FOURIER ANALYSIS, COMPLEX VARIABLES and Z-TRANSFORMS

ENGINEERING MATHEMATICS – III

II/IV B.Tech. I – Semester

[R-19 Regulation]

(ECE)

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

Pre -requisites: Basic concepts of Differentiation, Partial differentiation, Integration and Binomial expansion for rational index.

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

1.	Understand the need for a function or its approximation as an infinite Fourier series to represent discontinuous function which occurs in signal processing and electrical circuits.
2.	Find different Fourier transforms of non-periodic functions and also use them to evaluate boundary value problems.
3.	Analyze limit, continuity and differentiation of functions of complex variables and understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
4.	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.
5.	Understand the characteristics and properties of Z- transforms and its applications.

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: FOURIER SERIES [12 Periods]

Introduction – Euler's formulae – Conditions for a Fourier expansion – Functions having points of discontinuity – Change of interval – Even and odd functions – Half range series - Parseval's formula.
Sections:10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7 and 10.9 .

UNIT – II: FOURIER TRANSFORMS [12 Periods]

Introduction – Definition – Fourier integral theorem(without proof) – Fourier sine and cosine integrals – Fourier transforms – Properties of Fourier transforms – Convolution theorem – Parseval's identity for Fourier transforms – Relation between Fourier and Laplace transforms – Fourier transforms of the derivatives of a function – Applications of transforms to boundary value problems.

Sections: 22.1, 22.2, 22.3, 22.4, 22.5, 22.6, 22.7, 22.8, 22.9 and 22.11.

UNIT – III: FUNCTIONS OF A COMPLEX VARIABLE [12 Periods]

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 – IV: COMPLEX INTEGRATION & SERIES OF COMPLEX TERMS [12 Periods]

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 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 – Evaluation of real definite integrals: Integration around the unit circle – Integration around a semicircle.

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

UNIT – V: Z - TRANSFORMS [12 Periods]

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.

TEXTBOOK:

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.