GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 4

Subject Name Mathematics-IV

Sr.No	Course content
1.	Complex numbers and functions: Limits of Functions, Continuity, Differentiability, Analytic functions, Cauchy-Riemann Equations, Necessary and Sufficient condition for analyticity, Properties of Analytic Functions, Laplace Equation, Harmonic Functions, Finding Harmonic Conjugate functions Exponential, Trigonometric, Hyperbolic functions and its properties. Multiple valued function and its branches: Logarithmic function and Complex Exponent function.
2.	Complex Integration: Curves, Line Integrals (contour integral) and its properties. Line integrals of single valued functions, Line integrals of multiple valued functions (by choosing suitable branches). Cauchy-Goursat Theorem, Cauchy Integral Formula, Liouville Theorem, Fundamental Theorem of Algebra, Maximum Modulus Theorems.
3.	Power Series: Convergence (Ordinary, Uniform, Absolute) of power series, Taylor and Laurent Theorems, Laurent series expansions. Zeros of analytic functions. Singularities of analytic functions and their classification Residues: Residue Theorem, Rouche's Theorem, Argument Principle.
4.	Applications of Contour Integration: Evaluating various type of definite real integrals using contour integration method.
5.	Conformal Mapping and its applications: Mappings by elementary functions, Mobius transformations, Schwarz-Christoffel transformation.
6.	Interpolation: Interpolation by polynomials, divided differences, error of the interpolating polynomial.
7.	Numerical integration: Composite rules, error formulae, Gaussian integration.
8.	Linear algebraic equation: Solution of a system of linear equations: implementation of Gaussian elimination and Gauss-Seidel methods, partial pivoting.

9.	Roots of equation: Solution of a nonlinear equation: Bisection and Secant methods, Newton's method, rate of convergence, Power method for computation of Eigen values.
10.	Ordinary differential equations: Numerical solution of ordinary differential equations, Euler and Runge-Kutta methods.

Reference Books:

1) R. V. Churchill and J. W. Brown, Complex variables and applicati (7th Edition), McGraw-Hill (2003).
2) J. M. Howie, Complex analysis, Springer-Verlag (2004).
3) M. J. Ablowitz and A. S. Fokas, Complex Variables- Introduction and Applications, Cambridge University Press, 1998 (Indian Edition).
4) E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
5) S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980.
6) C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981.