MATHEMATICAL TRANSFORM TECHNIQUES

II Semester: AE / ECE / EEE / ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB11	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge solving algebra and transcendental equations and understanding Laplace transforms.
II. Determine the unknown values of a function by interpolation and applying inverse Laplace transforms.
III. Fitting of a curve and determining the Fourier transform of a function.
IV. Solving the ordinary differential equations by numerical techniques.
V. Formulate to solve partial differential equation.

COURSE OUTCOMES (COs):

CO1: Analyzing real roots of algebraic and transcendental equations by Bisection method, False position and Newton -Raphson method. Applying Laplace transform and evaluating given functions using shifting theorems, derivatives, multiplications of a variable and periodic function.

CO2: Understanding symbolic relationship between operators using finite differences. Applyiing Newton's forward, Backward, Gauss forward and backward for equal intervals and Lagrange's method for unequal interval to obtain the unknown value. Evaluating inverse Laplace transform using derivatives, integrals, convolution method. Finding solution to linear differential equation.

CO3: Applying linear and nonlinear curves by method of least squares. Understanding Fourier integral, Fourier transform, sine and cosine Fourier transforms, finite and infinite and inverse of above said transforms.

CO4: Using Numericals methods such as Taylors, Eulers, Modified Eulers and Runge-Kutta methods to solve ordinary differential equations.

CO5: Analyzing order and degree of partial differential equation, formation of PDE by eliminating arbitrary constants and functions, evaluating linear equation b Lagrange's method. Applying the heat equation and wave equation in subject to boundary conditions.

COURSE LEARNING OUTCOMES (CLOs):

1 Evaluate the real roots of algebraic and transcendental equations by Bisection method, False position and Newton -Raphson method.
2 Apply the nature of properties to Laplace transform and inverse Laplace transform of the given function.
3 Solving Laplace transforms of a given function using shifting theorems.
4 Evaluate Laplace transforms using derivatives of a given function.
5 Evaluate Laplace transforms using multiplication of a variable to a given function.
6 Apply Laplace transforms to periodic functions.
7 Apply the symbolic relationship between the operators using finite differences.
8 Apply the Newtons forward and Backward, Gauss forward and backward Interpolation method to determine the desired values of the given data at equal intervals, also unequal intervals.
9 Solving Laplace transforms and inverse Laplace transform using derivatives and integrals.
10 Evaluate inverse of Laplace transforms and inverse Laplace transform by the method of convolution.
11 Solving the linear differential equations using Laplace transform.
12 Understand the concept of Laplace transforms to the real-world problems of electrical circuits, harmonic oscillators, optical devices, and mechanical systems
13 Ability to curve fit data using several linear and non linear curves by method of least squares.
14 Understand the nature of the Fourier integral.

15	Ability to compute the Fourier transforms of the given function.
16	Ability to compute the Fourier sine and cosine transforms of the function
17	Evaluate the inverse Fourier transform, Fourier sine and cosine transform of the given function.
18	Evaluate finite and infinite Fourier transforms
19	Understand the concept of Fourier transforms to the real-world problems of circuit analysis, control system design
20	Apply numerical methods to obtain approximate solutions to Taylors, Eulers, Modified Eulers
21	Runge-Kutta methods of ordinary differential equations.
22	Understand the concept of order and degree with reference to partial differential equation
23	Formulate and solve partial differential equations by elimination of arbitrary constants and functions
24	Understand partial differential equation for solving linear equations by Lagrange method.
25	Learning method of separation of variables.
26	Apply solving the heat equation and wave equation in subject to boundary conditions
27	Understand the concept of partial differential equations to the real-world problems of electromagnetic and fluid dynamics

Module-I	**ROOT FINDING TECHNIQUES AND LAPLACE TRANSFORMS**	**Classes: 09**

ROOT FINDING TECHNIQUES: Root finding techniques: Solving algebraic and Transcendental equations by bisection method, Method of false position, Newton-Raphson method.

LAPLACE TRANSFORMS: Definition of Laplace transform, Linearity property, Piecewise continuous function, existence of Laplace transform, Function of exponential order, First and second shifting theorems, change of scale property, Laplace transforms of derivatives and integrals, Multiplied by t, Divided by t, Laplace transform of periodic functions.

Module-II	**INTERPOLATION AND INVERSE LAPLACE TRANSFORMS**	**Classes: 09**

INTERPOLATION: Interpolation: Finite differences, Forward differences, Backward differences and central differences; Symbolic relations; Newton's forward interpolation, Newton's backward interpolation; Gauss forward central difference formula, Gauss backward central difference formula; Interpolation of unequal intervals: Lagrange's interpolation.

INVERSE LAPLACE TRANSFORMS: Inverse Laplace transform: Definition of Inverse Laplace transform, Linearity property, First and second shifting theorems, Change of scale property, Multiplied by s, divided by s; Convolution theorem and applications.

Module-III	**CURVE FITTING AND FOURIER TRANSFORMS**	**Classes: 09**

CURVE FITTING: Fitting a straight line; Second degree curves; Exponential curve, Power curve by method of least squares.

FOURIERTRANSFORMS: Fourier integral theorem, Fourier sine and cosine integrals; Fourier transforms; Fourier sine and cosine transform, Properties, Inverse transforms, Finite Fourier transforms.

Module-IV	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**Classes: 09**

STEP BY STEP METHOD: Taylor's series method; Euler's method, Modified Euler's methodfor first order differential equations.

MULTI STEP METHOD: Runge-Kutta method for first order differential equations.

Module-V	**PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS**	**Classes: 09**

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, Solutions of first order linear equation by Lagrange method

APPLICATIONS: Method of separation of variables; One dimensional heat and wave equations under initial and boundary conditions.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Dr. M Anita, Engineering Mathematics-I, Everest Publishing House, Pune, First Edition, 2016.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://www.mathworld.wolfram.com/

E-Text Books:

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re