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. Given $v_1 = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$, $v_2 = \begin{bmatrix} -2 \\ 4 \end{bmatrix}$, Does $\{v_1, v_2\}$ spans R^2?
2. Explain null space, range and nullity.
3. Find the matrix representation of the linear map G: $R^2 \rightarrow R^2$ defined by G(x,y) = (2x-3y,4x+y) relative to the basis $\{u_1 = (1,-2), u_2 = (2,-5)\}$ of R^2.
4. Verify the Pythagoras Theorem for the following orthogonal set in R^4 , u = (1,2,-3,4), v = (3,4,1,-2), w = (3,-2,1,1).
5. State Spectral Theorem with example.
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 nullspace and nullity of AA^T and A^TA.
8. Explain the geometry of pseudo inverse.

PART B

Each question carries 6 marks

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

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 = λ, x+4y+10z = λ^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 of the matrix A= $\begin{bmatrix} 3 & -1 \\ 3 & -1 \end{bmatrix}$.

OR

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