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. Express the vector v= (1,-2,5) as a linear combination of the vectors v_1= (1,1,1), v_2= (1,2,3), v_3 = (2,-1,1).
2. Explain the row-reduced echelon form.
3. Find the inverse of the linear transformation T: $R^3 \to R^3$ is defined by $T(x_1,x_2,x_3) = (2x_1+3x_2+x_3, 3x_1+3x_2+x_3, 2x_1+4x_2+x_3)$.
4. Find a unit vector orthogonal to v_1= (1,1,2) and v_2= (0,1,3) in R^3.
5. Explain the properties of eigen values.
6. Determine the eigen values of $A = \begin{bmatrix} -1 & 2 & 1 \\ 0 & 1 & -1 \\ 0 & 2 & -2 \end{bmatrix}$ and their algebraic multiplicity.
7. Explain range and rank of AA^T and A^TA with example.
8. Explain Pseudo inverse of a matrix using SVD.

PART B

Each question carries 6 marks

9. Find the dimension and basis for column space of the matrix $A= \begin{bmatrix} -1 & 2 & -1 & 5 & 6 \\ 4 & -4 & -4 & -12 & -8 \\ 2 & 0 & -6 & -2 & 4 \\ -3 & 1 & 7 & -2 & 12 \end{bmatrix}$.

OR

10. a) Show that the vector $\begin{bmatrix} 20 \\ 4 \end{bmatrix}$ belongs to span of $\left\{ \begin{bmatrix} 1 \\ 3 \end{bmatrix}, \begin{bmatrix} 2 \\ 5 \end{bmatrix} \right\}$

    b) Prove that the vectors (1,-1,1), (0,1,2) and (3,0,-1) form a basis for R^3.

11. Find the least square solution to the matrix equation $\begin{bmatrix} 2 & -2 \\ -2 & 2 \\ 5 & 3 \end{bmatrix} X = \begin{bmatrix} -1 \\ 7 \\ -26 \end{bmatrix}$ using pseudo inverse method.

OR

12. Find the values of 'λ' for which the system of equations $x+y+z=1$, $x+2y+4z = \lambda$, $x+4y+10z = \lambda^2$ will be consistent and also show that for each value of 'λ' the system has a one parameter family of solutions and find these solutions.
13. Find the four fundamental sub spaces of the given matrix $A= \begin{bmatrix} 1 & -2 & -1 & 3 & 2 \\ 2 & -2 & -3 & 6 & 1 \\ -1 & -4 & 4 & -3 & 7 \end{bmatrix}$.

OR

14. Given bases of R^2 : S_1= (u_1= (1,-2), u_2 =(3,-4)) and S_2=(v_1= (1,3), v_2=(3,8)). Find the change of basis matrix from S_1 to S_2 and find the change of basis matrix from S_2 back to S_1.
15. Find the orthonormal basis of the subspace 'W' of R^5 spanned by v_1=(1,1,1,0,1), v_2=(1,0,0,-1,1), v_3=(3,1,1,-2,3), v_4= (0,2,1,1,-1).

OR

16. Find a basis for $W^{\perp}$ where W= span $\left\{\begin{bmatrix}1\\-5\\2\\3\end{bmatrix}, \begin{bmatrix}2\\1\\1\\1\end{bmatrix}\right\}$.
17. Compute eigen vectors of the matrix A= $\begin{bmatrix}4 & 6 & 10\\3 & 10 & 13\\-2 & -6 & -8\end{bmatrix}$.

OR

18. Diagonalize the given matrix A= $\begin{bmatrix}1 & -3 & 3\\3 & -5 & 3\\6 & -6 & 4\end{bmatrix}$.
19. Find SVD for the matrix A= $\begin{bmatrix}1 & 0\\0 & 4\end{bmatrix}$.

OR

20. Find the pseudo inverse of the matrix A= $\begin{bmatrix}2 & -2\\-1 & 2\\5 & 3\end{bmatrix}$ using SVD.