

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

Subject Code: 3140708

Date: 16/06/2026

Subject Name: Discrete Mathematics

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.

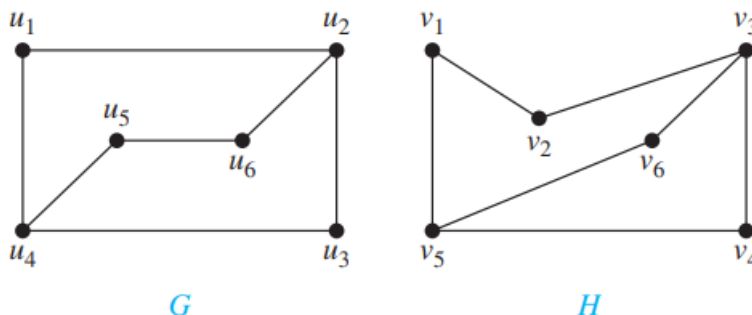
- Q.1**
- | | | |
|-----|--|----|
| (a) | Out of the integers 1 to 1000. How many of them are neither divisible by 3, nor by 5 nor by 7? | 03 |
| (b) | Define with an example (i) complete graph (ii) Tree (iii) Adjacency matrix (iv) strongly connected graph | 04 |
| (c) | Define partition of a set. Let a relation R is defined by xRy iff $(x-y)$ is divisible by 5. Then show that R is an equivalence relation. Also, find the all distinct partition for R. | 07 |

- Q.2**
- | | | |
|-----|--|----|
| (a) | How many rectangles are there in 8×8 chessboard? | 03 |
| (b) | Define (i) partial ordered relation with an example. (ii) complemented lattice (iii) maximal element in POSET | 04 |
| (c) | Define the relation divisibility on the set D_{12} . where D_{12} is the set of all positive divisors of 12. (i) show that it is an partial orderd relation (ii) Draw Hassse digram (iii) Is it a lattice? Justify (iv) find the least and greatest element. (v) give two chains from POSET. | 07 |

OR

- Q.2**
- | | | |
|-----|--|----|
| (c) | Solve the recurrence relation:
$a_n - 5a_{n-1} + 6a_{n-2} = 2^n + n, n \geq 2, a_0 = a_1 = 1$ | 07 |
|-----|--|----|

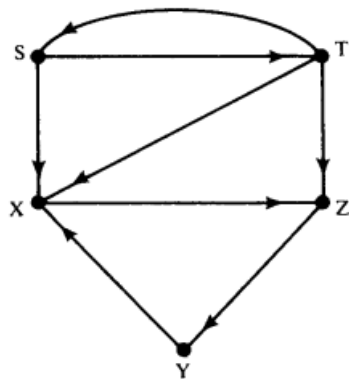
- Q.3**
- | | | |
|-----|---|----|
| (a) | Show that the function from R to R defined by $f(x)=4x+8$ is one-one and onto. Also, find the inverse. | 03 |
| (b) | (i) Define the semigroup and give an example of it. (ii) Give an example which is semigroup but not monoid with justification. | 04 |
| (c) | Define the isomorphic graphs. Show that following two graphs are isomorphic with defined one-one correspondence between vertices. | 07 |



OR

Q.3

- (a) Find the minimum number of students needed to guarantee that five of them belong to the same class. 03
- (b) Define integral domain. show that the set $Z_6 = \{[0], [1], [2], [3], [4], [5]\}$ is not an integral domain. 04
- (c) Use warshall's algorithm to find the path between each pair of vertices for given directed graph 07



- Q.4 (a) Show that 03

$$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$$
- (b) Show that $(\mathbb{Z}, +)$ is an commutative group. 04
- (c) Show that the set $Z_5 = \{[0], [1], [2], [3], [4]\}$ is the field under the operation addition modulo 5 and multiplication modulo 5. 07

OR

- Q.4 (a) Find the inverse, converse and contrapositive of the statement: "If there is vacation then i will go to Goa" 03
- (b) Show that the set $\{-i, i, 1, -1\}$ is the abelian group with usual multiplication. Also, show that it is cyclic group. 04
- (c) Define a ring. Show that set of all 3×3 matrices with real entries forms a ring with usual matrix addition and matrix multiplication. 07

- Q.5 (a) Obtain the pcnf of the expression 03

$$\neg(p \wedge q) \vee (\neg p \wedge q) \vee (q \wedge r)$$
- (b) Let $(\mathbb{Z}, +)$ be a group. Consider the set $H = \{5n : n \text{ is an integer}\}$. show that H is subgroup of $\mathbb{Z}$. Find the all cosets of H in $\mathbb{Z}$. 04
- (c) Define (i) Path (ii) strongly connected graph (iii) k-regular graph. (iv) Indegree (v) How many nodes are necessary to construct a graph with exactly eight edges in which each node is of degree 2. 07

OR

- Q.5 (a) There are two shopping malls next to each other. A with the sign board as "Good items are not cheap" and B with sign board as "Cheap items are not good". Covert this into symbolic proposition. Do they mean same? 03
- (b) Define the identity element of a group. For the set of integer a binary operation is defined by $x * y = x + y - 2$. Find the identity element and inverse of each integer. 04

(c) Define cycle in a graph. For the given tree find the pre order post order and in order traversal.

07

