



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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

Regulation: IARE – R16

MATHEMATICAL TRANSFORM AND 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) Determine the Fourier series for $f(x) = x - x^2$ in $(-\pi, \pi)$ [7M]
(b) Find the half range Fourier Cosine Series of $f(x) = x(l-x)$ in $0 \leq x \leq l$. [7M]
2. (a) Express $f(x) = \begin{cases} 1, & \text{for } -1 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$ as Fourier series. [7M]
(b) Obtain the Fourier series of the function $f(x) = \begin{cases} 1 + \frac{4x}{3}, & -3/2 < x \leq 0 \\ 1 - \frac{4x}{3}, & 0 \leq x < 3/2 \end{cases}$ hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ [7M]

UNIT – II

3. (a) Express $f(x) = \begin{cases} 1, & \text{for } -1 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$ as Fourier integral and hence evaluate $\int_0^{\infty} \frac{\sin \lambda \cos \lambda x}{\lambda} d\lambda$. [7M]
(b) Find the finite Fourier sine transform of $f(x) = \frac{x}{\pi}$, $0 < x < \pi$ [7M]
4. (a) Find the finite Fourier sine transform of $f(x) = x$, $0 < x < 4$ [7M]
(b) Find the Fourier Transform of $f(x) = \begin{cases} 1 & \text{for } |x| < 1 \\ 0 & \text{for } |x| > 1 \end{cases}$ and hence evaluate $\int_0^{\infty} \frac{\sin x}{x} dx$ [7M]

UNIT – III

5. (a) Evaluate $\int_0^{\infty} t e^{-3t} \cos 2t dt$ using Laplace transforms. [7M]
(b) Solve the differential equation, $y'' + 4y' + 3y = e^{-t}$, $y(0) = 1, y'(0) = 1$ using Laplace transforms. [7M]
6. (a) Find the inverse Laplace transform of $\frac{s}{(s+3)^2+4}$ [7M]
(b) Solve $\frac{d^4 y}{dt^4} - k^4 y = 0$, where $y'(0) = 1, y''(0) = y'''(0) = 0$ by Laplace [7M]

UNIT – IV

7. (a) Find the inverse Z – transform of $\frac{4Z^2-2Z}{Z^3-5Z^2+8Z-4}$ using Partial fraction method [7M]
- (b) Using Power Series method, prove that $Z^{-1} \left[e^{1/z} \right] = 1/n!$ and
 $z^{-1} \left[z \left(e^{1/z} - 1 \right) \right] = \frac{1}{(n+1)!}$. [7M]
8. (a) Using convolution theorem, determine the inverse - transform of $\frac{z^2}{(z-a)(z-b)}$ [7M]
- (b) Using Z - transform, solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ with $u_0 = 0, u_1 = 1$ [7M]

UNIT – V

9. (a) Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$. [7M]
- (b) Form a Partial differential equation by eliminating arbitrary function from $\varphi(x + y + z, x^2 + y^2 - z^2) = 0$. [7M]
10. (a) Solve $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$ [7M]
- (b) A thin bar of length 10 cms has its ends A and B maintained at temperatures 50°C and 100°C respectively, until steady state is reached. The temperature of the end A is suddenly raised to 90°C and these end temperatures are maintained throughout. Find the temperature field in the bar. [7M]

