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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations (Supplementary) - July, 2018

Regulation: IARE – R16

MATHEMATICAL TRANSFORM TECHNIQUES

Time: 3 Hours **(COMMON TO AE | ECE)** **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 $\sqrt{1-\cos x}$ in $(0, 2\pi)$ and hence deduce that $\frac{1}{2} = \sum \frac{1}{4x^2-1}$. **[7M]**

   (b) Find the Fourier series of $f(x) = \begin{cases} 4-x, & 3 < x < 4 \\ x-4, & 4 < x < 5 \end{cases}$ **[7M]**

2. (a) Find the Fourier series of $f(t) = \begin{cases} 0\, if & -\pi < t < -\frac{\pi}{2} \\ 5\, if & -\frac{\pi}{2} < t < \frac{\pi}{2} \\ 0\, if & \frac{\pi}{2} < t < \pi \end{cases}$ **[7M]**

   (b) Find the Fourier series of $f(t) = \begin{cases} 0 \ if & -\pi < t < 0 \\ t \ if & 0 < t < \pi \end{cases}$ **[7M]**

UNIT – II

3. (a) Find the Fourier transform of $e^{-\frac{|t|}{T}}$. **[7M]**

   (b) Find the Fourier sine transform of $e^{-|x|}$ and hence evalute $\int\limits_0^\infty \frac{x\sin(mx)}{1+x^2}$. **[7M]**

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

   (b) Find f(x) if its Fourier sine transform is $w/\left(w^2+1\right)$. **[7M]**

UNIT – III

5. (a) Show that $L\left\{\sin\sqrt{t}\right\} = \frac{1}{s}e^{-s/w}.\ \sqrt{\frac{\pi}{s}}$. **[7M]**

(b) A periodic function of period $(2\pi/w)$ defined by $f(t) = \begin{cases} E\sin wt, & 0 \le t < \pi/w \\ 0, & \pi/w \le t < 2\pi/w \end{cases}$

Where E and W are constants show that $L\left\{f(t)\right\} = EW|(s^2+w^2)\left(1-e^{-\pi s/w}\right)$. **[7M]**

6. (a) Find $i)\ L^{-1}\left\{\frac{5s+3}{(s-1)\left(s^2+2s+5\right)}\right\}$ $ii)\ L\left\{\frac{\cos 6t-\cos 4t}{t}\right\}$ **[7M]**

(b) The current i and q in a series circuit containing an inductance L, a capacitance C, e.m.f. E satisfying the D.E. Express $L\frac{di}{dt}+\frac{q}{c}=E$, i and q in terms of t given that L, C, E are constants and i, q both are initially zero using Laplace transforms. **[7M]**

UNIT – IV

7. (a) Find the Z-transform of $(n+p)\,C_p$. **[7M]**

(b) By resolving into partial fractions find $Z_T^{-1}\left[\frac{4z^2-2z}{z^3-5z^2+8z-4}\right]$. **[7M]**

8. (a) By using convolution theorem, find inverse Z-transform of $\frac{z}{(z-a)^3}$ and hence deduce for $\left(\frac{z}{z-1}\right)^3$. **[7M]**

(b) Solve the difference equation $u_{n+2}-2\,u_{n+1}-3u_n = 3^n+2n,\ u_0=0,\ u_1=0$. **[7M]**

UNIT – V

9. (a) Find the temperature u(x,t) in a homogeneous bar of heat conducting material of length L in cm with its ends kept at zero temperature and initial temperature given by $dx\,(L-x)\,/L^3$. **[7M]**

(b) Solve $(y+zx)\,p-(x-yz)q = x^2-y^2$. **[7M]**

10. (a) Solve $(x^2-2yz-y^2)dx+(xy+xz)dy=(xy-xz)$. **[7M]**

(b) Solve $u_{xx}=u_y+2u$ by separation of variables under the condition that $u=0, u_x=e^{-y}$ when x=0 and for all y. **[7M]**

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