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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech III Semester End Examinations (Supplementary) - February, 2018

Regulation: IARE – R16

MATHEMATICAL TRANSFORM AND TECHNIQUES

(Common to AE | ECE)

Time: 3 Hours **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) Find the Fourier series in $(-\pi, \pi)$ for the function $f(x) = \begin{cases} \pi + x, (-\pi, -\pi/2) \\ \pi/2, (-\pi/2, \pi/2) \\ \pi - x, (\pi/2, \pi) \end{cases}$ **[7M]**

   (b) Obtain the half range Fourier cosine series of $f(x) = \begin{cases} x, 0 < x < \pi/2 \\ \pi - x, \pi/2 < x < \pi \end{cases}$ **[7M]**

2. (a) Find the Fourier series of the function (1+ sin x) in (-1, 1). **[7M]**

   (b) Obtain the Fourier series of the function $|\cos x|$ in $(-\pi, \pi)$. **[7M]**

UNIT – II

3. (a) Express the function, $f(x) = \begin{cases} \sin x, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$ as Fourier sine integral and show that $\int_0^\infty \frac{\sin wx \ \sin \pi w}{1-w^2} dw = \frac{\pi}{2} \sin x, \ 0 \le x \le \pi$. **[7M]**

   (b) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & |x| \le | \\ 0, & |x| > | \end{cases}$ and hence evaluate **[7M]**

   $\int_0^\infty \frac{\sin x \ -x \cos x}{x^3} . \ \cos\left(\frac{x}{2}\right) dx$.

4. (a) Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$ and hence derive the Fourier sine transform of $\frac{x}{1+x^2}$. **[7M]**

   (b) Find the Fourier transform of $f(x) = \begin{cases} 1 - |x|, & |x| \le | \\ 0, & |x| \ge | \end{cases}$. Hence deduce that $\int_0^\infty \frac{\sin^2 x}{x^2} dx = \pi/2$. **[7M]**

UNIT – III

5. (a) Find the Laplace transforms of the function f(t)=sin^5x. **[7M]**

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

6. (a) Find the Laplace transform of square wave function of period 2a defined by **[7M]**

$$f(t) = \begin{cases} a, 0 \le t \le a \\ -a, a \le t \le 2a \end{cases}$$

   (b) Using convolution theorem find $L^{-1}\left\{\frac{1}{(s^2+a^2)^2}\right\}$ **[7M]**

UNIT – IV

7. (a) Use convolution theorem to evaluate $Z^{-1}\left\{\frac{z^2}{(z-a)(z-b)}\right\}$ **[7M]**

   (b) Using the Z-transform, solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ with u_0=0,u_1=1. **[7M]**

8. (a) State and prove convolution theorem and by using convolution theorem find inverse Z-transform of $z^2/(z-a)(z-b)$. **[7M]**

   (b) Solve the difference equation, $y_{n+2} + 4y_{n+1}` + 4y_n = 7,\ y_0 = 1,\ y_1 = 2$. **[7M]**

UNIT – V

9. (a) Solve $(mz - ny)p + (nx - lz)q = ly - mx$ **[7M]**

   (b) Solve ∇^2V = 0 subject to $V(0,y) = V(\pi,y) = 0, V(x,0) = V_0$ and $\lim_{y\to\infty} V = 0$. **[7M]**

10. (a) Solve $z^2\left(p^2x^2 + q^2\right) = 1$. **[7M]**

    (b) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(x,0) = 3\sin\pi x, u(0,t) = 0, u(1,t) = 0$ where $0 < x < 1, t > 0$. **[7M]**

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