



Time Allotted : 3 Hours

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : MCAN-104 Discrete Mathematics

UPID : 001610

MCA

Full Marks : 70

The Figures in the margin Indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[1 x 10 = 10]

- (i) Let A and B be two sets each having n number of elements. Then how many bijective mappings will exist from A to B?
- (ii) Is the set of all real numbers w.r.t the relation 'less than or equal to' - a partial order relation or a total order relation?
- (iii) Write down the necessary and sufficient condition of a subset H of a group $(G, *)$, to be a subgroup of G.
- (iv) What is the maximum number of edges of a simple graph with n vertices?
- (v) Let S be a subset of a ring $(R, +, \cdot)$. Write down the two conditions for S to be a subring of R.
- (vi) What is the degree of a common vertex of two edges in series?
- (vii) If $f(x) = 3x+2$ is a mapping then write down $f^{-1}(x)$.
- (viii) The sum of the degrees of all the vertices of a graph is 40. Then write down the number of edges of the graph.
- (ix) How many generators does an infinite cyclic group have?
- (x) How many edges does a simple graph with 8 vertices have?
- (xi) If p: 'Anil is rich' and q: 'Kanchan is poor' then what is the symbolic form the statement 'Either Anil or Kanchan is rich'?
- (xii) If $f(x) = 2x-3$, then write the expression for $(f \circ f)(x)$.

Group-B (Short Answer Type Question)

Answer any three of the following :

[5 x 3 = 15]

2. If all the permutations of the letters of the word DIRECTOR be written down as in a dictionary what is the rank of the word? [5]
3. Let a be an element of a group $(G, \cdot)$, of order n. Then $a^m = e$ if and only if n is a divisor of m. [5]
4. Prove that a tree with n vertices has $n-1$ number of edges. [5]
5. State Lagrange's theorem. Hence show that every group of prime order is cyclic. [5]
6. Prove that a complete graph with n vertices consists of $n(n-1)/2$ edges. [5]
How many edges does a complete graph with 10 vertices have.

Group-C (Long Answer Type Question)

Answer any three of the following :

[15 x 3 = 45]

7. (a) Find the number of ways a company can assign 7 projects to 4 people so that each person gets at least one project. [8]
- (b) Four dice are thrown at a time. In how many way a total of 16 can be obtained? [7]
8. (a) In an examination, out of 90 students 65 passed in Physics and 50 passed in Mathematics and 35 passed in both Physics and Mathematics. [8]
 - i. How many students passed in exactly one of the two subjects?
 - ii. How many students failed in both the subjects?
- (b) If $A = \{1, 3, 5\}$, $B = \{1, 3, 8\}$ then find [7]
 - i. $A \times B$
 - ii. $B \times A$
 - iii. $(A \times B) - (B \times A)$
9. (a) Show that $G = \{0, 1, 2, 3\}$ is a group with respect to the operation $\tilde{+}_4$. Is it abelian? [5]
- (b) If y be an element of a group $(G, *)$ and $O(y) = 20$, find the order of y^8 . [5]
- (c) Let $(G, \cdot)$ be a cyclic group generated by a. Then $O(G) = n$ if and only if $O(a) = n$. [5]

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10. (a) Prove that the intersection of two subrings S and T of a ring $(R, +, \cdot)$ is a subring of R . Give an example to show that the union of two subrings may not be a subring of the ring. [8]
- (b) Show that the set of rational numbers other than 1, $\mathbb{Q}'$, forms a group under the binary operation $*$ defined by
 $a * b = a + b - a.b$. [7]
11. (a) Prove that number of odd vertices in any graph is even. [8]
- (b) Prove that the minimum number of edges in a connected graph with n vertices is $n-1$. [7]

*** END OF PAPER ***

