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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular) - May, 2018

Regulation: IARE – R16

MATHEMATICAL TRANSFORM AND 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) Obtain the Fourier Series of $f(x) = \begin{cases} -\pi & -\pi < x < 0 \\ x & 0 < x < \pi \end{cases}$ and hence deduce that $1/1^2 + 1/3^2 + 1/5^2 + \ldots = \pi^2/8$ **[7M]**

   (b) Obtain the half range Fourier Sine Series of f(x)=$(x-1)^2$ in (0,1). **[7M]**

2. (a) Determine the Fourier series for $f(x) = x^2$ in $(-\pi, \pi)$. **[7M]**

   (b) Obtain the half range sine series $f(x) = x$ in (0, 2). **[7M]**

UNIT – II

3. (a) Find the Fourier Transform of $f(x) = \begin{cases} 1-|x|, & 0 < x < 1 \\ 0, & |x| > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{(sin^2 t)}{t^2} dt = \pi/2$ **[7M]**

   (b) Find the Finite Fourier Cosine Transform $\begin{cases} x, & 0 \le x \le \frac{1}{2} \\ 1-x, & \frac{1}{2} \le x \le 1 \end{cases}$ **[7M]**

4. (a) Find the Fourier Sine Transform of $\frac{e^{-ax}}{x}$ **[7M]**

   (b) Find the Fourier Integral Transform of the function $f(x) = \begin{cases} 0, & x < 0 \\ 1, & 1 \le x \le 2 \\ 0, & x > 2 \end{cases}$ **[7M]**

UNIT – III

5. (a) Find the Laplace Transform of the periodic triangular wave function of period 2a given by,
$f(x) = \begin{cases} x, & 0 < x < a \\ 2a - x, & a < x < 2a \end{cases}$ **[7M]**

   (b) Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^{-x}\sin x$ using Laplace transform where $y(0) = 0, y'(0) = 1$.

[7M]

6. (a) Find the Laplace Transform of the periodic function $f(x) = \begin{cases} x, & 0 < x < \pi \\ \pi - x, & \pi \leq x \leq 2\pi \end{cases}$

[7M]

   (b) Find the Inverse Laplace Transform of **[7M]**

   i. $log\left\{\frac{s^2+1}{s(s+1)}\right\}$

   ii. $\frac{e^{-s}}{s^2+1}$

UNIT – IV

7. (a) Evaluate $Z\left[\frac{1}{(n+1)\,!}\right]$. **[7M]**

   (b) If $f(z) = \frac{2z^2+5z+14}{(z-1)^4}$, find the values of f(2) and f(3) by Initial value theorem.

[7M]

8. (a) Evaluate $Z^{-1}\left[\frac{z^2}{(z-1)(z-2)(z-3)}\right]$

[7M]

   (b) Determine the inverse Z-transform of $\frac{z^2}{z^2-4z+3}$ by convolution theorem. **[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 $u(x,0) = 6\,e^{-3x}$ **[7M]**

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

[7M]

10. (a) Solve $\frac{du}{dx} = 4\frac{du}{dy}$ where u(0,y)=8 $e^{(-3y)}$ by the method of separation of variables. **[7M]**

    (b) Solve $\frac{du}{dx} = 4\frac{d^2u}{d^2x}$ subject to the boundary conditions u(0,t)=u(1,t)=0 and an initial condition $u(x,0) = x - x^2$, in 0≤x≤1. **[7M]**

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