RAN-2311001101040001

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M.Sc. IT / B.Sc. IT (Sem. I) Examination December - 2023

MDC-102 - Mathematics - I

Time: 3 Hours] **[Total Marks: 70**

સૂચના : / Instructions

(૧) **નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.**
Fill up strictly the details of ☛ signs on your answer book

Name of the Examination:
☛ **M.Sc. IT / B.Sc. IT (Sem. I)**

Name of the Subject :
☛ **MDC-102 - Mathematics - I**

Subject Code No.: **2311001101040001**

Seat No.:

Student's Signature

(2) Answer all questions.

(3) Figures to the right indicates marks.

(4) Follow usual notations and conventions.

Q-1 A. Attempt Any Three. **(9)**

a) Define one-one function and verify that $f(x) = 2x$ is bijective.

b) Given function $f(x) = 2x + 1$ and $g(x) = x^2 - 8$ then find fog and gof.

c) $A = \{1, 2, 3\}$. Let P(A) be the power set of A and $\subseteq$ be a relation on P(A). List the elements of it. Hence show that it is antisymmetric.

d) Find inverse of $A = \begin{bmatrix} 2 & -3 & 3 \\ 2 & 2 & 3 \\ 3 & -2 & 2 \end{bmatrix}$ using elementry row operations.

B. Attempt Any Three. **(9)**

a) Solve the system of linear equations.

$x + 3y - 2z = 0$

$2x - y + 4z = 0$

$x - 11y + 14z = 0$

b) Find $6^2 + 7^2 + 8^2 + ... + 20^2$.

c) Show that $(A + B)^2 = A^2 + AB + BA + B^2$ where $A = \begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 3 & -4 \\ 5 & 7 \end{bmatrix}$

d) Prove that every square matrix can be uniquely represented as sum of its symmetric matrix and skew symmetric e matrix.

Q-2 A. Attempt Any Three. **(9)**

a) $A = \{1,2,3\}$, $B = \{a,b,c\}$

$R = \{(1, a), (1, b), (2, b), (2, c), (3,b)\}$

$S = \{(1, b), (2, c), (3, b)\}$

Then compute

(1) R' (2) $R \cap S$

(3) $R \cup S$ (4) R^{-1}

b) Find 12^{th} term of geometric progression whose 8^{th} term is 192 and common ratio is 2.

c) Find Adjoint of $A = \begin{bmatrix} 2 & 7 & 3 \\ 8 & 4 & 5 \\ 4 & 2 & 9 \end{bmatrix}$

d) Define 1) Transpose of a matrix with illustration.

2) Skew symmetric matrix with illustration.

B. Attempt Any Two. **(8)**

a) Define the congruence relation and prove that congruence relation is equivalence relation.

b) Define multiplication of two matrices and if possible, find the value of (AB)C and BA for

$A = \begin{bmatrix} 3 & -2 \\ -1 & 0 \\ 4 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 4 & 7 \\ -1 & 4 & -3 \end{bmatrix}$, $C = \begin{bmatrix} 3 & 2 & -1 \\ 1 & 0 & 4 \\ 5 & -5 & 7 \end{bmatrix}$

c) If $A = \begin{bmatrix} 2 & 3 & 1 \\ 1 & 3 & 5 \\ 3 & 4 & 2 \end{bmatrix}$ then find

(1) $|A|$,

(2) $adjA$, also show that $\frac{A.(adjA)}{|A|} = \frac{(adjA).A}{|A|}$

Q-3 A. Attempt Any Three. **(9)**

a) In a group of 9 children consisting of 5 boys and 4 girls, 3 children are selected at random from it. Then find the probability that in a group of 3 children (I) one boy and (II) at least one boy.

b) Find Quartile deviation.

Wage (in rs.)	20-25	25-30	30-35	35-40	40-45	45-50
No. of persons	5	12	15	8	5	5

c) State Merits and Demerits of Mean, Median and Mode.

d) In a binomial distribution $n = 6$ and $9P(x = 4) = P(x = 2)$ find the value of mean and variance.

B. Attempt Any Three. **(9)**

a) Find Harmonic mean.

Marks	20	30	40	50	60	70	80
No. of students	3	61	132	153	140	51	3

b) Define: Range, quartile deviation and mean deviation.

c) For two events A and B P(A) = 1/2 = P(B) and $P(A \cup B) = 2/3$ then find $P(A' \cap B')$, $P(A' \cup B')$ and $P(A' \cap B)$.

d) For Poisson distribution if $P(x = l) = P(x = 4)$ then find $P(x \leq 1)$.

Q-4 A. Attempt Any Three. **(9)**

a) If a pair of dice is thrown and X denote the sum of numbers obtained on them, then find $E(X)$.

b) Define the following terms

I) Random variable

II) Mutually exclusive events

III) Sample space

c) The pmf function of a random variable x is,

X	0	1	2	3
P(x)	0.1	0.3	0.2	0.4

Find $E[(2x + 1)^2]$ and Var (X)

d) Find binomial distribution with mean is 4 and variance is 4/3 find $P(x \leq 2)$.

B. Attempt Any Two. **(8)**

a) Define Poisson distribution and find its mean and variance.

b) In a factory Producing screws, three machines produce respectively 25%, 30%, and 45% of the total production out of which 5%, 4% and 2% are defective respectively. One screw draw from random from the production and found that defective, what is the probability that it is produced by machine III.

c) Find mean, median, D_8, and P_{65}. From the following data:

Class Interval	20-25	25-30	30-35	35-40	40-45	45-50
Frequency	5	12	15	8	5	5