SRM Institute of Science and Technology

DEPARTMENT OF MATHEMATICS

ASSIGNMENT-1

Subject Code: 18MAB302T **Subject: Discrete Mathematics**

Chapter-I Sets, Relations and Functions

PART-B

1. Prove that $\overline{(A - B)} = \bar{A} \cup B$ analytically.
2. If R is the relation on the set $A = \{1, 2, 3, 4, 5\}$ defined by $(a, b) \in R$ if $a + b \leq 6$, then list elements of R, R^{-1} and $\bar{R}$. Find the relational matrix M_R, $M_{R^{-1}}$ and $M_{\bar{R}}$.
3. If $f(x) = x + 2$, $g(x) = x - 2$ for $x \in R$ then prove that $f \circ g = g \circ f$.
4. If $f, g: R \to R$ where $f(x) = ax + b$, $g(x) = 1 - x + x^2$ and $(g \circ f)(x) = 9x^2 - 9x + 3$, find the value of a, b.
5. Verify whether the given relation R on the set $A = \{a, b, c, d\}$ is an equivalence relation or not justify your answer $R = \{(a, a), (a, c), (a, d), (b, b), (c, a), (c, c), (d, a), (d, d)\}$.
6. Find the matrix representation of $R \cup S$ and $R \cap S$ where $R = \{(1, 1), (1, 3), (2, 2)\}$ and $S = \{(1, 2), (1, 3), (2, 1), (2, 2), (3, 3)\}$ are the relations defined on the set $A = \{1, 2, 3\}$.

PART-C

1. State and prove Demorgan's Law of set theory.
2. If A, B and C are sets then prove the statement $(A - B) - C = A - (B \cup C)$ analytically.
3. If R is a relation on the set of integers such that $(a, b) \in R$, if and only if $3a + 4b = 7n$ for some integer n, prove that R is an equivalence relation.
4. If R is a relation on the set $A = \{1,2,4,6,8\}$ defined by aRb if and only if $\frac{b}{a}$ is an integer. Show that R is partial ordering on A.
5. Let $R = \{(1, 1), (1, 3), (1, 5), (2, 3), (2, 4), (3, 3), (3, 5), (4, 2), (4, 4), (5, 4)\}$ be a relation on the set $A = \{1, 2, 3, 4, 5\}$. Find the transitive closure using Warshall's algorithm.
6. Show that the composition of invertible function is invertible.
7. Draw the Hasse diagram for the "less than or equal to" relation on $\{0, 2, 5, 10, 11, 15\}$ starting from the digraph.
8. If $f: Z \times Z \to Z$ defined by $f(m, n) = 2m + 3n$, then determine whether it is one-to-one and/or onto.
9. If $f: Z \to N$ is defined by $f(x) = \begin{cases} 2x - 1, & if \ \ x > 0 \\ -2x, & if \ \ x \leq 0 \end{cases}$ prove that f is bijective.
10. Prove that R is an equivalence relation where aRb iff $3a + b$ is a multiple of 4.