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

Applied Mathematics - IV

P. Pages : 3 **NRJ/KW/17/4408/4413**

Time : Three Hours Max. Marks : 80

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. Assume suitable data whenever necessary.
9. Use of non programmable calculator is permitted.
10. Use of normal distribution table is permitted.

1. a) Find the real root of $x\log_{10} x - 2 = 0$ by Newton- Raphson method correct to three places of decimal. **6**

b) Use Crout's method to solve the equations. **6**

$$x_1 + 2x_2 + 3x_3 = 7$$
$$2x_1 + 7x_2 + 15x_3 = 26$$
$$3x_1 + 15x_2 + 41x_3 = 62$$

c) Use Runge-Kutta to find approximate value of y for x = 0.2 when **6**
$\frac{dy}{dx} = \frac{x^2 + y^2}{10}$; y (0) = 1 by taking h = 0.1.

OR

2. a) Solve by Gauss-Seidel method: **6**
$$4x + 11y - z = 33$$
$$6x + 3y + 12z = 36$$
$$8x - 3y + 2z = 20$$

b) Use modified Euler's method to solve the equation $\frac{dy}{dx} = \log(x + y)$ **6**
given y(0) = 2, for x = 0.8, h = 0.4.

c) Find largest eigen value and corresponding eigen vector for the matrix. **6**
$$\begin{bmatrix} 3 & 2 & 4 \\ 2 & 0 & 2 \\ 4 & 2 & 3 \end{bmatrix}$$

3. a) Find Z-Transform of $\frac{(n+1)(n+2)}{2!} a^n$. **6**

b) Find inverse Z-Transform of $\dfrac{z^2+z}{(z-1)(z^2+1)}$. **6**

OR

4. a) Find inverse Z-Transform of $\dfrac{z^3}{(z-2)^3}, |z|>2$. **6**

b) Solve using Z-Transform $y_{n+2}-y_n = 2^n; y_0 = 0,\ y_1 = 1.$ **6**

5. a) Solve in series. **8**

$(2x+x^3)y''-y'-6xy=0$
by Frobenius method.

b) Prove that. **4**
$4J_n''(x)=J_{n-2}(x)-2J_n(x)+J_{n+2}(x)$

OR

6. a) Find $p_0(x), p_1(x), p_2(x), p_3(x)$ by using Rodrigues' formula. **6**

b) If $f(x)=\begin{cases} 0\ ; -1<x<0 \\ 1\ ;\ \ 0<x<1 \end{cases}$ **6**
obtain Legendre's expansion for f (x).

7. a) Pair of dice is tossed. If the numbers appearing are different, find the probability that the sum is even. **5**

b) An urn holds 5 white and 3 black marbles. If two marbles are drawn at random without replacement and X denotes the number of white marbles **7**
i) Find the probability function and
ii) The distribution function &
iii) Graph of prob. fun^{n} & distribution function.

OR

8. a) Find the distribution function for r.v. X whose density function is **6**
$f(x)=\begin{cases} x/2 ; 0 \le x \le 2 \\ 0\ ; \text{otherwise} \end{cases}$
Hence or otherwise find p (X > 1).

b) The joint probability function of two discrete random variable X & Y is given by **6**
$f(x,y)=\begin{cases} cxy\ ; x=1,2,3\ \&\ y=1,2,3 \\ 0\ ; \text{otherwise} \end{cases}$
find i) The constant C
ii) $p(x \ge 2)$
iii) Marginal prob. function of x and y

9. a) Find mathematical expectation of discrete random variable X whose prob. function is **6**

$$f(x) = \left(\frac{1}{2}\right)^x ; x = 1, 2, 3.$$

b) Find the mean, variance and moment generating function for exponential distribution. **8**

$$f(x) = \begin{cases} \alpha e^{-\alpha x} & ; x > 0 \\ 0 & ; x \le 0 \end{cases}$$

OR

10. a) Find the skewness and kurtosis for the probability distribution. **8**

$$f(x) = \begin{cases} \frac{4x(9-x^2)}{81} & ; 0 \le x \le 3 \\ 0 & ; \text{otherwise} \end{cases}.$$

b) Find (i) Mean (ii) Variance & (iii) std deviation for the **6**

$$f(x) = \begin{cases} \frac{1}{b-a} & ; a < x < b \\ 0 & ; \text{otherwise} \end{cases}$$

11. a) Prove central limit theorem for the independent variables. **6**

$$X_k = \begin{cases} 1 & ; \text{prob } p \\ -1 & ; \text{prob. } q. \end{cases}$$

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) Exactly 2, (ii) More than 5 &

(iii) At the most 2 will be defective.

OR

12. a) Find the probability of getting between 2 heads to 4 heads in 10 tosses of fair coin using **6**

(i) Binomial distribution and

(ii) The normal approximation to the Binomial distribution.

b) Verify central limit theorem for a random variable X which is Binomially distributed with mean np and std deviation $\sqrt{npq}$. **6**

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