Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)

TRANSFORM CALCULUS AND FOURIER SERIES

Sub. Code: GR14A1003 **L T P C**
I year II sem 2 1 0 3

Prerequisites: Differential and integral calculus, multiple integrals and linear differential equations

Course objectives
1. To introduce improper integrals and specially to Beta and Gamma Functions
2. To introduce the idea of domain transformation for easy problem solving
3. To learn the skill of decomposing a periodic and non-periodic function in to fundamental Components using Fourier series and Fourier transforms
4. To understand the difference between ODE and PDE and acquire the skill of finding analytical solutions of such equations.

Course outcomes: At the end of the course, the student will be able to
1. To be able calculate definite integral values using Beta and Gamma Functions
2. Develop the skill of evaluating Laplace and inverse Laplace transform to solve linear systems under initial and boundary conditions

Unit-I Improper Integrals and Beta, Gamma Functions: Beta and Gamma functions – Their properties – Evaluation of improper integrals in terms of Beta and Gamma functions.

Unit-II Laplace Transform: Definition and existence of the Laplace Transform-Elementary functions-Properties of the Laplace transform-Convolution integral - Convolution theorem-Heaviside's unit step-function-Dirac delta function.
The inverse Laplace transform-Properties-Method of partial fractions- Heaviside's inversion formula-Inversion by convolution theorem.
Application of the Laplace transform to solve initial value problems and boundary value problems in ODE. Solution of a system of linear differential equations-Solution of problems in electrical circuits by Laplace transforms method.

Unit-III Z-Transform and Fourier series: Definition-Z transform of elementary sequences-Properties- The inverse Z Transform, Application of Z transform to solve difference equations Definition of orthogonal functions-The concept of Weight function-Fourier series of periodic functions- Fourier expansion of periodic functions-Half range Fourier series expansions.

Unit-IV Fourier Transform: Exponential Fourier series-The continuous one dimensional Fourier transform-Properties-Convolution-Parseval's identity- Fourier Sine and Cosine transforms.

Unit-V Partial differential equations: Formation of PDE-Solution of Lagrange's linear equations-Method of separation of variables to solve IBVP like 1-D heat, 1-D wave and BVP like 2-D Laplace's equations. Application of Fourier transform to the solution of partial differential equations.

Teaching methodologies
1. Tutorial sheets uploaded in website
2. NPTEL video lectures
3. MATLAB exercises for visualization

Text Books
1. Advanced Engineering Mathematics: R.K.Jain and S.R.K.Iyengar Narosa Publishing House.
2. Advanced Engineering Mathematics: Erwin Kreyszig-Wiley
3. Schaum's outline series on Laplace transforms

Reference Books
1. Higher Engineering Mathematics: B.S.Grewal-Khanna Publications
2. Higher Engineering Mathematics: C.Das Chawla-Asian Publishers
3. GRIET reference manual