Hall Ticket No | | | | | | | | | | Question Paper Code: AHS011

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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

Regulation: IARE – R16

MATHEMATICAL TRANSFORM TECHNIQUES

Time: 3 Hours **(EEE)** **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 a periodic functions for function f(x) and give examples. Write half range Fourier sine and cosine series for the function. **[7M]**

   (b) Obtain the Fourier cosine series for f(x)= x sin x when 0<x< π and hence deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \frac{1}{7.9} + ... = \frac{\pi}{4} - \frac{1}{2}$. **[7M]**

2. (a) State the Dirichlets conditions for the existence of Fourier series of function f(x). **[7M]**

   (b) Obtain the Fourier series for $\begin{cases} x \ for \ -1 \leq x \leq 0 \\ x+2 \ for \ 0 \leq x \leq 1 \end{cases}$. **[7M]**

UNIT – II

3. (a) State and prove modulation theorem for Fourier transforms . **[7M]**

   (b) Find the Fourier transform of $f(x) = \begin{cases} 1 - |x|;\ |x| < 1 \\ 0;\ |\text{x}| > 1 \end{cases}$. **[7M]**

4. (a) State Fourier intergral theorem. Write properties of Fourier transforms of f(x). **[7M]**

   (b) Find the Fourier transform of $f(x) = \begin{cases} a - |x|;\ |x| < a \\ 0;\ |\text{x}| > a > 0 \end{cases}$ hence deduce that $\int\limits_0^\infty \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$. **[7M]**

UNIT – III

5. (a) Define Laplace transforms and write sufficent conditions for existence Laplace transforms. **[7M]**

   (b) Use the property of convolution to find the inverse Laplace transform of the function $\frac{1}{s^2(s^2+1)}$. **[7M]**

6. (a) State and prove linearity property of Laplace transforms. **[7M]**

   (b) Solve the differential equation y”+y=t using the Laplace transform subject to the conditions y(t)=1 and $\frac{dy}{dt}$=1 at t=0. **[7M]**

UNIT – IV

7. (a) Define convolution theorem of Z-transforms. State linearity property of Z- transforms. **[7M]**

   (b) Determine $Z^{-1}\left\{\frac{z^2}{(z-2)(z-3)}\right\}$ **[7M]**

8. (a) Define Z- transforms of function f(n) and $Z\{(-2)^n\}$. **[7M]**

   (b) Solve the equation $y_{n+2} + 6y_{n+1} + 9y_n = 2^n \text{with} y_0 = y_1 = 0$, Using Z-transform. **[7M]**

UNIT – V

9. (a) Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u\,(x, 0) = 6e^{-3x}$ by the method of separation of variables. **[7M]**

   (b) Define order and degree of partial differential equation. Write procedure for obtaining solution to linear partial differential equation by Lagrange method. **[7M]**

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

    (b) A tightly stretched flexible string has its ends fixed at x=0 and x=l. At time t=0, the string is given a shape defined by g(x) = μx(l − x) , where μ is a constant, and then released. Find the displacement of any point x of the string at any time t. **[7M]**

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