COMPLEX VARIABLES, Z-TRANSFORMS & SAMPLING THEORY

ENGINEERING MATHEMATICS – IV

II/IV B.Tech. II - Semester

[R-19 Regulation]

(EEE)

	Credits:3
Instruction: 3 Periods & 1 E/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Pre -requisites: Complex Numbers, Differentiation, Integration, Binomial expansions and partial fractions**.**

COURSE OUTCOMES: At the end of the course, the student will be able to:

1.	Analyze limit, continuity and differentiation of functions of complex variables and understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
2.	Understand Cauchy theorem and Cauchy integral formulas and apply these to evaluate complex contour integrals and represent functions as Taylor and Laurent series and determine their intervals of convergence and use residue theorem to evaluate certain real definite integrals.
3.	Be familiar with numerical solution of ordinary differential equations.
4.	Understand the characteristics and properties of Z-transforms and its applications.
5.	Analyze the Statistical data by using statistical tests and to draw valid inferences aout the population parameters.

CO – PO Mapping :

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3	2										1
CO-2	3	2										1
CO-3	3	2										1
CO-4	3	2										1
CO-5	3	2										1

SYLLABUS

UNIT – I: FUNCTIONS OF A COMPLEX VARIABLE [12 Lectures]

Complex function – Real and Imaginary parts of complex function – Limit – Continuity and derivative of a complex function – Cauchy-Riemann equations – Analytic function – Entire function – Singular point – Conjugate function – Cauchy-Riemann equations in polar form – Harmonic functions – Milne-Thomson method – Simple applications to flow problems – Applications to flow problems – some standard transformations(Translation, Inversion and reflection , Bilinear transformations and its fixed points).

Sections: 20.1, 20.2, 20.3, 20.4, 20.5, 20.6 and 20.8.

UNIT – II: COMPLEX INTEGRATION & SERIES OF COMPLEX TERMS

[12 Lectures]

Complex integration – Cauchy's theorem – Cauchy's integral formula – Series of complex terms: Taylor's series – Maclaurin's series expansion – Laurent's series (without proofs). Zeros of an analytic function – Singularities of a complex function – Isolated singularity – Removable singularity – Poles – Pole of order m – simple pole – Essential singularity – Residues – Residue theorem – Calculation of residues – Residue at a pole of order m – Evalation of real definite integrals: Integration around the unit circle – Integration around a semi circle.

Sections: 20.12, 20.13, 20.14, 20.16, 20.17, 20.18, 20.19 and 20.20.

UNIT – III: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

[12 Lectures]

Numerical solution of ordinary differential equations: Picard's Method – Taylor's series method – Euler's Method – Runge-Kutta Method – Predictor-Corrector Methods – Milne's Method.

Sections: 32.1,32.2,32.3,32.4,32.7,32.8 and 32.9

UNIT – IV: Z -TRANSFORMS [12 Lectures]

Introduction – Definition - Some standard Z-transforms – Linearity property – Damping rule – Some standard results - Shifting $U_n$to the right/left, Multiplication by n - Two basic theorems (Initial value theorem and Final value theorem) – Convolution theorem.Evaluation of inverse Z- transforms - Applications to difference equations.

Sections:23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 23.12, 23.15 and 23.16.

UNIT – V: SAMPLING THEORY [12 Lectures]

Introduction – Sampling distribution – Testing a hypothesis – Level of significance – Confidence limits – Test of Significance of Large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown mean – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – $\chi^2 -$ test – Goodness of fit.

Sections: 27.1, 27.2, 27.3, 27.4, 27.5, 27.7, 27.11, 27.12,27.13, 27.14, 27.15, 26.16, 27.17 and 27.18.

TEXT BOOK

1. **B. S. Grewal**, "*Higher Engineering Mathematics*", 43rd edition, Khanna publishers, 2017.

REFERENCE BOOKS

1. **N P. Bali and Manish Goyal**, "*A text book of Engineering mathematics*", Laxmi publications, latest edition.
2. **Erwin Kreyszig**, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons,2011.
3. **R. K. Jain and S. R. K. Iyengar**, "*Advanced Engineering Mathematics*", 3rdedition, Alpha Science International Ltd., 2002.
4. **George B. Thomas, Maurice D. Weir and Joel Hass, "***Thomas Calculus*", 13thedition, Pearson Publishers.