**JECRC, Jaipur**

**Course Plan**

**7CE5A – Applications of Numerical Methods in Civil Engineering**

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| **S. No.** | **Topics** |
| 1 | Introduction to Mathematical Modeling and Engineering Problem Solving. |
| 2 | Decimal & Binary Number system. |
| 3 | Accuracy, Precision and Significant Digits. |
| 4 | Approximations, |
| 5 | Errors and their types. |
| 6 | Truncation errors and Taylor’s series |
| 7 | General Error Formula |
| 8 | Propagation of Errors |
| 9 | Roots of Equations: Iterative processes and their Convergence. Existence of roots in engineering practices & their geometrical representation. |
| 10 | Roots of the equations by: Graphical Method, Bisection Method. |
| 11 | Regula Falsi Method, Secant Method. |
| 12 | Newton-Raphson Method |
| 13 | Method of Successive Substitution |
| 14 | Application to simple civil engineering problems. |
| 15 | Matrices and Determinants: Their types and basic operations. |
| 16 | Matrix inversion |
| 17 | Rank of a matrix |
| 18 | Solution of Linear system of equations. Direct Method and Iterative methods. |
| 19 | Cramer’s Rule |
| 20 | Gaussian elimination method |
| 21 | Gauss-Jordan Method |
| 22 | Cholesky Method |
| 23 | Application to simple civil engineering problems. |
| 24 | LU decomposition |
| 25 | Iterative Methods for solving Linear system of equations: Jacobi Method |
| 26 | Gauss Seidel method. |
| 27 | Application to simple civil engineering problems. |
| 28 | Interpolation, Finite Differences, Operators |
| 29 | Difference Table, Fundamental Theorem of Finite differences |
| 30 | Interpolation with equal interval, Newton Gregory Forward difference formula and backward difference formula |
| 31 | Interpolation with unequal interval, Divided difference, Newton’s divided difference formula. |
| 32 | Lagrangian interpolation formula. |
| 33 | Inverse interpolation |
| 34 | Central interpolation, Central Differences. |
| 35 | Hermite Interpolation |
| 36 | Curve Fitting, Method of least squares. |
| 37 | Fitting of a straight line. |
| 38 | Fitting a polynomial of degree two. |
| 39 | Fitting of other curves. |
| 40 | Application to simple civil engineering problems. |