

**Discrete Mathematics (CSM-353)
(Semester-5TH)**

Attempt any four questions. All questions carry equal marks.

Section-A

1. (i) Show that $2^n > n^3$ for $n \geq 10$.
(ii) Among the integers 1-300, find how many of them are neither divisible by 3, nor by 5 and nor by 7. Also, find how many of them are divisible by exactly one number out of 3,5 and 7.
2. (i) Show that if 5 points are selected in a square whose sides have length 1 inch, atleast two of the points must be no more than $\sqrt{2}$ inches apart.
(ii) Can a graph with 7 vertices be isomorphic to its complement? Justify.
3. (i) Let (P, \leq) be a POSET. Suppose that the length of longest chain in P is n. Then the elements in P can be partitioned into n disjoint anti-chains.
(ii) Is the composition of relations commutative? Justify your answer.
(iii) Define integer function with suitable example.
4. (i) State and prove Euler's formula for a connected planar graph.
(ii) Define Discrete numeric function with suitable example.

Section-B

5. (i) Using the generating function, solve the recurrence relation
$$S_{n+2} - 7S_{n+1} + 12S_n = 0, n \geq 0, S_0 = 2, S_1 = 5.$$

(ii) Find the particular solution of $S_n - 5S_{n-1} + 6S_{n-2} = 3n^2$.
6. (i) Prove that product of two lattices is a lattice.
(ii) Define bounded lattice with suitable example.
7. (i) State and prove absorption laws of Boolean algebra.
(ii) What are equivalent Boolean expressions. Give example.
(iii) Define isomorphism between Boolean algebras.
8. (i) Check the validity of following argument: If it rains then crop will be good. It did not rain. Therefore, the crop will not be good.
(ii) Prove that $\{[(p \rightarrow q) \vee p] \wedge q\} \rightarrow q$ is a tautology.

Section-C

9. (i) Define symmetric difference of two sets. Give suitable example.
(ii) Define equipotent sets. Give suitable example.
(iii) What is XNOR gate.
(iv) Draw Hasse diagram of D_{105} under the relation of divisibility.
(v) Discuss in brief the concept of switching circuits.

