NUMERICAL METHODS AND COMPLEX VARIABLES

Course Code	20BS1302	Year	II	Semester	I
Course Category	Basic Sciences course	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	**Understand** the basic concepts of Numerical Methods and complex variables.(L2)
CO2	**Apply** different Numerical methods to solve the problems of numerical differentiation, integration, ordinary differential equations.(L3)
CO3	**Construct** an analytic function and complex power series. (L3)
CO4	**Estimate** the interpolated values, approximate roots, areas and derivatives. (L4)
CO5	Analyse the region to evaluate integrals. (L4)
CO6	**Apply the** concepts of Numerical methods and Complex variables to solve the problems and submit a report. (L3)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	2								2	2				
CO3	3								2	2				
CO4		2							3	3				
CO5		2							3	3				
CO6	1								2	2				
Average* (Rounded to nearest integer)	2	2							2	2				

UNIT No.	Contents	Mapped COs
I	**Solution to Algebraic and Transcendental Equations** Solution of algebraic and transcendental equations: Bisection method, method of false position and Newton-Raphson's method. Finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formula. (All theorems/properties without proofs)	**CO1,CO2, CO4,CO6**
II	**Numerical Differentiation and Integration** Numerical Differentiation- Newton's forward and backward difference formulae. Numerical integration- trapezoidal rule,	**CO1,CO2, CO4,CO6**

	Simpson's $\frac{1}{3}^{rd}$ and $\frac{3}{8}^{th}$ rules. Ordinary differential equations: Euler's, modified Euler's, Runge-Kutta method of fourth order for solving first order equations. (All theorems/properties without proofs)	
III	**Functions of a complex variable:** Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions –Milne- Thompson's method. (All theorems/properties without proofs)	**CO1,CO3, CO5,CO6**
IV	**Complex Integration:** Line integral – Evaluation along a path– Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula. Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. (All theorems/properties without proofs)	**CO1,CO3, CO5,CO6**
V	**Singular points** – Isolated singular point – pole of order n – essential singularity. **Residue** – Evaluation of residues - Residue theorem - Evaluation of integrals of the form $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ and $\int_{-\infty}^{\infty} f(x)dx$ (All theorems/properties without proofs)	**CO1,CO3, CO5,CO6**

Learning Recourse (s)
Text Book(s)
1. B.S. Grewal, *Higher Engineering Mathematics,* Khanna Publishers, 44/e, 2019. 2. Engineering Mathematics (Volume – III) - S. Chand - T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N. Prasad- 9th Revised Edition: 2012.
Reference Book(s)
1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9/e, John Wiley & Sons, 2006.
e- Resources & other digital material
1. https://www.nptel.ac.in/courses/111/107/111107105/ 2. https://www.nptel.ac.in/courses/111/105/111105134/ 3. https://nptel.ac.in/courses/111/106/111106141/ 4. FED Moodle