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| **Name of The Course** | Numerical methods | | | | |
| **Course Code** | MATH 2300 (Sem-III) | | | | |
| **Prerequisite** |  | | | | |
| **Corequisite** |  | | | | |
| **Antirequisite** |  | | | | |
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**Course Objectives:**

To enhance problem solving skills of engineering students using a powerful problem-solving tool namely numerical method. The tool is capable of handling large systems of equations, nonlinearities and complicated geometries that are common in engineering practice but often impossible to solve analytically.

**Course Outcomes:**

After learning the course, the students should be able to:

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| **CO1** | Employ the concept of errors and apply various numerical methods to find the roots  of nonlinear equations and solution of system of equations (K3). |
| **CO2** | Apply interpolation formulas to find approximate polynomials and missing values (K3). |
| **CO3** | Solve differentiation and integration for complex functions using numerical methods (K4). |
| **CO4** | Solve Ordinary differential equations using different numerical methods (K4). |
| **CO5** | Solve Partial differential equations using different numerical methods (K4). |
| **CO6** | Apply Numerical techniques to real life applications (K3). |

**Text Books:**

T1: Numerical methods for Engineers,6th edition, Steven C. Chapra and Raymond P. Caynale.

T2: Numerical Methods for Scientific and Engineering Computation (6th edition) by Jain, Iyengar& Jain, New Age International publishers.

**Reference Books:**

R1: Numerical Methods by E Balagurusamy, Tata McGraw Hill

R2: Curtis F. Gerald and Patrick O Wheatley, Applied Numerical Analysis, Pearson Education Ltd.

R3: Introductory Methods of Numerical Analysis by S.S. Sastry, PHI learning Pvt Ltd.

R4: Numerical Methods by Engineering and Science by B.S. Grewal, Khanna Publishers.

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| **Unit-1 12 Hours** |
| **Non-Linear Equations and system of linear equation:** Introduction, error and error propagation. Bisection method, False position Method, Method of Iteration, Newton-Raphson Method, Secant Method, convergence of iterative methods, Gauss Elimination method, Gauss – Jordan method, Gauss –Seidel method. |
| **Unit-2 7 Hours** |
| **Interpolation:** Newton’s Forward and Backward Interpolation, Lagrange’s Interpolation, Newton’s Divided Difference Interpolation, Inverse Interpolation |
| **Unit-3 7 Hours** |
| **Numerical Differentiation and Integration:** Derivatives from difference tables, Higher order derivatives, Newton – Cote’s integration formula, Trapezoidal rule, Simpson’s rule, Boole’s rule, Romberg’s Integration |
| **Unit-4 7 Hours** |
| **Numerical Solution of Ordinary Differential Equations:** Taylor series method, Euler and modified Euler method, Runge Kutta methods, Milne’s method |
| **Unit-5 7 Hours** |
| **Numerical Solution of Partial Differential Equations:** Finite difference approximations of partial derivatives, Solution of Laplace’s equation (Elliptic) by Liebmann’s iteration method, Solution of one-dimensional heat equation (Parabolic) by Bender-Schmidt method and Crank – Nicolson method, Solution of one-dimensional wave equation (Hyperbolic), CFL stability condition |
| **Unit-6 4 Hours** |
| Applications of Numerical Methods in domain related problems such as mechanical, thermal and dynamical problems etc. |

**Continuous Assessment Pattern**

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| **Internal Assessment (IA)** | **Continuous Assessment Test (CAT)** | **End Term Test (ETE)** | **Total Marks** |
| 20 | 30 | 50 | 100 |