B.E. Fourth Semester (Electronics / Electronics Telecommunication / Electronics Communication Engineering) (C.B.S.)

# Applied Mathematics - IV

P. Pages : 3 **NKT/KS/17/7268/7273**

Time : Three Hours Max. Marks : 80

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Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Use of non programmable calculator is permitted.
9. Use of normal distributed table is permitted.

**1.** a) Use Newton-Raphson method to find the real root of the equation 3x = cos x + 1 correct to four decimal places. **6**

b) Solve the following system of equation by Crout's method. **6**

$2x + 3y + z = 9$

$x + 2y + 3z = 6$

$3x + y + 2z = 8$

c) Use Taylor's series method to solve **6**

$\frac{dy}{dx} = x + y,\ y(1) = 0$ find y(1.2) with h = 0.1.

**OR**

**2.** a) Given $\frac{dy}{dx} = y - x,\ y(0) = 2$. Find y(0.1) and y(0.2) by R. K. $4^{th}$ order method, correct to four decimal places. **6**

b) Apply Milne's predictor - corrector method to solve the $diff^n$ equation. **6**

$\frac{dy}{dx} = -xy^2$ at x = 0.8 given that y(0) = 2, y(0.2) = 1.923 y(0.4) = 1.724, y(0.6) = 1.471.

c) Apply modified Euler's method to solve $\frac{dy}{dx} = e^x + xy,\ y(0) = 0$ to compute y(0.1) & y(0.2). **6**

**3.** a) Find $Z^{-1}\left[\frac{2z^2 - 5z}{(z-2)(z-3)}\right]$ **6**

b) If $Z[f_n] = F(z)$ then $Z\left\{\frac{f_n}{n+k}\right\} = z^k \int_z^\infty \frac{F(z)}{z^{k+1}} dz$ **6**

**OR**

**4.** a) Find $Z[a^n \cosh 3n]$ & $Z[a^n \sinh 3n]$. **6**

b) Solve by using Z-transform : **6**
$y_{n+3} - 3y_{n+2} + 3y_{n+1} - y_n = u(n)$,
y(0) = y(1) = xy(2) = 0
where u(n) is unit step function.

**5.** a) Solve the equation by Frobenious method. **6**

$$2x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} - (x+1)y = 0$$

b) Prove that $J_{n+3} + J_{n+5} = \frac{2}{x}(n+4)J_{n+4}$ **6**

**OR**

**6.** a) Express the polynomial into Legendre polynomial $f(x) = 4x^3 - 2x^2 - 3x + 8$ **6**

b) Prove that $\int P_n\, dx = \frac{1}{2n+1}[P_{n+1} - P_{n-1}] + c$ **6**

**7.** a) Three urns contains 6 red, 4 black, 4 red 6 black, 5 red, 5 black balls respectively. One of the urns is selected at random and a ball is drawn from it. If the ball is red, find the probability that it is drawn from the first urn. **6**

b) Two dice are tossed. The random variable X is sum of two numbers. Which can come up. Find probability function, distribution fun and draw a graph of both. **6**

**OR**

**8.** a) The density fun. of a random variable is given by $f(x) = \begin{cases} 2x & , \quad 0 \le x \le 1 \\ 0 & , \quad \text{otherwise} \end{cases}$ **6**

find $P(X > ½)$, $P(X < ½)$ and $F(x)$.

b) The probability fun. of two discrete random variables x and y is given by - **6**

$$f(x, y) = \begin{cases} c(x^2 + y^2) & , \quad 1 \le x \le 5,\ 0 \le y \le 4 \\ 0 & , \quad \text{otherwise} \end{cases}$$

find C, $P(x=3)$, $P(y=2)$, $P(x \ge 3,\ y \le 3)$ Marginal probability for x and y.

**9.** a) The density fun. of random variables x & y is given by **7**

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

Find E(X), E(Y), E(XY).

b) The density fun of random variable is given by **7**

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

Find moment generating function and first two moments about origin and about mean.

**OR**

**10.** a) Let X have the density function **7**

$$f(x) = \begin{cases} \frac{3}{4}(1-x^2) & , \quad -1 \le x \le 1 \\ 0 & , \quad \text{otherwise} \end{cases}$$

find skewness and Kurtosis of X.

b) Find variance and standard deviation of a random variable X having probability fun. **7**

| x | ½ | -½ |
|---|---|---|
| f(x) | ½ | ½ |

**11.** a) Verify central limit theorem in case where $x_1, x_2, ....x_n$ are independent and identically distributed as Poisson distribution. **6**

b) Five fair coins are tossed simultaneously find the probability fun. of the random variable X = number of heads. And compute the probabilities of obtaining no heads, precisely 1 head, at least 1 head not more than 4 heads. **6**

**OR**

**12.** a) The mean grade on a final examination was 72 and the standard deviation was 9. The top 10% of the students are to receive A's. What is the minimum grade a student must get in order to receive an A ? **6**

b) If 3% of the electric bulbs manufactured by a company are defective, find the probability that in a sample of 100 bulbs. **6**

i) more than 5 ii) bet$^n$ 1 & 3

iii) at the most 2 bulbs will be defective.

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