

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

Subject Code: 3144202

Date: 06/06/2026

Subject Name: Discrete Mathematics and Graph Theory

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

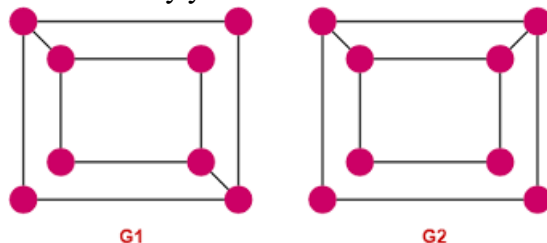
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) For the two sets $A=\{a, b, c\}$ and $B=\{p, q\}$, write the cartesian product $A \times B$. In general when $A \times B$ will be the same as $B \times A$? 03
- (b) In an apartment, there are 500 people residing. Out of all of them at least how many have been born in same month? 04
- (c) Define injective and surjective function with one example for each. What is the condition for a function to be invertible? For $f: \mathbb{R} \rightarrow \mathbb{R}$, $f(x)=5x-9$, then find the inverse of f , if possible. 07
- Q.2** (a) Define Directed graph and Undirected graph with an example for each. 03
- (b) Check whether $(p \rightarrow q) \wedge \sim r$ and $(\sim p \vee q) \wedge \sim r$ are logically equivalent or not. 04
- (c) Solve the recurrence relation $F_n=5F_{n-1} - 6F_{n-2}$, where $F_0 = 1$ and $F_1 = 4$. 07
- OR
- Q.2** (c) Define tautology, contradiction and contingency for propositions. Determine the nature of $[(p \rightarrow q) \wedge (q \rightarrow r)] \wedge (p \wedge \sim r)$ by using all possible truth values. 07
- Q.3** (a) Define partially ordered set with an example. 03
- (b) Draw the Hasse diagram for the lattice (S_{48}, D) , where S_{48} is the set of divisors of 48 and D is the relation divides. 04
- (c) Define connected graph and disconnected graph with an example for each. Also define strongly connected, unilaterally connected and weakly connected graph with an example for each. 07
- OR
- Q.3** (a) Define (i) Range of a relation and (ii) Void relation with one example for each. 03
- (b) Let the relation $R = \{ (x, y) / x \leq y, x, y \in X \}$ where $X = \{1, 2, 3\}$. Write the relation R , draw the corresponding graph and write its relation matrix. 04
- (c) Define Equivalence relation. Let R be the relation on integers defined by aRb if and only if a and b are both even or both odd. Check whether R is an equivalence relation or not. 07
- Q.4** (a) Define Ring and Integral domain with an example for each. 03
- (b) Give an example of a monoid which is not a group, with proper justification. 04
- (c) Check whether the algebraic structure $(G, *)$, where $G = \{ (a, b) / a, b \in \mathbb{R}, a \neq 0 \}$ and $*$ is defined as $(a, b) * (c, d) = (ac, bc + d)$, $\forall (a, b), (c, d) \in G$ forms a group. 07

OR

- Q.4**
- (a) Define subgroup of a group with an example. 03
 - (b) Check whether $G = \{\pm 1, \pm i\}$ is a cyclic group or not. 04
 - (c) Check whether $(Z_6, +_6)$ forms a commutative group or not, where $Z_6 = \{0, 1, 2, 3, 4, 5\}$ and $+_6$ is an addition operation under modulo 6. 07

- Q.5**
- (a) Let G be the complete graph with five vertices A, B, C, D and E . Draw such graph G and write the adjacency matrix for G . 03
 - (b) Define (i) Euler graph and (ii) Hamiltonian graph with one example for each. 04
 - (c) Define Isomorphic graphs. Check whether the given graphs G_1 and G_2 are isomorphic or not. Justify your conclusion. 07



OR

- Q.5**
- (a) Define (i) Regular graph and (ii) Complete graph with one example for each. 03
 - (b) Define Component of an undirected graph with an example. 04
 - (c) Use Warshall's algorithm to find the shortest distance between each pair of vertices in the given graph G . 07

