

- (b) Find the value of the constant  $C$  such that  $f(x) = Cx(1 - x)$ ,  $0 < x \leq 1$   
 $= 0$ , elsewhere  
 is a possible density function and compute  $P(X > \frac{1}{2})$ . Also find  $E(X)$ .

6 + 6 = 12

**Group - E**

8. (a) The distribution of the number of road accidents per day in a city is Poisson with mean 4. Find the approximate number of days out of 100 days where there will be  
 (i) no accident.  
 (ii) at least 2 accidents.  
 (iii) at most 3 accidents.

- (b) The expenditure of 1000 families is given below:

Expenditure(₹):	40-59	60-79	80-99	100-119	120-139
No of Families:	50	?	500	?	50

The median and mean for the distribution are both ₹ 87.50. Calculate the missing frequencies.

6 + (2 + 2 + 2) = 12

9. (a) Calculate the mean, median and mode of the following frequency distribution

Marks:	10-19	20-29	30-39	40-49	50-59	60-69
Frequencies:	8	11	15	17	17	7

- (b) From the following data, obtain the line of regression of  $Y$  on  $X$

Sales ( $X$ ):	91	97	108	121	67	124	51	73
Purchases ( $Y$ ):	71	75	69	97	70	91	39	61

6 + 6 = 12

**NUMERICAL & STATISTICAL METHODS  
(MATH 2002)**

Time Allotted : 3 hrs

Full Marks : 70

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group - A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Newton-Raphson method is also known as  
 (a) method of chords (b) method of tangents  
 (c) method of arcs (d) none of these.
- (ii) Which of the following relation is valid?  
 (a)  $\Delta = 1 - E$  (b)  $\nabla = 1 - E^{-1}$   
 (c)  $\Delta \cdot \nabla = \Delta - \nabla$  (d) none of these.
- (iii) A matrix can be factorized into lower and upper triangular matrix if all the principal minors of the matrix are  
 (a) singular (b) non-singular  
 (c) zero (d) none of these.
- (iv) If the interval of differencing is unity and  $f(x) = ax^2$  ( $a$  is constant) which one of the following is wrong?  
 (a)  $\Delta f(x) = a(2x + 1)$  (b)  $\Delta^2 f(x) = 2a$   
 (c)  $\Delta^3 f(x) = 2$  (d)  $\Delta^4 f(x) = 0$
- (v) If  $f(x)$  is defined at  $(n + 1)$  distinct points then degree of Lagrangian function is  
 (a) exactly  $(n + 1)$  (b) at most  $n$   
 (c) exactly  $(n - 1)$  (d) 0
- (vi) The median of first  $(2n + 1)$  natural numbers is  
 (a)  $n$  (b)  $(n + 1)$  (c)  $(n + 2)$  (d) none of these.

(vii) The expected value of the product of points on two dice, both tossed simultaneously is

- (a)  $\frac{7}{2}$                       (b)  $\frac{2}{7}$                       (c)  $\frac{4}{49}$                       (d)  $\frac{49}{4}$

(viii) A random variable  $X$  has the following probability density function:

$$f(x) = \begin{cases} \frac{1}{4}, & -2 < x < 2 \\ 0, & \text{elsewhere} \end{cases}$$

then  $P(2X + 3 > 5)$  is

- (a)  $\frac{1}{2}$                       (b)  $\frac{1}{3}$                       (c)  $\frac{1}{4}$                       (d) 1

(ix) What is the probability that a leap year selected at random, will contain 53 Saturdays

- (a)  $\frac{1}{7}$                       (b)  $\frac{4}{7}$                       (c)  $\frac{3}{7}$                       (d)  $\frac{2}{7}$

(x) If  $b_{xy} = -0.4$  and  $b_{yx} = -0.9$ , then the correlation coefficient between  $x$  and  $y$  ( $r_{xy}$ ) is

- (a) 0.36                      (b)  $-0.6$                       (c) 0.6                      (d)  $-0.06$

**Group - B**

2. (a) Find a positive real root of the equation  $e^x = 2x + 1$  by Newton-Raphson method correct to five significant figures.

(b) Solve the following system of linear equations, correct to 3 decimal places, by Gauss Siedel method.

$$x + 10y + z = 20.08$$

$$10x + y - z = 11.19$$

$$-x + y + 10z = 35.61$$

**6 + 6 = 12**

3. (a) Find the smallest positive root of the equation  $xe^x - 1 = 0$ , correct to 3 significant figures using bisection method.

(b) Use Gauss Elimination method to solve the following system of equations.

$$5x - y = 9$$

$$-x + 5y - z = 4$$

$$-y + 5z = -6$$

**6 + 6 = 12**

**Group - C**

4. (a) Compute  $f(0.29)$  by Newton's backward difference interpolation formula from the following table.

$x$	0.20	0.22	0.24	0.26	0.28	0.30
$f(x)$	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

(b) Compute the value of  $\pi$  from the formula  $\frac{\pi}{4} = \int_0^1 \frac{1}{1+x^2} dx$  using

Trapezoidal rule taking the 10 sub-interval. Can you calculate the absolute error committed from this?

**6 + 6 = 12**

5. (a) Find the value of  $y(0.4)$  using Runge-Kutta method of fourth order taking  $h = 0.2$ , given that  $\frac{dy}{dx} = \sqrt{(x^2 + y)}$ , and  $y(0) = 0.8$ .

(b) Find the equation of the cubic curve that passes through the points  $(-1, -8)$ ,  $(0, 3)$ ,  $(2, 1)$  and  $(3, 2)$  using Lagrange's interpolation formula.

**6 + 6 = 12**

**Group - D**

6. (a) Two persons A and B throw alternatively a pair of dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. If A begins, find the probability of his winning.

(b) Suppose that there is a chance for newly constructed house to collapse whether the design is faulty or not. The chance that the design is faulty is 10%. The chance that the house collapse if the design is faulty is 95% and otherwise it is 45%. It is seen that the house collapsed. What is the probability that it is due to faulty design?

**6 + 6 = 12**

7. (a) The probability density function of a continuous random variable  $X$  is given by

$$f(x) = \begin{cases} \frac{x}{2}, & 0 < x \leq 1 \\ \frac{1}{2}, & 1 < x \leq 2 \\ \frac{3-x}{2}, & 2 < x \leq 3 \end{cases}$$

Find the mean and variance of  $X$ .