BRAINWARE UNIVERSITY

Course – BCA

Discrete Mathematics (BCAC102)

(Semester – 1)

Time allotted: 3 Hours   **Full Marks : 70**

[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

1. Answer any TEN from the following questions: **1 x 10 = 10**

    i.   Two sets are called disjoint if there _____ is the empty set.
    a) Union
    b) Difference
    c) Intersection
    d) Complement

    ii.   The set O of even positive integers less than 10 can be expressed by _____.
    a) {1, 2, 3}
    b) {2, 4, 5, 6, 8}
    c) {2, 4, 6, 8}
    d) {1, 2, 3, 10}

    iii.   Which is the correct statement about the function $f(x) = 3x - 2$ if $f: Z \rightarrow Z$
    a) $f(x)$ is one-to-one and onto
    b) $f(x)$ is not one-to-one but onto
    c) $f(x)$ is one-to-one but not onto
    d) $f(x)$ is neither one-to-one nor onto

    iv.   The relation { (1,1), (1,3), (2,1), (2,2), (3,3), (3,2)} is
    a) Reflexive
    b) Transitive
    c) Symmetric
    d) Asymmetric

v. In a graph if e=[a, b], Then a and b are called
    a) Terminal vertex of e
    b) Adjacent vertices
    c) Neighbors
    d) All of above

vi. If $A = \{\emptyset\}$ then power set of A is _____.
    a) {}
    b) $\{\emptyset, \{0\}\}$
    c) $\{\emptyset, \{\emptyset\}\}$
    d) None of these

vii. According to De-Morgan's law $[A \cap (B \cup C)]^c$
    a) $A^c \cup (B \cap C)$
    b) $A^c \cap (B^c \cup C^c)$
    c) $A^c \cup (B^c \cap C^c)$
    d) None of these

viii. Solution of $a_n = -a_{n-1}$ is
    a) $a_n = 5$
    b) $a_n = n$
    c) $a_n = 3^n$
    d) None of these

ix. Let R be a symmetric and transitive relation on a set A. Then
    a) R is reflexive and hence a partial order
    b) R is reflexive and hence a equivalence relation
    c) R is not reflexive and hence not a equivalence relation
    d) None of the above

x. If $A \supseteq B \wedge B \supseteq C$ then $A \supseteq C$
    a) True
    b) False

xi. An identity matrix is always a square matrix.
    a) True
    b) False

Group – B

Answer any THREE from the following: **3 x 5 = 15**

2. Define one-to-one, onto and into function with example.

3. Verify the following relation defined on set of straight line L is equivalence or not.

    $R = \{(l_1, l_2) : l_1 \text{ is parallel to } l_2, l_1, l_2 \in L\}$

4. Prove that any matrix can be expressed as a sum of symmetric and skew symmetric matrix.

5. Define distance and diameter graph. Give an example.

6. Obtain the principal CNF of $(P \wedge Q) \vee (\sim P \wedge Q) \vee (Q \wedge R)$

Group – C

Answer any THREE from the following: **3 x 15 = 45**

7. a) Prove the following using mathematical induction:

$$1(1!) + 2(2!) + 3(3!) + \cdots + n(n!) = (n + 1)! - 1$$

b) Prove that $[(p \to q) \wedge p] \to q$ is a tautology.

c) Consider the following

$p: It is raining.$ $q: The game is cancelled.$

Write in simple sentence the meaning of the following:

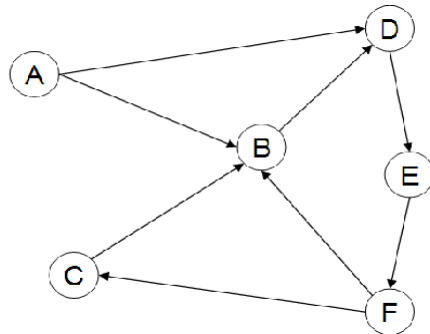(i) $\sim (p \to q)$ (ii) $\sim p \leftrightarrow q$ 6+5+4=15

8. a) Prove the following using Venn diagram.

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

b) Find the adjacency and incidence matric of the following undirected graph.

5+10=15

9. a) Solve the following system of equations using matrix method:
$$x + 2y + 3z = 10$$
$$6x - 4y - 3z = 7$$
$$2x - 3y + z = 1$$

b) In a competition, a school awarded medals in different categories. 36 medals in dance, 12 medals in dramatics and 18 medals in music. If these medals went to a total of 45 persons and only 4 persons got medals in all the three categories, how many received medals in exactly two of these categories? $8 + 7$

10. a) If $A = \begin{bmatrix} 3 & 2 \\ 7 & 5 \end{bmatrix} \wedge B = \begin{bmatrix} 6 & 7 \\ 8 & 9 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$

b) Solve the following recurrence relation:
$$f(n) = 4f(n-2) + n - 10, f(0) = 5, \ f(1) = 8 \qquad 5+10=15$$