



HALDIA INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION UNDER MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL)

Paper Code: PCC-CS401

Paper Name: Discrete Mathematics

Time Allotted: 3 Hours

Full Marks: 70

The figures in the margin indicate full marks

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

Group – A

(Multiple Choice Type Questions)

Choose the correct alternatives from the followings:

15 x 1 = 15

1. (i) If U is universal set and $A \subset U$ then which of the following is not correct **(CO1)**
 (a) $A \cap A' = \varnothing$ (b) $A \cap U = A$ (c) $A \cup A' = U$ (d) $U - A = A - U$
- (ii) If a finite set has 5 elements, then the number of elements of its power set is **(CO1)**
 (a) 5! (b) 10 (c) 12 (d) 32
- (iii) If $f(x) = 3x + 2$ is a mapping from $Q \rightarrow Q$ then $f^{-1}(x) =$ **(CO2)**
 (a) $\frac{x}{3}$ (b) $\frac{x-4}{3}$ (c) $\frac{x-1}{3}$ (d) $\frac{x-2}{3}$
- (iv) The number of three digit that can be formed from the digit 1, 3, 5, 7 is **(CO3)**
 (a) 24 (b) 6 (c) 4 (d) None of these
- (v) The number of ways 10 people can seat in a row so that a certain pair of them are next to each other is **(CO3)**
 (a) $10! - 9!$ (b) $8 \times 9!$ (c) $10 \times 9!$ (d) $9 \times 10!$
- (vi) A car company manufactures 5 models of cars. Find the number of ways a customer can buy 8 cars. **(CO3)**
 (a) 500 (b) 495 (c) 395 (d) None of these
- (vii) A store sells 4 kinds of biscuits. How many way a customer can by 15 biscuits? **(CO3)**
 (a) 644 (b) 645 (c) 646 (d) 816
- (viii) From the premises $p \rightarrow q$ and $q \rightarrow r$, one can conclude **(CO4)**
 (a) $p \vee \sim q$ (b) $\sim p \vee r$ (c) $p \wedge \sim r$ (d) None of these
- (ix) From the premises $\sim p$ and $p \vee q$ one can conclude **(CO4)**
 (a) q (b) p (c) $\sim p$ (d) $\sim q$
- (x) If the cyclic group G contains 11 distinct elements then the number of generators G has **(CO5)**
 (a) 1 (b) 2 (c) 3 (d) 10
- (xi) The number of generators of a cyclic group of order 8 is **(CO5)**
 (a) 2 (b) 6 (c) 7 (d) 4
- (xii) The only generators of the cyclic group $(Z, +)$ is **(CO5)**
 (a) 1 (b) 0, 1 (c) 1, -1 (d) All positive integers
- (xiii) A connected planar graph determine how many number of regions if it has 5 edges and 3 vertices. **(CO6)**
 (a) 1 (b) 2 (c) 4 (d) 5

(xiv) If G is non-planar graph then the possible number of vertices of G is (CO6)
 (a) 6 (b) 5 (c) 4 (d) None of these

(xv) If G is a tree with 5 vertices then $\chi(G) = ?$ (CO6)
 (a) 1 (b) 2 (c) 3 (d) 5

Group – B

(Short Answer Type Questions)

Attempt any three from the followings: **3 x 5 = 15**

2. (i) Find $|\mathcal{P}(\mathcal{P}(\mathcal{P}(\phi)))|$ where $|\mathcal{P}(S)|$ implies the cardinality of the power set of the set S . (CO1)
 (ii) Find the number of possible symmetric relations defined on a set with n elements. 2+3

3. How many ways are there for 8 men and 5 women to stand in a line so that no two women stand next to each other? 5(CO3)

4. Is $(p \rightarrow q) \rightarrow ((p \rightarrow q) \rightarrow q)$ a tautology? Why or why not? 5(CO4)

5. Show that $\sigma \circ \rho = \rho \circ \sigma$, where $\sigma = (3\ 4\ 6)$ and $\rho = (1\ 2\ 5)$, which are defined on the set $\{1, 2, 3, 4, 5, 6\}$. 5(CO5)

6. Define independent set of vertices, independence number, clique, and clique number. Illustrate all those with an example. 5(CO6)

Group – C

(Long Answer Type Questions)

Attempt any four from the followings: **4 x 10 = 40**

7. (i) For a set A with $|A| = n$, deduce how many reflexive relation is possible? (CO1)
 (ii) What is the cardinality of the set X , such that (CO2)
 $X = \{n: 2 \nmid n, 3 \nmid n, 5 \nmid n, 1 \leq n \leq 123, n \in \mathbb{Z}\}$ 5+5

8. (i) A ship's captain sends signals by arranging 4 **orange** and 3 **blue** flags on a vertical pole. How many different signals could the ship's captain possibly send? (CO3)
 (ii) How many 3 letter 'words' can be made using the letters a, b, c, d, e, and f if each letter can be used at most once? (CO3) 5+5

9. (i) Find the CNF of $\sim(p \vee q) \leftrightarrow (p \wedge q)$ (CO4)
 (ii) Find the DNF of $p \wedge (p \rightarrow q)$ (CO4) 5+5

10. Define Zero divisor of a ring. Show that $(M_2(\mathbb{Z}), +, \cdot)$ is a ring with zero divisors. (CO5) 2+8

11. Define an Integral domain. Show that $(\mathbb{Z}, +, \times)$ is an integral domain. (CO5) 2+8

12. Define graph and sub-graph. Give examples of two sub-graphs H_1 and H_2 of a graph G with $\delta(G) < \delta(H_2)$ and $\Delta(H_1) \leq \Delta(G)$. (CO6) 2+2+6