Advanced Numerical Analysis (Theoretical)

1. **Numerical Linear Algebra**
   - **1.1 Linear Systems of Equations.**
   - **1.2 Definitions**
     - 1.2.1 Matrix Operations.
     - 1.2.2 Matrix Transpose.
     - 1.2.3 Special Matrices.
     - 1.2.4 Matrix Determinant.
     - 1.2.5 Matrix Singularity.
     - 1.2.6 Matrix Inverse.
     - 1.2.7 Matrix Adjoint.
   - **1.3 Numerical Methods for Solving Linear System of Equations**
     - 1.3.1 Gaussian Elimination (Direct Method).
     - 1.3.2 LU Decomposition (Direct Method).
     - 1.3.3 Vectors and Matrix Norms.
     - 1.3.4 Jacobi's Method (Iterative Methods).
     - 1.3.5 Gauss-Seidel Method (Iterative Methods).
2. **Interpolation and Polynomial Approximation**
   - 2.1 Polynomials.
   - 2.2 Interpolation and the Lagrange Polynomial.
   - 2.3 Divided Differences.
   - 2.4 Forward Differences.
   - 2.5 Backward Differences.
   - 2.6 Centered Differences.

Laboratory	
1. Array in MATLAB (Matrices and Vectors). 2. Gaussian Elimination Method. 2.1 Partial Pivoting. 2.2 Scaled Partial Pivoting. 3. LU Decomposition Method. 4. Jacobi Method. 5. Gauss-Seidel Method. 6. Introduction to Interpolation. 7. Polynomial Method. 8. Lagrange Interpolation.	9. Divided Difference Method. 10. Finite Difference Method. 11. Forward Difference Method. 12. Backward Difference Method. 13. Central Difference Method. 14. Plotting. 15. Plotting.

References:

1. **"Numerical Methods for Engineers and Scientists Using MATLAB"**, Ramin S. Esfandiari, CRC Press (Taylor & Francis Group), 2nd edition, 2017.
2. **"Numerical Analysis"**, Richard. L. Burden, J. Douglas. Faires and Annette M. Burden, Brooks/Cole, Cengage Learning, 10th edition, 2016.
3. **"Programming with MATLAB for Scientists: A beginner's Introduction"**, Eugeniy E. Mikhailov, CRC Press (Taylor & Francis Group), 2017.