



RAN-2203000206020035

T. Y. B. Sc. (Sem. - VI) Examination September - 2025

Mathematics : MTH - 605 - Discrete Mathematics

Time: 2 Hours]

[Total Marks: 50

સૂચના : / Instructions

(1)

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of signs on your answer book

Name of the Examination:

T. Y. B. Sc. (Sem. - VI)

Name of the Subject :

Mathematics : MTH - 605 - Discrete Mathematics

Subject Code No.: 2203000206020035

Seat No.:

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Student's Signature

- (2) All questions are compulsory.
- (3) Figures to the right indicate marks of the corresponding question.
- (4) Follow usual notations and conversations.

Q. 1. Answer the following. (Any five)

(10)

1. Consider a Lattice (S_{30}, D) , where 'D' is a relation 'Divides'. Is $L_1 = \{30, 15, 6, 1\}$ a sub lattice of (S_{30}, D) ? Justify your answer.
2. Obtain product of sums canonical form of the Boolean function $x_1 \oplus x_3$ containing three variables.
3. Obtain the values of the Boolean forms: $x_1 * (x_1 \oplus x_2)$ over the ordered pairs of the two-element Boolean algebra.
4. Prepare the Karnaugh map representation of the function $f(a, b, c) = \Sigma(0, 2, 3, 7)$.
5. Is $f(x, y, z) = x(y+z) + x\bar{z} = x + xy$? Justify your answer.
6. Let n be a positive integer and S_n be set of all divisors of n. Let D denote the relation of 'division', then draw the Hasse diagram of (S_{75}, D) .
7. Let $X = \{1, 2, 3, 4\}$ and $R = \{(x, y) / x > y\}$. Draw the graph of R and also write its matrix.

8. Draw the Hasse diagram of $\{3, 9, 27, 54\}$ under the partial ordering relation “divides”. Is this set totally ordered? Justify.

Q. 2. Answer the following. (Any Two) (10)

1. If relation R and S are reflexive and symmetric, show that $R \cap S$ is also reflexive and symmetric.
2. Let $(L, \leq)$ is a lattice in which the meet and join are $*$ and $\oplus$ respectively.

For any $a, b \in L$, show that $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$.

3. State and prove Isotonicity property of a lattice.

Q. 3. Answer the following. (Any Two) (10)

1. Show that in a Lattice with two or more elements, no element is its own complement.
2. Let $L = \{0, 1\}$ then draw the Hasse diagram of $(L^3, \leq_3)$, and show that $(L^3, \leq_3)$ is a complemented lattice.
3. Define Lattice homomorphism. Let $(L, *, \oplus)$ and $(S, \wedge, \vee)$ be two lattices, with partial ordering relation $\leq$ and $\leq'$ respectively. If $g : L \rightarrow S$ is an isomorphism then show that $a \leq b \Leftrightarrow g(a) \leq' g(b)$.

Q. 4. Answer the following. (Any Two) (10)

1. Let $\langle B, *, \oplus, ', 0, 1 \rangle$ and $\langle P, \cap, \cup, \sim, \alpha, \beta \rangle$ be two Boolean algebra. If the mapping $f : B \rightarrow P$ preserves the operation $*$ and $'$ then prove that f is a Boolean Homomorphism.
2. Obtain the sum of products canonical form of $(x_1 \oplus x_2)' \oplus (x_1' * x_3)$
3. Check whether the following Boolean expressions are equivalent to one another or not.
 - i. $(x \oplus y) * (x' \oplus z) * (y \oplus z)$
 - ii. $(x * z) \oplus (x' * y)$

Q. 5. Answer the following. (Any Two)

(10)

1. Minimize the Boolean function $f(w, x, y, z) = \Sigma(0, 4, 6, 7, 8, 9, 15)$ by using Karnaugh map representation.
2. Minimize the Boolean function $f(w, x, y, z) = \Sigma(0, 1, 2, 8, 10, 11, 14, 15)$ by using Quine-Mc-Cluskey algorithm.
3. Draw truth table, cube representation and circuit diagram of the Boolean function $f(a, b, c) = c \cdot (a + b)$.
