BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(CSE)-AIML-2021/B.Tech.(CSE)-DS-2021/B.Tech.(CSE)-AIML-2022/B.Tech.(CSE)-DS-2022/B.Tech.(CSE)-AIML-2023/B.Tech.(CSE)-DS-2023/B.Tech.(CSE)-2023
Course Name – Discrete Mathematics
Course Code - PCC-CSM405/PCC-CSD405/PCC-CSG405
(Semester IV)

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) Given the relation $R=\{(a,b),(b,c)\}$ in the set $A=\{a,b,c\}$ then identify the minimum number of ordered pairs that need to be added to R make it an equivalence relation.

a) 5 b) 6

c) 7 d) 8

(ii) Select the correct option. If S is defined on R by $(x,y)\in S \Leftrightarrow xy \geq 0$ then S is

a) An equivalence relation b) Reflexive only

c) Symmetric only d) Transitive only

(iii) A graph with no circuit and no parallel edges can be illustrated as

a) Multi graph b) Pseudo graph

c) Simple graph d) None of these

(iv) Select the correct option. Number of edges in a complete graph with n-vertices is:

a) ${}^nC_1$ b) ${}^nC_2$

c) ${}^nC_3$ d) ${}^nC_n$

(v) Select the correct option. A minimally connected graph is a

a) Binary tree b) Hamiltonian graph
c) Tree d) Regular graph

(vi) Given the function $f(x)=\frac{3^x+3^{-x}}{2}$ then identify the function $f(x+y)+f(x-y)$.

a) $f(x)-f(y)$ b) $f(x)f(y)$

c) $\frac{f(x)}{f(y)}$ d) $2f(x)f(y)$

(vii) An one-to-one function can be recognized as

a) injective function b) surjective function
c) bijective function d) none of these

(viii) Identify the correct statement about the function $f(x)=2x$ if $f:Z\rightarrow Z$.

a) $f(x)$ is one-to-one and onto b) $f(x)$ is one-to-one but not onto

c) $f(x)$ is not one-to-one but onto d) $f(x)$ is neither one-to-one nor onto

(ix) Choose the appropiate option to fill in the blank. If n pigeonholes are occupied by n+1 pigeons, then at least _____ number of hole is occupied by more than one pigeon.

a) 2 b) 1
c) 3 d) None of these

(x) Express $\neg(p\vee q)\vee(p\wedge\neg q)$ in simplest form.

a) $\neg p$ b) p

c) $\neg q$ d) None of these

(xi) In a Boolean algebra B, if $a+b=b$ then compute the value of $(a.b)$.

a) a b) b

c) a' d) Cannot determined from the given data

(xii) Let $f:G\rightarrow G'$ 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) If G is a tree with n vertices, then illustrate the number of edges of G.

a) n b) (n-1)
c) n(n+1) d) n(n-1)

(xiv) Let P: If Sahil bowls, Saurabh hits a century. ,Q: If Raju bowls , Sahil gets out on first ball. Now if P is true and Q is false then identify the correct statement.

a) Raju bowled and Sahil got out on first ball
b) Raju did not bowled
c) Sahil bowled and Saurabh hits a century
d) Sahil bowled and Saurabh got out

(xv) Determine the inverse of the element $-i$ in the multiplicative group $\{-1, 1, -i, i\}$, where $i^2 = -1$

a) i
b) $-i$
c) 1
d) -1

Group-B
(Short Answer Type Questions) 3 x 5=15

2. If p: Today is Friday (3)

q: It is raining

r: It is hot

Cite the following Symbol

(i) $\sim q \rightarrow (r \wedge p)$ (ii) $(p \wedge \sim q) \rightarrow \sim r$.

3. Illustrate the definition of Group with an example. (3)

4. A non-directed graph G has 8 edges. Write the number of vertices, if the degree of each vertex in G is 2. (3)

5. If there are three functions, such as $f(x) = x, g(x) = 2x$ and $h(x) = 3x$. Then identify $[f \circ (g \circ h)](x)$ for $x = -1$. (3)

6. Let S be a set of eleven 2-digit numbers. Justify that S must have two elements whose digit differences are same. (3)

OR

Write the number of distinct sets of 3 differently colored scarves can be bought if the shop has scarves in 8 different colors. (3)

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

7. By using mathematical induction identify that the following statement is true for all positive integers $2 + 6 + 10 + \ldots + (4n - 2) = 2n^2$. (5)

8. Calculate the graph from the following adjacency matrix: (5)

$$\begin{bmatrix} 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$

9. (5)

Deduce that $((p \rightarrow q) \wedge (q \rightarrow r)) \rightarrow (p \rightarrow r)$ is a tautology.

10. Describe Disjunctive Normal Form and Conjunctive Normal Form with proper examples. (5)

11. Let G be a group and let H and K be two subgroups of G, then examine if $H \cap K$ a subgroup of G. (5)

12. Justify that the generating function for 1,2,3,4,5.. is $\frac{1}{(1-x)^2}$. (5)

OR

Write the coefficient of x^{2005} in the generating function $G(x)=(1-2x)^{5000}$ and $H(x)=1/(1+3x)$. (5)

****