B.E. Computer Science & Engineering / Computer Technology / Information Technology
(CBCS Pattern) Third Semester

3BECS01 / 3BECT01 / 3BEIT01
Applied Mathematics - III

P. Pages : 3 **GUG/W/18/11481**

Time : Three Hours * 3 5 6 6 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Use of non programmable calculator is permitted.

1. a) If $z\{f(n)\} = F(z)$, then prove that $z\left\{\frac{f(n)}{n+k}\right\} = z^k \int_z^\infty \frac{F(z)}{z^{k+1}} dz$ & hence evaluate $z\left\{\frac{1}{n+1}\right\}$ **8**

b) Solve the following difference equation by z-transform **8**
$x_{n+2} - 3x_{n+1} + 2x_n = 4^n$ where $x_0 = 0,\ x_1 = 1.$

OR

2. a) Express $f(x) = \begin{cases} 1 & , \text{ for } |x| < 1 \\ 0 & , \text{ for } |x| > 1 \end{cases}$ as Fourier integral & hence evaluate **8**
$\int_0^\infty \frac{\sin\lambda \cos\lambda x}{\lambda} d\lambda$

b) Solve the integral equation $\int_0^\infty f(x)\cos\alpha x\, dx = \begin{cases} 1-\alpha & , \ 0 \le \alpha \le 1 \\ 0 & , \ \alpha > 1 \end{cases}$ **8**

3. a) Find the inverse of A by Partitioning method where **8**
$$A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$

b) Investigate the consistency of the following equations & if possible find the solutions **8**
$4x - 2y + 6z = 8$
$x + y - 3z = -1$
$15x - 3y + 9z = 21$

OR

4. a) Are the following vectors linearly dependent. If so, find the relation between them **5**
$x_1 = (1, 2, 4)$ $x_2 = (2, -1, 3)$
$x_3 = (0, 1, 2)$ $x_4 = (-3, 7, 2)$

b) Find the modal matrix B of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ **8**

Also write diagonal matrix.

c) Find the rank of matrix $A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ **3**

5. a) Find A^{-2} by Sylvester's theorem if $A = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$ **8**

b) Verify Cayley - Hamilton theorem for $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence find **8**

$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$

OR

6. a) Solve the following differential equation by matrix method **8**

$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0$ given y(0) = 5, y'(0) = 8.

b) Find the largest eigen value and the corresponding eigen vector for the matrix. **8**

$\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$

7. a) A random variable X has following probability distribution. **8**

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

i) Determine the value of a
ii) find P(X < 3), P(0 < X < 5)
iii) Find the distribution function of X

b) The joint density function of two continuous random variable X and Y is **8**

$$f(x, y) = \begin{cases} Cxy, & 0 < x < 4, 1 < y < 5 \\ 0 & \text{otherwise} \end{cases}$$

Find :
i) The constant C
ii) $P(x \geq 3, y \leq 2)$
iii) $P(1 < x < 2, 2 < y < 3)$
iv) marginal density function.

OR

8. a) The joint probability function of two discrete random variable X and Y is given by **8**

$$f(x, y) = \begin{cases} Cxy, & x = 1, 2, 3 \text{ and } y = 1, 2, 3 \\ 0 & \text{otherwise} \end{cases}$$

Find

i) The constant C

ii) $P(1 \le y \le 2, y \le 3)$

iii) Find marginal probability function of x and y

iv) Determine whether X and Y are independent

b) Let X be random variable having density function **8**

$$f(x) = \begin{cases} Cx, & 0 \le x \le 2 \\ 0, & \text{otherwise} \end{cases}$$

Find

i) the constant C

ii) $P(\frac{1}{2} < x < \frac{3}{2})$

iii) P(x > 1)

iv) The distribution function.

9. a) Find the mathematical expectation of discrete random variable X whose probability function is $f(x) = (\frac{1}{2})^x$, $x = 1, 2, 3.....$ **8**

b) Let X and Y the random variable joint density function **8**

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

Find

i) E(x) ii) E(y) iii) Var(x) iv) Cov(xy)

OR

10. a) The joint probability function of two discrete random variables X & Y is given by **8**

$$f(x, y) = \begin{cases} \frac{2x+y}{42}, & x = 0, 1, 2, \ y = 0, 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$

Find

i) E(x) ii) E(y) iii) Var(x) iv) Var(y)

b) **8**

Let $f(x) = \begin{cases} C(1-x^2), & -1 \le x \le 1 \\ 0, & \text{otherwise} \end{cases}$

Find

i) C

ii) Coefficient of skewness

iii) Coefficient of Kurtosis

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