25MA802 Fourier Series and Integral Transform 3 1 0 4

Course Description:

Department	Sciences
Course Title	Fourier Series and Integral Transform
Course Code	-
Program and Section	PhD
Academic Year	2025
Semester	II
LTP/ hours per week- Credit	L: 03, T: 01 and P: 00, 4 **Credits**

Learning Objectives:

1. Understand and apply Fourier series, Fourier transforms, and their inverse transforms to analyze periodic and aperiodic signals, respectively.

2. Grasp the concept of Laplace transform, its properties, and its application to solve differential equations and integral equations.

Pedagogy:

- **Lecture-Based Instruction:** Clear and concise explanations, Real-world examples, Problem-solving demonstrations, Interactive discussions.

- **Problem-Solving and Homework Assignments:** Regular problem sets, Exam preparation**,** Feedback and guidance.

Syllabus:

Unit I

Fourier series, Dirichlet's conditions, Fourier series for even and odd functions, Half range Fourier series

Unit-II

Definition of Laplace transform, Linearity property – Piecewise continuous function, Existence of Laplace transform, First and second shifting theorems of Laplace transform, Change of scale property, laplace transform of derivatives, Initial value problem, Laplace transform of integrals, Multiplication by t, Division by t, Evaluation of integrals Laplace transform of periodic functions, Bessel function.

Unit III

Inverse Laplace transform, Linearity property, First and second shifting theorems of inverse Laplace transform, Change of scale property, Division by p, Convolution theorem, Heaviside's expansion formula and its applications

Unit IV

Applications of Laplace transforms to the solution of ODEs with constant coefficients and variable coefficients, Simultaneous ODEs, PDEs, Application of Laplace transform to integral equations.

Unit V

Dirichlet's conditions, Fourier integral formula, Fourier transform, Inverse Fourier transform, Fourier sine and cosine transform and their inversion formulae, Linearity property Fourier transforms, Change of scale property, Shifting theorem, Modulation theorem, Convolution theorem of Fourier transforms, Parseval's identity

Text Books:

1. S Sreenath, S. Ranganatham, M.V.S.S.N. Prasad, V. Ramesh Babu, *Fourier Series and Integral Transforms*, S. Chand Publishing

Course Outcome:

CO1	Students will be able to represent periodic functions as Fourier series and apply Dirichlet's conditions to determine the convergence of Fourier series.
CO2	Students will be able to compute the Laplace transform of various functions, including piecewise continuous functions, derivatives, integrals, and periodic functions.
CO3	Students will be able to calculate the inverse Laplace transform of functions and apply techniques like convolution and Heaviside's expansion formula to solve inverse Laplace transform problems.
CO4	Students will be able to solve ordinary and partial differential equations using Laplace transform techniques.
CO5	Students will be able to compute Fourier and inverse Fourier transforms.

Evaluation Pattern:

Unit wise Evaluation Pattern:

Unit No	Midterm	End sem	Other IA Components		Total
			Assignment 1	Research paper/ case study/ Literature survey	
1	**25**	**16**	**02**		
2	**25**	**15**	**02**		
3		**26**	**02**		
4		**23**	**02**	**05**	
5		**20**	**02**	**05**	
Total	**50 (30)**	**100 (50)**	**10**	**10**	**100**

Internal Assessment Component:

Sl. No.	Component Name		Weightage	CO Mapping	Unit Mapping
1	Midterm Examination		30	1, 2, 3	1, 2, 3
2	Other IA components	Assignment 01	10	1,2,3,4,5	1,2,3,4,5
		Research paper/ case study/ Literature survey	10	4,5	4,5

External Assessment Component:

Sl. No.	Component Name	Weightage	CO Mapping
1	End sem exam	50	1,2,3,4,5

Employability:

With a strong foundation in Fourier and Laplace transforms, graduates can excel in diverse fields like engineering, physics, signal processing, and data science. They can contribute to research, development, and problem-solving in areas such as control systems, image and signal processing, and numerical analysis.