

**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) $\Delta\left(\frac{1}{x}\right)$ is equal to
(a) $\frac{1}{x(x+h)}$ (b) $\frac{1}{(x+h)}$ (c) $-\frac{h}{(x+h)}$ (d) $-\frac{h}{x(x+h)}$
- (ii) 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.
- (iii) 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.
- (iv) One of the root of $x^2 + 5x - 3 = 0$ lies in between
(a) 1 & 2 (b) 0 & 1 (c) 2 & 3 (d) 4 & 5.
- (v) Let X be a random variable. Then which of the combination of $E(X)$ and $E(X^2)$ is **NOT** possible for the random variable X .
(a) 0 & 1 (b) 2 & 3 (c) $\frac{1}{2}$ & $\frac{1}{3}$ (d) 2 & 5.
- (vi) 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.
- (vii) The mean of a uniform distribution with parameters a and b is
(a) $\frac{a-b}{2}$ (b) $\frac{b-a}{2}$ (c) $\frac{b^2-a^2}{2}$ (d) $\frac{b+a}{2}$.

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- (viii) A fair coin is tossed 10 times. What is the probability that **ONLY** the first two tosses will yield heads.
 (a) $\left(\frac{1}{2}\right)^{10}$ (b) $\left(\frac{1}{2}\right)^2$ (c) $10C_2 \left(\frac{1}{2}\right)^2$ (d) $10C_2 \left(\frac{1}{2}\right)^{10}$
- (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 $b_{yx} = -0.9$, the 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) Using Newton-Raphson method, obtain iteration formula for the reciprocal of a number N and hence find the value of $\frac{1}{22}$, correct upto four decimal places.
- (b) Using Gauss-Seidel method, find the solution of the following system of linear equations correct to one decimal places.

$$\begin{aligned} 5x - 2y + z &= 4 \\ x + 6y - 2z &= -1 \\ 3x + y + 5z &= 13 \end{aligned}$$

6 + 6 = 12

3. (a) Solve the following system of linear equations by Gauss Elimination method.

$$\begin{aligned} x + 2y + 3z &= 10 \\ x + 3y - 2z &= 7 \\ 2x - y + z &= 5 \end{aligned}$$
- (b) Find the smallest positive root of the equation $xe^x - 1 = 0$, correct to 2 significant figures using bisection method.

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) Find the solution of the differential equation $\frac{dy}{dx} = y^2 + xy$, $y(1) = 1$ for $x = 1.1$ taking $h = 0.1$ using Runge-Kutta method of fourth order.
5. (a) 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.

7 + 5 = 12

- (b) Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{1 - 0.612 \sin^2 x} \, dx$ using trapezoidal rule with 6 sub-intervals.

6 + 6 = 12**Group - D**

6. (a) 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.
- (b) Two newspapers, X and Y are published in a certain city. It is estimated from a survey that 16% read X , 14% read Y and 5% read both newspapers. Find the probabilities that a randomly selected person
- does not read any newspaper, and
 - reads only Y .

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 .

- (b) The distribution function $F(x)$ of the random variable X is defined as follows:

$$F(x) = \begin{cases} A, & -\infty < x < -1 \\ B, & -1 \leq x < 0 \\ C, & 0 \leq x < 2 \\ D, & 2 \leq x < \infty \end{cases}$$

where A, B, C and D are constants. Determine values of A, B, C and D , it being given that $P(X = 0) = \frac{1}{6}$ and $P(X > 1) = \frac{2}{3}$.

6 + 6 = 12**Group - E**

8. (a) A passenger arrives at a bus stop at 9 *am* knowing that the bus will arrive at some time uniformly distributed between 9 *am* and 9.30 *am*.
- Find the probability that he will have to wait longer than 10 *mins*.
 - If at 9.15 *am* the bus has not yet arrived, find the probability that he will have to wait at least 10 additional minutes.
- (b) 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

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- (i) no accident,
- (ii) at least 2 accidents,
- (iii) at most 3 accidents.

6 + 6 = 12

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

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

(b) The following data gives the hardness (x) and tensile strength (y) for some specimens of a material, in certain units. Find the correlation coefficient and the regression line of x on y .

x	23.3	17.5	17.8	20.7	18.1	20.9	22.9
y	4.2	3.8	4.6	3.2	5.2	4.7	4.4

6 + 6 = 12**Note:**

1. Students having backlog in MATH2002 and if not joined in any Google classroom for this paper code yet, are advised to follow both Step-I and Step-II as mentioned below in order to submit the answer-scripts properly.
2. Students who have already joined any Google Classroom for MATH2002 can directly go to Step-II as mentioned below.

Department & Section	Steps	Link
All (Backlog)	Step-I : Join Google Classroom using institutional email account	https://classroom.google.com/c/Mzc0MjcyMTQ5NjUz?cjc=ccguwqp
	Step-II: Submit the answer script.	https://classroom.google.com/c/Mzc0MjcyMTQ5NjUz/a/Mzc0MjcyMTQ5Njc1/details