

B.E. Computer Science & Engineering (MODEL CURRICULUM) Sem-III
SE101CS : Applied Mathematics-III

P. Pages : 3

Time : Three Hours



GUG/W/22/13801

Max. Marks : 80

- Notes :
1. All questions carry equal marks.
 2. Assume suitable data wherever necessary.
 3. Use of non programmable calculator is permitted.

1. a) If $L[f(t)] = f(\bar{s})$ then show that $L(t^n f(t)) = (-1)^n \frac{d^n}{ds^n} f(\bar{s})$ Hence find $L[t \cdot \sin^2 t]$. 8

b) Find Laplace transform of the periodic function. 8

$$f(t) = \begin{cases} t, & 0 \leq t \leq a \\ 2a - t & a < t \leq 2a \end{cases} \text{ where } f(t + 2a) = f(t).$$

OR

2. a) If $L\{f(t)\} = f(\bar{s})$ then $L\left\{\int_0^t f(t) dt\right\} = \frac{f(\bar{s})}{s}$. 8

b) Express function in terms of Heaviside's unit step function find 8

$$L[F(t)] = \begin{cases} \sin t, & 0 < t < \pi \\ \sin 2t, & \pi < t < 2\pi \\ \sin 3t, & t > 2\pi \end{cases}$$

3. a) Find $L^{-1}\left[\frac{1}{(s+1)(s^2+2s+2)}\right]$ 8

b) By using convolution theorem find $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$ 8

OR

4. a) Find $L^{-1}\left[\log \frac{s(s+1)}{(s^2+1)}\right]$ 8

b) Solve Differential equation by using Laplace Transform. 8

$$y'' - 3y' + 2y = 4t + e^{3t}; y(0) = 1, y'(0) = -1$$

5. a) Find Fourier transform of 8

$$f(x) = \begin{cases} 1-x^2, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$$

and hence find $\int_0^{\infty} \left(\frac{\sin x - x \cos x}{x^3} \right) \cos x/2 dx$

- b) Using Fourier Integrals show that 8

$$\int_0^{\infty} \frac{(1 - \cos \pi \lambda)}{\lambda} \sin \lambda x dx = \begin{cases} \pi/2, & 0 < x < \pi \\ 0, & x > \pi \end{cases}$$

OR

6. a) Express the function $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ as a Fourier integral Hence Evaluate 8

$$\int_0^{\infty} \frac{\sin \lambda \cos \lambda x}{\lambda} d\lambda$$

- b) Solve Integral equation 8

$$\int_0^{\infty} f(x) \cos \alpha x dx = \begin{cases} 1-\alpha, & 0 \leq \alpha \leq 1 \\ 0, & \alpha > 1 \end{cases}$$

7. a) Find inverse of matrix. 8

$$A = \begin{bmatrix} 4 & -5 & 6 \\ -1 & 2 & 3 \\ -2 & 4 & 7 \end{bmatrix} \text{ by partitioning method.}$$

- b) Find values of λ for which system of equation 8

$$x + y + z = 1$$

$$x + 2y + 4z = \lambda$$

$$x + 4y + 10z = \lambda^2$$

is consistent. Also solve system for these values of λ

OR

8. a) Find eigen values & eigen vectors & modal matrix for matrix. 8

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

- b) Solve $\frac{d^2x}{dt^2} + 4 \frac{dx}{dt} - 12x = 0$ $x(0) = 0$; $x'(0) = 8$ 8

By matrix method

9. a) The distribution function of a random variable x is given by 8

$$f(x) = \begin{cases} Cx^3, & 0 < x < 3 \\ 1, & x \geq 3 \\ 0, & x < 0 \end{cases}$$

Find

- i) Constant C
- ii) Density function
- iii) $P(x > 1)$

- b) The joint probability function of two discrete random variables X & Y is given by 8

$$f(x, y) = \begin{cases} C(2x + y), & 0 \leq x \leq 2, 0 \leq y \leq 3 \\ 0, & \text{otherwise} \end{cases}$$

Find

- i) Constant C
- ii) $p(x \geq 1, y \leq 2)$
- iii) Marginal probability functions of x & y
- iv) Whether x and y are independent.

OR

10. a) Find moment generating function and the first four moments about origin for the random variable X given by. 8

$$X = \begin{cases} 1, & \text{prob } \frac{1}{2} \\ -1, & \text{prob } \frac{1}{2} \end{cases}$$

- b) Let $f(x) = \begin{cases} c(1 - x^2), & -1 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$ 8

find

- i) Constant C
- ii) Coefficient of skewness
- iii) Coefficient of kurtosis
