P P SAVANI UNIVERSITY

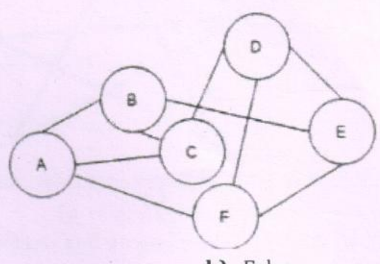
Third Semester of Diploma Examination
November 2022
IDSH2010 Discrete Mathematics

19.11.2022, Saturday | **Time: 10:00 a.m. To 12:30 p.m.** | **Maximum Marks: 60**

Instructions:
1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION - I

			CO	BTL
Q-1	**MCQ. (Any Five)**	**[05]**	**CO**	**BTL**
(i)	Let $f: R \to R$ be defined by $f(x) = \sin x$ and $g: R \to R$ be defined by $g(x) = x^2$. Find $f \circ g(x)$. **a)** $x^2 \sin x$ **b)** $\sin^2 x$ **c)** $\sin x^2$ **d)** $x \sin x$		CO1	3
(ii)	A relation R in a set A is called ____, if $(a_1, a_2) \in R$ implies $(a_1, a_2) \in R \forall a_1, a_2 \in A$. **a)** Symmetric **b)** Transitive **c)** Equivalence **d)** Non-Symmetric		CO1	1
(iii)	The members of the set $S = \{x: x$ is the square of natural number and $x < 100\}$ is ____. **a)** $S = \{1,4,9,16,20,36,49,64,81\}$ **b)** $S = \{1,4,9,16,25,36,49,64,81\}$ **c)** $S = \{0,1,4,9,16,20,36,49,64,81\}$ **d)** $S = \{0,1,4,9,16,25,36,49,64,81\}$		CO1	6
(iv)	A graph is a collection of ____. **a)** Row and columns **b)** Vertices and edges **c)** Equations **d)** None of these		CO2	1
(v)	What is Null Graph? **a)** A null graph has no nodes **b)** A null graph has no edges **c)** A null graph has no odd vertex **d)** A null graph has no even vertex		CO2	1
(vi)	The given graph is regular.		CO2	2



a) True   **b)** False

(vii) A graph with finite number of edges and vertices is called finite graph. CO2 1

a) True b) False

Q-2 (a) Use Venn diagrams to verify Commutative laws with Suitable example. [05] CO1 2

Q-2 (b) Show that if $f: R - \left\{\frac{7}{5}\right\} \rightarrow R - \left\{\frac{3}{5}\right\}$ is defined by $f(x) = \frac{3x+4}{5x-7}$ and [05] CO1 3

$g: R - \left\{\frac{3}{5}\right\} \rightarrow R - \left\{\frac{7}{5}\right\}$ is defined by $g(x) = \frac{7x+4}{5x-3}$, then $f \circ g = I_A$ and $g \circ f = I_B$, where, $A = R - \left\{\frac{3}{5}\right\}, B = R - \left\{\frac{7}{5}\right\}$; $I_A(x) = x, I_B(x) = x, \forall x \in B$ are called identity function A and B respectively.

OR

Q-2 (a) The relation R on $A = \{1,2,3,4,5\}$ is defined by the rule of $(a, b) \in R$, if $a + b = 4$. [05] CO1 3

a) List the element of R and R^{-1}.

b) Find the domain and range of R.

c) Find the domain and range of R^{-1}.

Q-2 (b) Let $U = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{2,4,6,8,10\}$, $B = \{3,6,8\}$ & [05] CO1 5

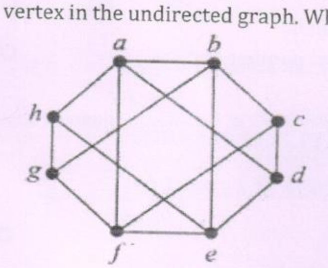
$C = \{1,2,3,8,9,10\}$. Perform the indicated operations.

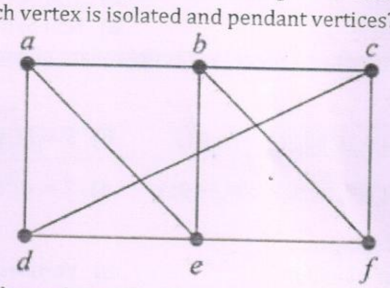
a) $A \cap B$

b) $A \cup B$

c) $A' \cap C$

Q-3 (a) Find the number of vertices, the number of edges, and the degree of each vertex in the undirected graph. Which vertex is isolated and pendant vertices? [05] CO2 4

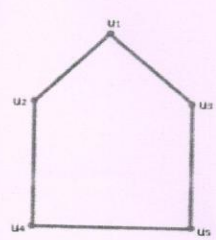


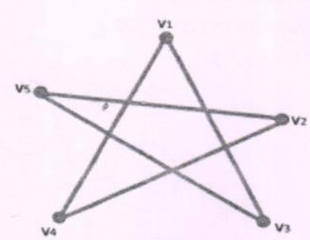


Q-3 (b) Define simple graph, multi graph and pseudo graph with an example. [05] CO2 1

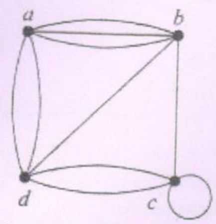
OR

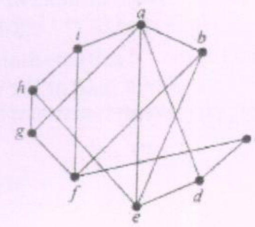
Q-3 (a) Check the graph is isomorphic or not: [05] CO2 4





Q-3 (b) Find the number of vertices, the number of edges, and the degree of each vertex in the undirected graph. **[05]** **CO2** 6





Q-4 **Answer the following question. (Any one)** **[05]**

(i) Draw a diagram for each of the following graphs $G\ (V, E)$. **CO2** 6

a) $V = \{A, B, C, D, E, F, G, H, I\}$ &
$E = \{(A,B), (A,C), (B,C), (D,E), (F,A), (F,H), (G,H), (E,I)\}$

b) $V = \{a, 1, b, 2, c, 3, d, 4\}$ &
$E = \{(1,1), (a,a), (a,b), (b,a), (1,c), (a,c), (3,4), (c,3), (b,d)\}$

(ii) Find the set A and B, if **CO1** 3

a) $A - B = \{1, 3, 7, 11\}$, $B - A = \{2, 6, 8\}$ & $A \cap B = \{4, 9\}$

b) $A - B = \{1, 2, 4\}$, $B - A = \{7, 8\}$ & $A \cup B = \{1, 2, 4, 5, 7, 8, 9\}$

SECTION – II

Q-1 **MCQ. (Any Five)** **[05]**

(i) The node which has at least one child is called an internal node. **CO2** 1/2
a) True **b)** False

(ii) A group has the properties of____. **CO4** 2
a) Closure, Associative
b) Closure, Associative, Commutative
c) Closure, Associative, Identity
d) Closure, Associative, Identity, Inverse

(iii) A abelian group has the properties of____. **CO4** 2
a) Closure, Associative
b) Closure, Associative, Identity, Inverse, Commutative
c) Closure, Associative, Identity
d) Closure, Associative, Identity, Inverse

(iv) A relation $(34 \times 78) \times 57 = 34 \times (78 \times 57)$ can have ____ property. **CO4** 4
a) Inverse **b)** Associative
c) Commutative **d)** Closure

(v) A compound proposition that is neither a tautology nor a contradiction is called a ________. **CO3** 1
a) Contingency **b)** Equivalence
c) Condition **d)** Inference

(vi) $A \wedge \neg(A \vee (A \wedge T))$ is always ____. **CO3** 4
a) True **b)** False

(vii) $(A \vee F) \vee (A \vee T)$ is always ____. **CO3** 4
a) True **b)** False

Q-2 (a) Find using truth table, whether of the following implication is tautology. **[05]** **CO3** 4

$$(p \rightarrow q) \wedge (q \rightarrow r) \Rightarrow p \rightarrow r$$

Q-2 (b) Write the associative law and prove that using truth table. **[05]** **CO3** 3

OR

Q-2 (a)	Prove the following equivalences by using the truth tables. $$(p \to q) \land (p \to r) \Rightarrow p \to (q \land r)$$	[05]	CO3	5
Q-2 (b)	Find the using truth table. $$p \leftrightarrow q \equiv (p \to q) \land (q \to p)$$	[05]	CO3	4
Q-3 (a)	Define the following terms with two examples of each: a) Tree b) Root c) Branches	[05]	CO2	1/6
Q-3 (b)	Define leaf node, Internal node and Degree with suitable example.	[05]	CO2	1/6

OR

Q-3 (a)	The binary operation $*: Q \times Q \to Q$ defined by $a * b = a + b + ab, \forall a, b \in Q$ is commutative and associative.	[05]	CO4	3
Q-3 (b)	Consider the Q of rational numbers, and let $*$ be the operation on Q defined by $a * b = a + b$. a) $1 * 4$ b) $9 * 8$ c) $(-1) * \frac{7}{2}$	[05]	CO4	5
Q-4	**Answer the following question. (Any one)**	[05]		
(i)	Prove the following equivalences by using the truth tables. $$p \leftrightarrow q \equiv (p \land q) \lor (\neg p \land \neg q)$$		CO3	4
(ii)	Prove that set if all positive integers are not a group under addition.		CO4	2

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CO : Course Outcome Number BTL : Blooms Taxonomy Level

Level of Bloom's Revised Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create