17586

BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – B.Tech.(CSE)-AIML-2024/B.Tech.(CSE)-AIR-2024/B.Tech.(CSE)-CYS-2024

Course Name – Discrete Mathematics

Course Code - BBS00008

(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the correct option. If $S = \{\emptyset\}$ then power set of S is

a) $\{\emptyset\}$ b) $\emptyset$

c) $\{\emptyset, \{\emptyset\}\}$ d) None of these

(ii) Observe and find out the singleton set from the following.

a) $A = \{ x : 3x^2 - 27 = 0 , x \in Q \}$ b) $B = \{ x : x^2 - 1 = 0 , x \in R \}$

c) $C = \{ x : 30x - 59 = 0 , x \in N \}$ d) $D = \{ x : x^2 - 1 = 0 , x \in N \}$

(iii) If $a = -17$ and $b = 5$, then identify the quotient and remainder according to the Division Algorithm.

a) $q = -4, r = 3$ b) $q = -3, r = 2$

c) $q = -5, r = 8$ d) $q = 3, r = 2$

(iv) Select the correct option. The statement $[\sim p \vee (p \rightarrow q)] \rightarrow \sim p$ is a

a) Tautology b) Contingency

c) Contradiction d) None of these

(v) If p:"Ashok is rich" and q:"Kamal is poor" then express the symbolic form of the statement "Either Ashok or Kamal is rich".

a) $p \vee q$ b) $p \vee \neg q$

c) $\neg p \vee q$ d) $\neg(p \vee q)$

(vi) Select the correct option. A monoid $(M,+)$ is called a group if

a) $a+b=b+a=e$ b) $a+(b+c)=(a+b)+c$

c) $a+b=b+a \forall a,b \in M$ d) $a+b \in M, \forall a,b \in M$

(vii) Compute the order of the additive group $(Z,+)$.

a) 1 b) Finite but more than 1

c) Infinite d) $(Z,+)$ does not formed a group

(viii) Select the correct option. A group of three element is

a) Always non-abelian b) Always abelian

c) Sometimes abelian d) Always non-cyclic

(ix) If $(G,.)$ be a group then illustrate $(ab)^{-1}$

a) $a^{-1}b$ b) ab^{-1}

c) $a^{-1}b^{-1}$ d) $b^{-1}a^{-1}$

(x) Select the correct option. The characteristic of the ring $(Z_5,+,.)$ is

a) 1 b) 2

c) 5 d) infinite

(xi) Let a be an element in a group with order 10. Then, determine the order of the element a^7.

a) 10 b) 70

c) 1 d) Cannot be determined from the given data

(xii) Let $f:G \to G'$ be a homorphism and e is the identity element of G. Then compute $f(a^{-1})$.

a) $f(a)$ b) $[f(a)]^{-1}$

c) e d) $f(e)$

(xiii) Select the correct option. The degree of an isolated vertex is

a) 0 b) 1

c) 2 d) none of these

(xiv) Choose the correct option. A self-loop cannot be included in a

a) walk b) circuit

c) trail d) path

(xv) Dijkstra's algorithm is used to calculate

a) the maximum flow in a network b) to scan all vertices of a graph

c) the shortest path from a specified vertex to another d) none of these

Group-B

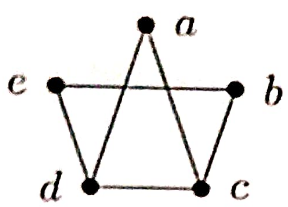
(Short Answer Type Questions) 3 x 5=15

2. Illustrate the definition of Integral domain. (3)

3. Explain the concept equality of two graphs and the concept of isomorphic graphs. Explain if the following two graphs are isomorphic (3)

Graph 1: V= {a, b, c, d, e}, E= {{a, b}, {a, c}, {a, e}, {b, d}, {b, e}, {c, d}}.

Graph 2:



4. Identify all integer solutions of the equation 12x + 8y = 4. (3)

5. Illustrate Tautology with an example. (3)

6. Evaluate the order of every element in the multiplicative group given by $G = \{a, a^2, a^3, a^4, a^5, a^6 = e\}$. (3)

OR

Evaluate the inverse of the permutation (4 6 2 7 3). (3)

Group-C
(Long Answer Type Questions) 5 x 6=30

7. Explain that among any 10 positive integers less than or equal to 100, there exist two whose difference is less than 12. (5)

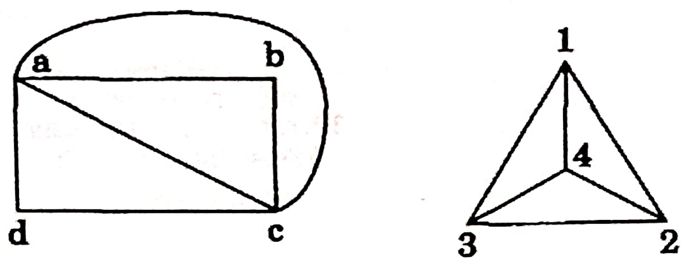
8. Identify the solution of the system of linear congruences using Chinese Remainder Theorem: $x \equiv 2\ (mod\ 3), x \equiv 3\ (mod\ 4), x \equiv 2\ (mod\ 5)$. (5)

9. Use the truth tables method to deduce if $(\sim p \vee q) \wedge (q \rightarrow (\sim r \wedge \sim p)) \wedge (p \vee r)$ is always true or not. (5)

10. Establish that in any group, the identity element is unique. (5)

11. Explain that every connected graph G has a spanning tree. (5)

12. Explain if the following graphs are isomorphic. (5)



OR

Deduce that in any graph G the number of points of odd degree is even. (5)

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