

Module Linear Algebra:
Syllabus covered in Engg Maths
for Adv. Studies (Autumn 2019,
IIT Dharwad)

1. Row and Column picture for a matrix operation
2. Singularity in case of system of linear equations
3. Gaussian elimination
 - a. Finding pivots
 - b. Failure scenarios
4. Gauss Jordan method
5. $A=LU$, $A=LDU$, $A=LDL^T$ factorization
6. Vector Space
 - a. Axioms for addition of vectors
 - b. Axioms for multiplication by a scalar
 - c. Linear combination
 - d. Subspaces
7. Four fundamental subspaces
8. Solution of Linear System of equations
 - a. Null solution
 - b. Particular solution
 - c. Complete solution
9. Echelon form
 - a. Pivot variables
 - b. Free variables
 - c. Rank of a matrix
10. Linear independence
11. Basis and dimension of vector spaces
12. Linear transformation
 - a. Interpretation of a column in transformation matrix (Page 129 point 2U Gilbert Strang)
13. Orthogonality of vectors
14. Orthogonal subspaces
15. Projection on a line
16. Projection Matrix and its properties
17. Least square method and projections onto a vector space
18. Orthogonal bases, orthogonal matrix, Gram Schmidt orthogonalization

19. QR factorization
20. Determinants
 - a. Applications
 - b. Rules
21. Eigenvalues and Eigenvectors
 - a. Characteristic polynomial equation
 - b. Eigenvalues and trace and determinant
 - c. Matrix diagonalization and its application to power of a matrix
22. Complex matrices
 - a. Hermitian
 - b. Unitary
23. Positive Definite matrices
 - a. $A^T A$
 - b. Interpretation of positive definite matrix
 - c. Test for positive definiteness
 - d. Singular value decomposition
24. Similarity transforms