(T) Roll No. .....

PAPER ID—21141

B. Tech. EXAMINATION, 2026

(Fourth Semester)

DISCRETE MATHEMATICS

Time : 3 *Hours* *Maximum Marks* : 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) Draw Hasse diagram for $\leq$ relation on $\{0, 2, 5, 10, 11, 15\}$.

(b) Show that :

$$(P \to (Q \to R)) \to ((P \to Q) \to (P \to R))$$

is a tautology.

(c) State any *two* properties of a group.

(d) State pigeonhole principle.

(e) Draw the complete graph K_5.

(f) What is the solution of the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$?

(g) Show that the inverse of an element in a group (G, *) is unique. **7×2=14**

Unit I

2. (a) Draw the Venn diagram of the following sets : 7

(i) $A - B$

(ii) $X \cup Y$

(iii) $A \cap (B \cup C)$.

(b) Prove that :

$$p \vee (q \wedge r) \leftrightarrow [(p \vee q) \wedge (p \vee r)]$$

is a Tautology. 7

3. (a) Let (L, $\leq$) be a Lattice in which $\wedge$ and $\vee$ denotes the operations of meet and join respectively. For any $a, b \in L$, prove that $a \leq b \Leftrightarrow a \wedge b = a \Leftrightarrow a \vee b = b$. 7

(b) Construct the truth table for the following statements : 7

(i) $(p \to (q \to r)) \to ((p \to q) \to (p \to r))$

(ii) $p \leftrightarrow (\sim p \vee q)$

(iii) $(p \to q) \vee (p \to \sim p)$.

Unit II

4. (a) State and explain the Fundamental Theorem of Arithmetic. Hence, determine whether 1189 is prime or composite by expressing it as a product of prime factors. 7

(b) Use generating functions to solve the recurrence relation :

$a_n - 2a_{n-1} - 3a_{n-2} = 0, \quad n \geq 2$ with $a_0 = 3, \ a_1 = 1$. 7

5. (a) If the 7 times the 7th term of an AP is equal to the 11 times its 11th term. Show that the 18th term of the AP is zero. 7

(b) Suppose a department consists of eight men and women. In how many ways can we select a committee of : 7

(i) Three men and four women

(ii) Four persons that has at least one woman.

(iii) Four persons that has at most one man.

(iv) Four persons that has persons of both gender.

Unit III

6. (a) Show that the union of two subgroups of a group G is subgroup of G if and only if one is contained in other. 7

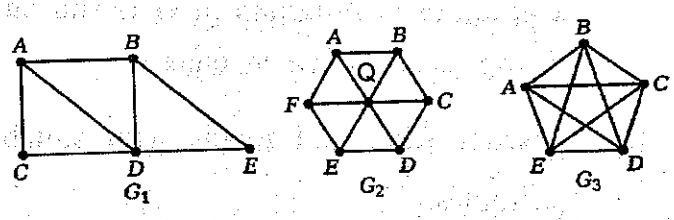
(b) Discuss Ring and Fields with suitable examples. 7

7. (a) State and prove Lagrange's theorem for groups. 7

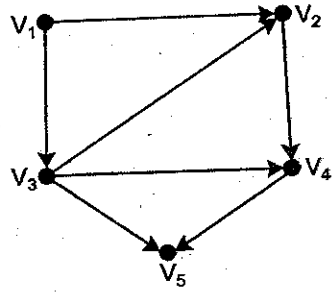
(b) State and prove the fundamental theorem of homomorphism. 7

Unit IV

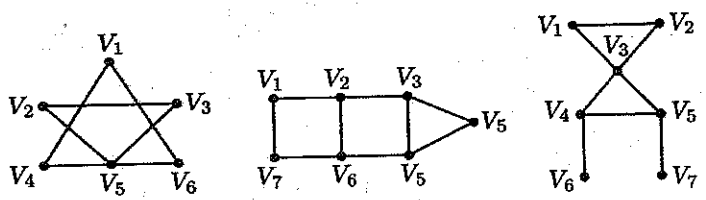
8. (a) Find an Euler path or Euler circuit if it exists in each of the three graphs below. If it does not exist, explain why ? 7



(b) Consider the directed graph G as shown in figure. Find its adjacency matrix M : 7



9. (a) Define a connected graph. Which of the given graph are connected ? 7



(b) Draw the complete graph K_5 with vertices A, B, C, D, E. Draw all complete subgraph of K_5 with 4 vertices 7

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