II Year – I Semester

L	T	P	C
3	0	0	3

NUMERICAL METHODS & COMPLEX VARIABLES (23BS3T02)

(Electrical and Electronics Engineering)

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To familiarize the complex variables.
- To equip the students to solve application problems in their disciplines.

Course Outcomes: At the end of the course Student will be able to

1. Apply numerical methods to find the solution algebraic and transcendental equations and interpolate the polynomials (L3).
2. Apply numerical methods to evaluate the definite integrals and to find the solution of initial value problems (L3).
3. Find the continuity, analyticity of functions of complex variables and different types of complex integrals(L3).
4. Evaluate the Taylor and Laurent expansions of simple functions, determine the nature of the singularities and calculate the residues. (L3).
5. Explain properties of various types of conformal mappings (L5).

Mr. B Sesha Rao	Dr. GVSR Deekshitulu	Dr. G Venkata Rao	Dr. M Bala Prabhakar
Chairman	University Nominee	Subject Expert-I	Subject Expert-2

BoS Members	Dr. NVSRC Murty Gamini	Mr. B Simhadri Rao	Mr. V Seshu Kumar
	Mrs. SNPG Vani	Mrs. A Sravani	Mr. KVNVS Prasad

UNIT – I: Iterative Methods:

Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – General Iteration method – Newton-Raphson method (Simultaneous Equations)

Interpolation: Forward, backward and central difference operators - Properties - Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula.

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions:

Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – Solution of initial value problems by Taylor's series – Picard's method of successive approximations – Euler's method – Modified Euler's Method - Runge- Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

UNIT – III: Functions of a complex variable and Complex integration:

Introduction – Limits - Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method.

Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems.

UNIT – IV: Series expansions and Residue Theorem:

Radius of convergence – Expansion of function in Taylor's series, Maclaurin's series and Laurent series.

Types of Singularities: Isolated – Essential singularities – Pole of order m – Residues – Residue theorem (without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_0^{2\pi} f(Cos\,\theta, Sin\,\theta)d\theta$.

UNIT – V: Conformal mapping:

Transformations - e^z , $ln\ z$, z^2, z^n (n positive integer), $sin\ z$, $cos\ z$, $z + \frac{a}{z}$. Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio - properties –invariance of circles and cross ratio – determination of bilinear transformation mapping given 3 points.

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Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Micheael Greenberg,** Advanced Engineering Mathematics, 2nd edition, Pearson edition.
3. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
4. **M. K. Jain, S.R.K. Iyengar and R.K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
5. **J. W. Brown and R. V. Churchill,** Complex Variables and Applications, 9thedition, Mc-Graw Hill, 2013.

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