Hall Ticket No | | | | | | | | | | | Question Paper Code: AHSB11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B. Tech II Semester End Examinations, May - 2020

Regulations: IARE - R18

MATHEMATICAL TRANSFORM TECHNIQUES

(COMMON FOR AE / ECE / EEE / ME / CE)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Module
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE-I

1. (a) Apply Newton –Raphson method to find an approximate root of the equation $x^3 - 3x - 5 = 0,$ which lies near x=2 carry out two approximations [7M]
   (b) Find a real root of the transcendental equation $e^x \sin x = 1$ by using False position method correct up to three decimals. [7M]

2. (a) Define the term Laplace Transform. Explain linearity and change of scale property of Laplace transform. [7M]
   (b) Find the Laplace transform of $te^{2t}\sin 3t$. [7M]

MODULE-II

3. (a) State Lagrange's interpolation formula, Newton's forward and backward, Gauss forward and backward interpolation. [7M]
   (b) Find y (25) given that y (20) = 24, y (24) = 32, y (28) = 35, y (32) = 40 using Gauss forward interpolation formula. [7M]

4. (a) Define Inverse Laplace Transform. State the Inverse Laplace Transform of derivative and integral and Convolution theorem. [7M]
   (b) Find the inverse Laplace transform of $\log\left(\frac{s^2+4}{s^2+9}\right)$. [7M]

MODULE-III

5 (a) Discuss the normal equations of the fitting a Straight line and second degree curves. [7M]
  (b) By the method of least squares, fit a Second degree polynomial $y = a + bx + cx^2$ to the following data.

x	0	0.5	1	1.5	2	2.5
y	0.10	0.45	2.15	9.15	40.35	180.75

[7M]

6. (a) State linearity and modulation theorem of Fourier transform [7M]

(b) Find the Fourier sine and cosine transform of $f(x)=\frac{e^{-ax}}{x}$ and deduce that [7M]

$$\int_0^{\infty}\frac{e^{-ax}-e^{-bx}}{x}\sin sx\,dx = Tan^{-1}\left(\frac{s}{a}\right)-Tan^{-1}\left(\frac{s}{b}\right)$$

MODULE-IV

7. (a) State Taylor's series, Euler's and Modified Euler's method for first order differential equations. [7M]

(b) Using Modified Euler's method, find y (0.2) and y (0.4). Given the differential equation $y' = y + e^x$, y(0) = 0. [7M]

8. (a) State Runge -Kutta method formulae for all orders for solving the first order differential equation. [7M]

(b) Apply the 4th order Runge-Kutta method to find an approximate value of y when x = 1.2 in steps of h= 0.1 given the differential equation $y' = x^2 + y^2$, y (1) =1.5. [7M]

MODULE-V

9. (a) Define order and degree with reference to partial differential equation. Also Define linear and non-linear partial differential equation with examples. [7M]

(b) Solve the partial differential equation $(mz-ny)p+(nx-lz)q=(ly-mx)$ [7M]

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10 (a) State One dimensional heat and wave equations under initial and boundary conditions. [7M]

(b) A string is stretched and fastened to two points at x=0 and x= L. Motion is started by displacing the string into the form $y = k(lx-x^2)$ from which it is released at time t=0. Find the displacement of any point on the string at a distance of x from one end at time t [7M]

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COURSE OBJECTIVES (COs):

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):

CO 1	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.
CO 2	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
CO 3	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.
CO 4	Using Numericals methods such as Taylors, Eulers, Modified Eulers and Runge-Kutta methods to solve ordinary differential equations.
CO 5	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):

AHSB11.01	Evaluate the real roots of algebraic and transcendental equations by Bisection method, False position and Newton -Raphson method.
AHSB11.02	Apply the nature of properties to Laplace transform and inverse Laplace transform of the given function.
AHSB11.03	Solving Laplace transforms of a given function using shifting theorems.
AHSB11.04	Evaluate Laplace transforms using derivatives of a given function.
AHSB11.05	Evaluate Laplace transforms using multiplication of a variable to a given function.
AHSB11.06	Apply Laplace transforms to periodic functions.
AHSB11.07	Apply the symbolic relationship between the operators using finite differences.
AHSB11.08	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.
AHSB11.09	Solving Laplace transforms and inverse Laplace transform using derivatives and integrals.
AHSB11.10	Evaluate inverse of Laplace transforms by the method of convolution.
AHSB11.11	Solving the linear differential equations using Laplace transform.
AHSB11.12	Understand the concept of Laplace transforms to the real-world problems of electrical circuits, harmonic oscillators, optical devices, and mechanical systems
AHSB11.13	Ability to curve fit data using several linear and non linear curves by method of least squares.
AHSB11.14	Understand the nature of the Fourier integral.

AHSB11.15	Ability to compute the Fourier transforms of the given function.
AHSB11.16	Ability to compute the Fourier sine and cosine transforms of the function
AHSB11.17	Evaluate the inverse Fourier transform, Fourier sine and cosine transform of the given function.
AHSB11.18	Evaluate finite and infinite Fourier transforms
AHSB11.19	Understand the concept of Fourier transforms to the real-world problems of circuit analysis, control system design
AHSB11.20	Apply numerical methods to obtain approximate solutions to Taylors, Eulers, Modified Eulers
AHSB11.21	Runge-Kutta methods of ordinary differential equations.
AHSB11.22	Understand the concept of order and degree with reference to partial differential equation
AHSB11.23	Formulate and solve partial differential equations by elimination of arbitrary constants and functions
AHSB11.24	Understand partial differential equation for solving linear equations by Lagrange method.
AHSB11.25	Learning method of separation of variables.
AHSB11.26	Solving the heat equation and wave equation in subject to boundary conditions
AHSB11.27	Understand the concept of partial differential equations to the real-world problems of electromagnetic and fluid dynamics

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AHSB11.01	Evaluate the real roots of algebraic and transcendental equations by Bisection method, False position and Newton -Raphson method.	CO 1	Understand
	b	AHSB11.01	Evaluate the real roots of algebraic and transcendental equations by Bisection method, False position and Newton -Raphson method.	CO 1	Understand
2	a	AHSB11.02	Apply the nature of properties to Laplace transform of the given function.	CO 1	Understand
	b	AHSB11.03	Solving Laplace transforms of a given function using shifting theorems.	CO 1	Understand
3	a	AHSB11.08	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.	CO 2	Understand
	b	AHSB11.08	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.	CO 2	Remember
4	a	AHSB11.09	Solving inverse Laplace transform using derivatives and integrals.	CO 2	Understand
	b	AHSB11.09	Solving inverse Laplace transform using derivatives and integrals.	CO 2	Understand
5	a	AHSB11.13	Ability to curve fit data using several linear and non linear curves by method of least squares.	CO 3	Understand
	b	AHSB11.13	Ability to curve fit data using several linear and non linear curves by method of least squares.	CO 3	Understand
6	a	AHSB11.15	Ability to compute the Fourier transforms of the given function.	CO 3	Understand
	b	AHSB11.17	Ability to compute the Fourier sine and cosine transforms of the function	CO 3	Understand
7	a	AHSB11.20	Apply numerical methods to obtain approximate solutions to Taylors, Eulers, Modified Eulers	CO 4	Understand
	b	AHSB11.20	Apply numerical methods to obtain approximate solutions to Taylors, Eulers, Modified Eulers	CO 4	Understand

8	a	AHSB11.21	Runge-Kutta methods of ordinary differential equations.	CO 4	Understand
	b	AHSB11.21	Runge-Kutta methods of ordinary differential equations.	CO 4	Understand
9	a	AHSB11.22	Understand the concept of order and degree with reference to partial differential equation	CO 5	Understand
	b	AHSB11.24	Understand partial differential equation for solving linear equations by Lagrange method.	CO 5	Understand
10	a	AHSB11.26	Solving the heat equation and wave equation in subject to boundary conditions	CO 5	Understand
	b	AHSB11.26	Solving the heat equation and wave equation in subject to boundary conditions	CO 5	Understand

Signature of the faculty **HOD, CE**