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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Supplementary) - July, 2018

Regulation: IARE – R16

MATHEMATICAL TRANSFORM TECHNIQUES

Time: 3 Hours **(Common to 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) Determine the Fourier series for $f(x) = e^{-x}$ in $(0, 2\pi)$. **[7M]**
   (b) Obtain the half range cosine series $f(x) = (x-1)^2$ in (0,1) **[7M]**

2. (a) Obtain the Fourier series for $f(x) = \begin{cases} -\pi & for\ -\pi < x < 0 \\ x & for\ 0 < x < \pi \end{cases}$ in $(-\pi, \pi)$. **[7M]**
   (b) Obtain the half range sine series f(x)=x in (0,2). **[7M]**

UNIT – II

3. (a) Using Fourier sine integral, show that $\int_0^\infty \left[\frac{\lambda \sin \lambda x}{1+\lambda^2}\right] d\lambda = \frac{\pi}{2} e^{-x},\ x \geq 0$. **[7M]**
   (b) Determine the Fourier cosine transform of $f(x) = \begin{cases} 1 & for\ 0 \leq x \leq a \\ 0 & for\ x > a \end{cases}$ **[7M]**

4. (a) Determine the Fourier sine transform of $f(x) = e^{-ax}$ for $a > 0,\ x > 0$. **[7M]**
   (b) Find the Fourier cosine transform of $f(x) = \begin{cases} x, & for\ 0 < x < 1 \\ 2-x, & for\ 1 < x < 2 \\ 0, & for\ x > 2 \end{cases}$ **[7M]**

UNIT – III

5. (a) Find the Laplace Transform of the periodic triangular wave function of period 2a is given by,
   $f(t) = \begin{cases} t, & 0 < t < a \\ 2a - t, & a < t < 2a \end{cases}$ **[7M]**
   (b) Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^{-x} sinx$ using Laplace transform where $y(0) = 0, y'(0) = 1$. **[7M]**

6. (a) Using Convolution Theorem find the Inverse Laplace Transform of $\frac{s^2}{(s^2+a^2)(s^2+b^2)}$. **[7M]**
   (b) Using Laplace Transform, evaluate $\int_0^\infty \frac{e^{-t}\sin^2 t}{t} dt$. **[7M]**

UNIT – IV

7. (a) Solve $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ with u_0=u_1=0 using Z-Transforms. **[7M]**

   (b) Find Z-transforms of (i) n cosnθ (ii) $(n+1)^2$ **[7M]**

8. (a) Find the Inverse Z-Transform of $\frac{z^3-20z}{(z-2)^3(z-4)}$ **[7M]**

   (b) If $U(z) = \frac{2z^2+5z+14}{(z-1)^4}$, find the value of U_2 and U_3 **[7M]**

UNIT – V

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

   (b) Form the partial differential equation by eliminating arbitrary functions from z=y f(x)+x g(y). **[7M]**

10. (a) Derive one-dimensional heat equation. **[7M]**

    (b) Solve $x(y^2+z)p - y(x^2+z)q = z(x^2-y^2)$ **[7M]**

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