

B.E. / B.Tech. Computer Science & Engineering (Model Curriculum) Semester-III  
**SE101CS / 101 - Applied Mathematics-III**

P. Pages : 3

Time : Three Hours



**GUG/W/24/13801**

Max. Marks : 80

- Notes :
1. All questions carry equal marks.
  2. All questions are compulsory.
  3. Non programmable calculator is permitted.

1. a) Solve using z-transform 8  
 $y_{n+2} - 2\cos \alpha y_{n+1} + y_n = 0$ , given  $y_0 = 0, y_1 = 1$ .

- b) Find  $z^{-1} \left[ \frac{z^2}{(z-a)(z-b)} \right]$  using convolution theorem. 8

**OR**

2. a) Using Fourier Integral show that, 8  
$$\int_0^{\infty} \frac{\sin \pi \lambda \cdot \sin \lambda x}{1 - \lambda^2} d\lambda = \begin{cases} \pi/2 \sin x, & 0 \leq x \leq \pi \\ 0, & x > \pi \end{cases}$$

- b) Find  $f(x)$  If its Fourier sine transform is  $\frac{e^{-a\lambda}}{\lambda}$ . Hence find the inverse Fourier sine transform of  $1/\lambda$ . 8

3. a) Find the inverse of matrix  $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$  by partition method. 8

- b) Find the value of K for which the equations 8  
 $2x + (4 - k)y = -7$   
 $(2 - k)x + 2y = -3$   
 $2x + 5y = k - 6$   
are consistent. Find the general solution for these value of K.

**OR**

4. a) Diagonalize the matrix - 8  
$$\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$$

- b) Find the eigen values & eigen vectors of 8

$$A = \begin{bmatrix} 5 & 7 & -5 \\ 0 & 4 & -1 \\ 2 & 8 & -3 \end{bmatrix}$$

5. a) If  $A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ , find  $A^{200}$  using Sylvester's theorem. 8

- b) Verify Cayley-Hamilton's theorem for the matrix  $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$  & hence express 8

$$A^6 - 6A^5 + 9A^4 - 2A^3 - 12A^2 + 23A - 9I \text{ as a linear polynomial in } A.$$

**OR**

6. a) Solve by matrix method. 8

$$\frac{d^2y}{dt^2} + 4y = 0, \text{ given } y = 8, \frac{dy}{dt} = 0, \text{ when } t = 0$$

- b) Find the largest eigen value & the corresponding eigen vectors of the matrix. 8

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix} \text{ by iteration method.}$$

7. a) A random variable x has the following distribution. 8

x	0	1	2	3	4	5	6	7	8
p(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

Then find

- (i) a (ii)  $p(x < 3)$ ,  $p(x > 3)$  (iii)  $p(x \geq 7)$  (iv) find the distribution function of x.

- b) Consider the density function 8

$$f(x) = \begin{cases} k\sqrt{x}, & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$$

find-

- i) k  
ii) Cumulative Distribution  
iii)  $p(0.3 < x < 0.6)$ .

**OR**

8. a) Let x & y be two random variables having joint density function. 8

$$f(x, y) = \begin{cases} 2/5^{(2x+3y)}; & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0; & \text{otherwise} \end{cases}$$

find-

- i) Marginal Distribution of function x & y
- ii)  $p(x < 1/2, y > 1/2)$
- iii)  $p(y < 3/4)$

- b) Let x & y be random variables having joint probability function. 8

$$f(x, y) = \begin{cases} c(2x + y); & x = 0, 1, 2, \dots; y = 0, 1, 2, 3, \dots \\ 0; & \text{otherwise} \end{cases}$$

Find

- i) C
- ii) Marginal density function of x & y
- iii) Are x & y independent?
- iv)  $p(x \geq 1, y \leq 2)$ .

9. a) The density function of a random variable x is 8

$$f(x) = \begin{cases} 2e^{-2x}; & x \geq 0 \\ 0; & \text{otherwise} \end{cases}$$

Find-

- i)  $E(x)$
- ii)  $\text{Var}(x)$
- iii)  $E[(x-1)^2]$
- iv) S.D.
- v) Moment generating function

- b) Find moment generating function & the first four moments about origin for the random variable x given by- 8

$$x = \begin{cases} 1, & \text{prob } 1/2 \\ -1, & \text{prob } 1/2 \end{cases}$$

**OR**

10. a) A random variable x has the density function given by  $f(x) = \begin{cases} e^{-x}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$  8

then find coefficient of-

- i) Skewness
- ii) Kurtosis

- b) Let x & y be random variables having joint density function 8

$$f(x, y) = \begin{cases} cxy; & 0 \leq x \leq 1; 0 \leq y < x \\ 0; & \text{otherwise} \end{cases}$$

Find-

- i) C
- ii)  $E(x)$  &  $E(y)$
- iii)  $\text{Var}(x)$  &  $\text{Var}(y)$

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