 1 & 2 \\ -1 & 3 \\ 2 & 4 \end{bmatrix}$.
3. Find the matrix representation of the linear map F: $R^2 \rightarrow R^2$ defined by F(x,y)= (2x-5y,3x+y) relative to the basis $\{u_1 = (2,1), u_2 = (3,2)\}$ of R^2.
4. Explain Gram Schmidt orthonormalization process.
5. Explain the properties of eigen vectors.
6. Check whether the given matrix $A=\begin{bmatrix} 4 & 0 & -2 \\ 2 & 5 & 4 \\ 0 & 0 & 5 \end{bmatrix}$ is diagonalizable or not.
7. Explain Pseudo inverse of a matrix using SVD.
8. Determine the eigen values of $A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and their algebraic multiplicity

PART B

Each question carries 6 marks

9. Find the dimension of the vector space spanned by the vectors (1,1,-2,0,-1) , (1,2,0,-4,1), (0,1,3,-3,2), (2,3,0,-2,0) and find a basis for that space.

OR

10. Explain the algebraic structures in linear algebra.

11. Show that the equations x+y+z = a, 3x+4y+5z = b, 2x+3y+4z = c

    i. have no solutions if a=b=c=1 and
    ii. have many solutions if a=b/2=c=1.

OR

12. Find the least square solution of the given equations $2x_1= 1$, $-x_1+x_2 = 0$, $2x_2 = -1$.

13. The bases of R^3 is given as $S_1 = \{u_1 = (1,2,0), u_2 = (1,3,2), u_3 = (0,1,3)\}$ and $S_2 = \{v_1 = (1,2,1),$ $v_2 = (0,1,2), v_3 = (1,4,6)\}$. Find the change of matrix from S_1 to S_2 and viceversa.

OR

14. Find four fundamental subspaces of the given matrix A= $\begin{bmatrix} 1 & 5 & 3 & 7 \\ 2 & 0 & -4 & -6 \\ 4 & 7 & -1 & -2 \end{bmatrix}$.

15. Given set S = $\left\{ v_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, v_2 = \begin{bmatrix} 6 \\ 4 \\ 5 \end{bmatrix}, v_3 = \begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix} \right\}$. Find orthogonal set and orthonormal set basis using Gram-Schmidt Orthonormalization Process.

OR

16. Show that X = $\begin{bmatrix} 1/3 \\ -2/3 \\ -2/3 \end{bmatrix}$ and Y = $\begin{bmatrix} 2/3 \\ -1/3 \\ 2/3 \end{bmatrix}$ are orthogonal and also find a vector Z orthogonal to both X and Y.

17. Given that 2 is an eigen value of A = $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & -2 \\ 0 & 1 & 0 \end{bmatrix}$. Determine its geometric multiplicity and give a basis for the associated eigen space.

OR

18. Diagonalize the matrix A = $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$.

19. Find the SVD of the matrix C = $\begin{bmatrix} 5 & 5 \\ -1 & 7 \end{bmatrix}$.

OR

20. Find the pseudo inverse of the matrix A= $\begin{bmatrix} 1 & 2 \\ -1 & 3 \\ 2 & 4 \end{bmatrix}$ using SVD.