Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: BE04000261 **Date: 02/06/2026**

Subject Name: Discrete Mathematics and Graph Theory

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

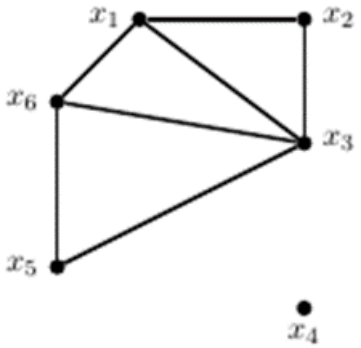
Q.1	**(a)**	Define surjective function. Check whether the function f: N → N defined by f(x)=2x-1 is one-one and onto.	**03**
	(b)	Determine the relation perpendicular on the set L of lines in the plane are reflexive, symmetric, transitive, irreflexive.	**04**
	(c)	Define (1) Complete graph (2) Path (3) Null graph. Find the number of edges in a r-regular graph with n- vertices.	**07**
Q.2	**(a)**	The chairs of an auditorium are to be labeled with an uppercase English letter followed by a positive integer not exceeding 100. What is the largest number of chairs that can be labeled differently?	**03**
	(b)	Identify the statement $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$ is tautology or contradiction.	**04**
	(c)	Use a truth table to determine whether the following argument form is valid. $p \rightarrow q$ $q \rightarrow r$ $\therefore p \rightarrow r$	**07**
		OR	
Q.2	**(c)**	Express the following using predicate, quantifier and logical connectives. Also verify the validity of the consequence. (1) All parrots like fruit. My pet bird is not a parrot. Therefore, my pet bird does not like fruit. (2) Every computer science major takes discrete mathematics. Natasha is taking discrete mathematics. Therefore, Natasha is a computer science major.	**07**
Q.3	**(a)**	Find the number of mathematics students at a college taking at least one of the languages French, German, and Russian, given the following data: 65 study French, 45 study German, 42 study Russian, 20 study French and German, 25 study French and Russian, 15 study German and Russian, 8 study all three languages.	**03**
	(b)	Define Semigroup. Consider the set of positive integers N. Check (N, +) is a semigroup. Is it monoid?	**04**
	(c)	Show that (R, +, ×) is an integral domain, where $R = \{a + b\sqrt{5} / a, b \in \mathbb{Z}\}$.	**07**
		OR	
Q.3	**(a)**	If A,B,C are sets then prove that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$.	**03**
	(b)	Let g be a homomorphism from a group (G, *) to a group (H, Δ). Show that $g(e_G)=e_H$ and for any $a \in G$, $g(a^{-1})=(g(a))^{-1}$.	**04**

(c) Define Group. Let Z_5 denotes the integers modulo 5. Check whether Z_5 is a group under addition. **07**

Q.4 **(a)** Solve $a_n - 6\,a_{n-1} + 9\,a_{n-2} = 0$. **03**

(b) Let A be a given finite set and ρ(A) its power set. Let ⊆ be the set inclusion relation on the elements of ρ(A). Draw the Hasse diagram of (ρ(A), ⊆) for A={a,b,c}. **04**

(c) (1) Let R ={(1,1),(1,2),(2,1),(2,2),(3,3),(4,4),(5,5)} be the relation on A= {1,2,3,4,5}. Check whether the relation is an equivalence relation? **07**
(2) Find out maximal compatibility blocks of following simplified graph of digraph.



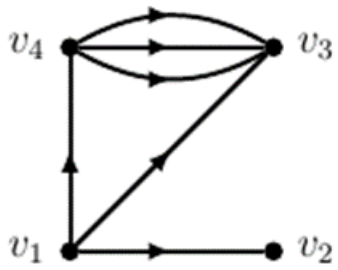
OR

Q.4 **(a)** Solve $a_n + 5\,a_{n-1} + 6\,a_{n-2} = 0$. **03**

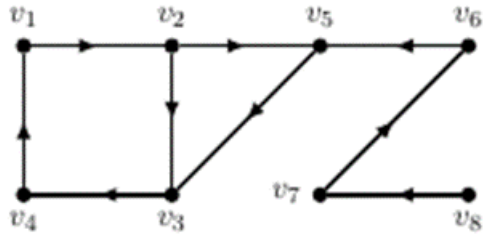
(b) Let the relation R={(a,a),(a,b),(b,c),(c,c)} on A = {a,b,c}. Find the transitive closure of R. **04**

(c) Let (L, ≤) be a lattice. Show that for a,b,c ∈ L, following inequalities holds. **07**
(i) $a \oplus (b * c) \leq (a \oplus b) * (a \oplus c)$ and
(ii) $a * (b \oplus c) \geq (a * b) \oplus (a * c)$.

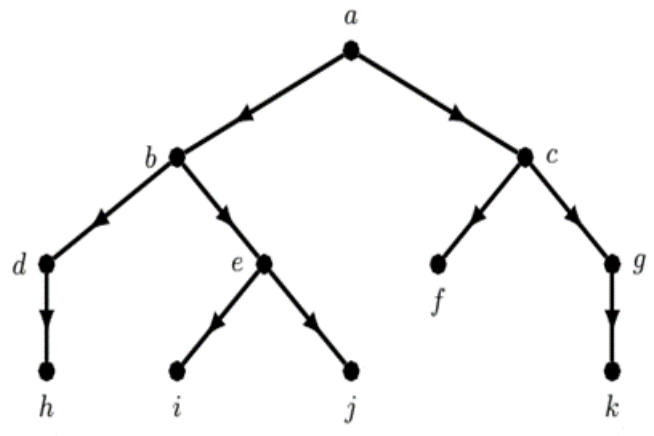
Q.5 **(a)** Find the in-degree and out-degree of each vertex of the following graph. Also find $d(v_1,v_3)$. **03**



(b) Find the reachable sets of all nodes for the given digraph **04**



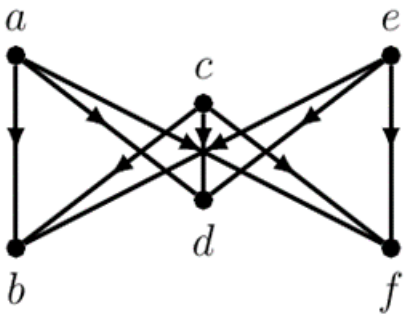
(c) Define binary tree. In which order does a pre-order, in-order and post-order traversal visit the vertices of the ordered rooted tree T shown in figure? **07**



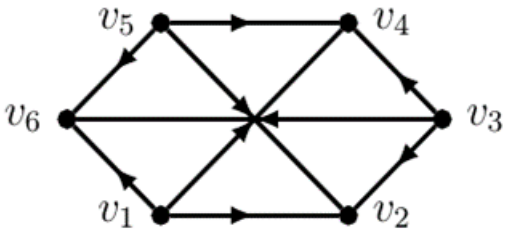
OR

Q.5 **(a)** A tree T has 3 vertices of degree 4, 5 vertices of degree 5. Find the number of pendant vertices in tree T. **03**

(b) Check whether the following graphs are isomorphic? **04**

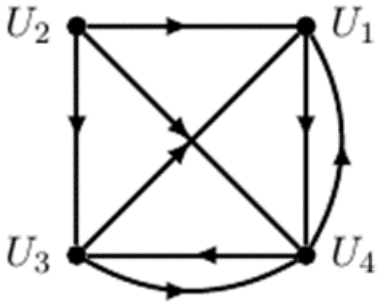


(H)



(G)

(c) Define adjacency matrix. Warshall's algorithm to obtain path matrix from the adjacency matrix of following graph **07**



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