

**B.Tech. (Computer Science & Engineering) Third Semester (C.B.C.S.)**  
**Applied Mathematics-III**

P. Pages : 4

Time : Three Hours



PSM/KW/23/2569

Max. Marks : 70

- 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. Due credit will be given to neatness and adequate dimensions.
  8. Assume suitable data whenever necessary.
  9. Diagrams and chemical equations should be given whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.
  11. Use of non programmable calculator is permitted.

1. a) Find the positive root of the equation  $2x^3 - 3x - 6 = 0$  by Newton-Raphson method correct to four decimal places. 7
- b) Use Runge Kutta fourth order method to find the value of  $y$  for  $x = 0.4$  taking  $h = 0.2$  from the differential equation  $\frac{dy}{dx} = x + y^2$ ; given  $y(0) = 1$ . 7

**OR**

2. a) Solve the following system of equation by Crout's method. 7
- $$\begin{aligned} 2x + 3y + 2z &= 2 \\ 10x + 3y + 4z &= 16 \\ 3x + 6y + z &= -6 \end{aligned}$$
- b) Use Euler's modified method to find  $y(0.4)$  given that  $\frac{dy}{dx} = x + \sqrt{y}$ , given  $y(0) = 1$  and  $h = 0.2$ . 7
3. a) Investigate the linear dependence of the vector  $X_1 = [1, 2, 4]$ ,  $X_2 = [2, -1, 3]$ ,  $X_3 = [0, 1, 2]$ ,  $X_4 = [-3, 7, 2]$  And if possible find the relation between them. 7
- b) Using Sylvester's theorem, prove that  $\sin^2 A + \cos^2 A = 1$ , where  $A = \begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$  7

**OR**

4. a) Find the modal matrix B corresponding to matrix  $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$  and verify that  $B^{-1}AB$  is diagonal form.

b) Find the largest eigen value and the corresponding eigen vectors for the matrix.

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

5. a) A random variable X is defined by

X	-2	3	1
p(x)	1/3	1/2	1/6

Find

i)  $E(X)$

ii)  $E(2X + 3)$

iii)  $E(X^2)$

iv)  $\text{Var}(X)$

v)  $E(X^2 + 5X)$

b) A and B play a game in which their chances of winning are in the ratio 3:2. Find A's chance of winning at least three games out of the five games played.

OR

6. a) Find the moment generating function of the random variable.

X	1/2	-1/2
p(x)	1/2	1/2

Also find first four moments about the origin.

b) If the diameter of ball bearings are normally distributed with mean 15.60mm and standard deviation 0.06mm, determine the percentage of ball bearings with diameters-

a) Between 15.50 and 15.70mm inclusive

b) Greater than 15.70mm

c) Less than 15.40mm

d) Equal to 15.60mm.

Assume the measurements to be recorded to the nearest 0.01mm.

7. a) Calculate mean and standard deviation for the following distribution, given the age distribution of 542 members.

Age (in year)	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of member	3	61	132	153	140	51	2

b) If  $X_1, X_2, X_3$  are three variates measured from their mean with  $N = 13$ ,

$$\sum X_1^2 = 90, \sum X_2^2 = 160, \sum X_3^2 = 40, \sum X_1 X_2 = 60, \sum X_2 X_3 = 60, \sum X_3 X_1 = 40.$$

Calculate the multiple correlation coefficient  $R_{1.23}$ .

OR

8. a) Obtain Karl Pearson's measure of skewness for the following data.

Value	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	6	8	17	21	15	11	2

- b) Obtain a regression plane by using Multiple linear regression  $y$  on  $x, z$  to fit the data given below:

x	1	2	3	4
z	0	1	2	3
y	12	18	24	30

9. a) In the fair coin experiment, the random process  $\{X(t)\}$  is defined as follows:

$$X(t) = \begin{cases} \sin \pi t, & \text{for Head} \\ 2t, & \text{for tail} \end{cases}$$

Find-

- Mean of  $X(t)$
  - Distribution function  $F(x, t)$  at  $t = 0.25$ .
- b) In an investigation of health and nutrition of two groups of children of different social status, the following result are obtained. <https://www.rtmnuonline.com>

Health \ Social Status	Poor	Rich	Total
Below Normal	130	20	150
Normal	102	108	210
Above Normal	24	96	120
Total	256	224	480

Discuss the relation between health and social status. Critical value of chi-square at 5% significance level with 2 degree of freedom is 5.99.

OR

10. a) Consider the Markov Chain with three states,  $S = \{1, 2, 3\}$ , that has the following transition matrix.

$$P = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{3} & 0 & \frac{2}{3} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$$

- Draw the state transition diagram
- If  $p(X_1 = 1) = p(X_2 = 2) = 1/4$   
Find  $p(X_1 = 3, X_2 = 2, X_3 = 1)$

- b) A fertilizer mixing machine is set to give 12kg of nitrate for quintal bag of fertilizer. Ten 100 kg bags are examined and the percentages of nitrate per bag are found to be as given below:  
12, 14, 13, 13, 12, 12, 14, 11, 12, 13  
Is there any reason to believe that the machine is defective? Value of t for 9 degree of freedom is 2.262.

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