

UNIT-I: INTEGRAL TRANSFORMS

1. FOURIER TRANSFORMS

Dirichlet's Conditions, Fourier Series, The infinite Fourier sine transform of $F(x)$, The infinite Fourier cosine transform of $F(x)$, The infinite Fourier transform of $F(x)$, Relationship between Fourier transform and Laplace transform, Illustrative Examples, Exercise 1(A), Answers, Linearity Property, Change of Scale Property, Shifting Property, Modulation Theorem, Derivative Theorem, Convolution, Illustrative Examples, Exercise 1 (B), Answers, Miscellaneous Illustrative.

2. THE FINITE FOURIER TRANSFORM AND FOURIER INTEGRAL

The Finite Fourier Cosine Transform of $F(x)$, $0 < x < l$ is defined by, The finite Fourier sine transform of $F(x)$, $0 < x < l$ is defined by, Fourier Integral, Different forms of Fourier integral Formula, Parseval's Identity for Fourier Series, Parseval's Identity for Fourier Transform. Rayleigh's Theorem, Riemann-Lebesgue Theorem, Illustrative Examples, Exercise 2 (A), Answers, More Illustrative Examples.

3. APPLICATIONS OF FOURIER TRANSFORM TO BOUNDARY VALUE PROBLEMS

Introduction, Heat Flow Equations, Choice of Infinite sine or Cosine transform, Applications of Infinite Fourier Transform, Illustrative Examples, Applications of Finite Fourier Transform, Illustrative Examples, Exercise 3, Answers.

4. Z-TRANSFORM

Introduction, Z-Transform (Definition), Some Standard Z-transforms, Illustrative Examples, Some More Examples, Exercise 4(A), Answer, Linearity Property, Change of Scale, Damping Rule, Shifting Property, Multiplication by n ., Division by n ., Initial Value Theorem, Final Value Theorem, Convolution of two Sequences, Illustrative Examples, Exercise (B), Answers, Table of Z-transfer theorem, Inverse of Z-Transform, Evaluation of Inverse Z-Transforms, Illustrative Examples, Exercise 4(C), Answers.

5. APPLICATIONS OF Z-TRANSFORMS TO SOLVE DIFFERENCE EQUATIONS

Introduction, Difference Equations, Differences and Operators, To write a difference equation as a relation among the values of y , Linear Difference Equation, Order of a linear difference equation, Solution of a Difference Equation, Solution of Difference Equations by Z-transforms, Illustrative Examples, Exercise 5, Answers.

UNIT-II : FUNCTIONS OF A COMPLEX VARIABLE-I

6. ANALYTIC FUNCTIONS

Functions of a Complex Variable, Limits, Continuity, Uniform Continuity, Differentiability, Geometrical Interpretation of the Derivative, Analytic Function, Differentials and Rules for Differentiation, Necessary and sufficient conditions for $f(z)$ to be analytic, Illustrative Example, Polar form of Cauchy-Riemann conditions, Derivative of w in polar form, Illustrative Examples, Function of a function, Illustrative Examples, Exercise 6 (A), Harmonic functions, Determination of the conjugate function, Illustrative Examples, Exercise 6 (B), To construct a function $f(z)$ when one conjugate function is given, Illustrative Examples, Exercise 6 (C).

7. COMPLEX INTEGRATION

Complex Integration, Some Important Definitions, Complex Line Integrals. (Riemann's definition of integration), Real Line Integral, Illustrative Examples, Exercise 7 (A), An Upper Bound for a Complex Integral, Cauchy's a Theorem, Connected Region, Extension of Cauchy's Theorem to Multi-Connected Region, Cauchy's Integral Formula, Extension of Cauchy's Integral Formula to Multiply connected Regions, Derivative of an Analytic Function, Higher Order Derivatives of an Analytic Function, Morera's Theorem. (*Converse of Cauchy's Theorem*), Cauchy's Inequality, Integral function (or Entire function), Poisson's Integral formula, Fundamental Theorem of Algebra, Illustrative Examples, Exercise 7 (B).

UNIT-III : FUNCTIONS OF A COMPLEX VARIABLE-II

8. REPRESENTATION OF A FUNCTION BY POWER SERIES

Power Series, Theorem 1. Taylor's Theorem., Theorem II. Laurent's Theorem., Some useful Results to remember, Illustrative Example, Exercise 8, Answers.

9. ZEROS AND SINGULARITIES

The Zeros of an Analytic Function, Zeros are Isolated, Singularities of an Analytic Function, Kinds of Singularity, Method for Detecting Singularities, Illustrative

Examples, Exercise 9, Answers.

10. THE CALCULUS OF RESIDUES (Contour Integration)

Residue at a Pole. (Definition), Computation of residue at a finite pole, Illustrative Examples, Residue at Infinity, Computation of Residue at Infinity, Illustrative Examples, Exercise 10 (A), Answers, Cauchy's Residue Theorem, Evaluation of real Definite Integrals by Contour Integration, Integration Round the Unit Circle, Illustrative Examples, Exercise 10 (B), Answers, Some Important Theorem, Theorem, Evaluation of the integrals of the form, Illustrative Examples, Exercise 10 (C), Answers, Contour integration of functions having poles on the real axis, Illustrative Examples, Contour integration of many valued functions, Illustrative Examples, Exercise 10(D).

11. CONFORMAL REPRESENTATION

Introduction, If $f(z)$ is analytic, mapping is conformal, Converse, The case $f'(z_0) = 0$, when $f'(z) = 0$, Geometrical Interpretation of, Transformation which are Isogonal but not conformal, Bilinear Transformation. Linear Fractional Transformation, Bilinear Transformation (Linear Fractional Transformations), Every bilinear transformation is the resultant of bilinear transformation with simple geometric imports, Theorem : The equation, Theorem, Cross-ratio, Preservance of cross-ratio under the bilinear transformation, To find the bilinear transformation which transform the points z_1, z_2, z_3 of z plane respectively into the point w_1, w_2, w_3 of w - plane, Illustrative Examples, Bilinear transformation of a circle, Illustrative Examples, Exercise 11 (A), Some Special Transformation, The Transformation $w = z^n$. (Where n is a positive integer), The transformation $w = z^2$, The transformation $z = \sqrt{w}$. (inverse mapping of $w = z^2$), Illustrative Examples.

UNIT-IV : STATISTICS AND PROBABILITY

12. MOMENTS, SKEWNESS AND KURTOSIS

Moments, Central Moments, Relation between central moments and moments about any arbitrary origin, Illustrative Examples, Exercise 12 (A), Answers, Sheppard's Correction, Illustrative Examples, Kurtosis, Charlier's Checks, Skewness, Measures of Skewness, Coefficient of Skewness (Based on moments), Illustrative Examples, Exercise 12 (B), Answers,

13. MOMENT GENERATING FUNCTIONS

Moment Generating Functions, M.G.F. For discrete probability distribution, m.g.f. For continuous probability distribution, Change of origin and scale in m.g.f., An important property of m.g.f., m.g.f. of Binomial Distribution, Method of generating moments from m.g.f., m.g.f. of Poission Distribution, To obtain m.g.f. of Poisson distribution from that of Binomial distribution, Negative Binomial Distribution, m.g.f. of Negative Binomial distribution, m.g.f. of Normal Distribution, Illustrative Examples, Exercise 13,

14. THEORETICAL DISTRIBUTIONS

Theoretical Distributions, Binomial Distribution, Pascal's Triangle, Characteristics of the Binomial Distribution, Moments of the Binomial Distribution (mo-

ments above the origin), Moments about the Mean, Recursion formula for binomial distribution, Illustrative Examples, Exercise 14 (A), Answers, Poisson Distribution, Limiting form of Binomial distribution, Mode of the Poisson Distribution, Constants of Poisson Distribution, Moments of Poisson distribution, Illustrative Examples, Exercise 14 (B), Answers, Normal Distribution, Derivation of Normal Distribution, Standard Form of the Normal curve, Properties of the Normal Distribution, Mean deviation from mean of the normal distribution, Some Further Properties of the Normal Distribution, Probable Error, Importance of the Normal Distribution, Illustrative Examples, Exercise 14 (C), Answers, Miscellaneous Illustrative Examples.

15. CORRELATION AND REGRESSION

Correlation, Types of Correlation, Degree of Correlation, Methods of Determining Correlation, Sterograms and Correlation Surface, Probable Error of coefficient of Correlation, Illustrative Examples, Exercise 15 (A), Answers, Spearman's Rank Correlation, Limits of Coefficient of rank correlation, Positive and Negative Rank Correlation Coefficients, Illustrative Examples, Exercise 15 (B), Answers, Linear Regression, Line of Regression, Equations of Lines of Regression, Angle between two Lines of Regression, Coefficient of Regression, Properties of Regression Coefficients, Limits of Coefficient of correlation, Illustrative Examples, Exercise 15 (C), Answers, Miscellaneous Illustrative Examples.

UNIT-V : CURVE FITTING AND SOLUTION OF EQUATIONS

16. METHOD OF LEAST SQUARES AND CURVE FITTING

Method of Least Squares, Illustrative Examples, Exercise 16 (A), Some definitions, Curve Fitting, Fitting of some special curves, Illustrative Examples, Exercise 16 (B).

17. SOLUTION OF CUBIC EQUATIONS

Cardan's method of solving the Cubic Equation, Application of Cardan's method to Numerical Equations, Trigonometrical Solutions, Illustrative Examples, Exercise 17 (A), Expressing the cubic as the sum of difference of two cubes, The Hessian, Illustrative Examples, Exercise 17 (B), Miscellaneous Examples.

18. SOLUTION OF THE BIQUADRATIC EQUATION

Transformation of the Biquadratic, Illustrative Examples, Resolution of the biquadratic into quadratic factors or solving a biquadratic by expressing it as the difference of two squares, Illustrative Examples, Exercise 18 (A), Answers, Resolution of the Biquadratic into quadratic factors, Illustrative Examples, Exercise 18 (B).