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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech II Semester End Examinations (Regular) - May, 2019

Regulation: IARE – R18

MATHEMATICAL TRANSFORM TECHNIQUES

Time: 3 Hours **(Common to AE | ECE | EEE | ME | CE)** **Max Marks: 70**

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

UNIT – I

1. (a) Define the term interpolation. State Newton's forward interpolation formula and Newton's backward interpolation formula for equal length of intervals. Prove the relationship between forward and backward difference operator. **[7M]**

   (b) Find Newton's forward difference interpolating polynomial for the following data given in Table 1: **[7M]**

Table 1

x	0.1	0.2	0.3	0.4	0.5
y=f(x)	1.4	1.56	1.76	2.0	2.28

2. (a) If f(x) and g(x) are two functions then evaluate forward difference of product of f(x) and g(x). Prove the relationship between backward difference operator and shift operator. **[7M]**

   (b) Obtain an approximate real root of the equation $x \tan x + 1 = 0$ by using Newton-Raphson method. **[7M]**

UNIT – II

3. (a) State the fourth order Runge-Kutta method and Modified Euler formula to find the numerical solution of ordinary differential equation. **[7M]**

   (b) Apply the fourth order Runge-Kutta method to find y(0.1) and y(0.2), given that $\frac{dy}{dx}$=xy+y^2 and y(0)=1. **[7M]**

4. (a) Prove the normal equations of a straight line y=a+bx. **[7M]**

   (b) The data given in Table 2 on the drying time of a certain varnish and the amount of an additive that is intended to reduce the drying time (Amount of varnish additive (grams) x), (Drying time (hours) y).

Table 2

x	0	1	2	3	4	5	6	7	8
y	12.0	10.5	10.0	8.0	7.0	8.0	7.5	8.5	9.0

Fit a second degree polynomial by the method of least squares. **[7M]**

UNIT – III

5. (a) Define Laplace transform and write the sufficient conditions for the existence of Laplace transform. Find the Laplace transform of Dirac delta function **[7M]**

   (b) Find the Laplace transform of the function $\left\{\frac{1-\cos 2t}{t}\right\}$. **[7M]**

6. (a) State and prove convolution theorem to find the inverse of Laplace transform. What is change of scale property and prove. **[7M]**

   (b) Solve $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$ by using Convolution theorem. **[7M]**

UNIT – IV

7. (a) Write the properties of Fourier transform of f(x). State and prove linear property of Fourier transform. **[7M]**

   (b) Find the Fourier cosine transform of $\frac{1}{1+x^2}$. **[7M]**

8. (a) State Fourier integral theorem. Write the Fourier sine integral and cosine integral formulae. **[7M]**

   (b) Obtain the Fourier Cosine transform of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$ **[7M]**

UNIT – V

9. (a) Define order and degree with reference to partial differential equation. State Charpits formulae with reference to partial differential equation. **[7M]**

   (b) Solve the P.D.E $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ by Lagrange's multiplier method. **[7M]**

10. (a) Explain complete integral and general integral with reference to non-linear partial differential equation. Write the one dimensional heat and wave equations. **[7M]**

    (b) If a string of length l is initially at rest in equilibrium position and each of its points is given the velocity $V_0 \sin^3\left(\frac{\pi x}{l}\right)$, find the displacement y(x,t). **[7M]**

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