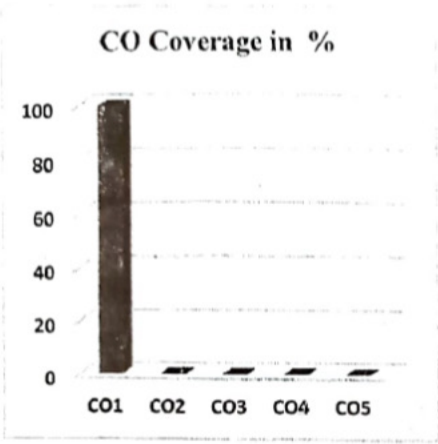
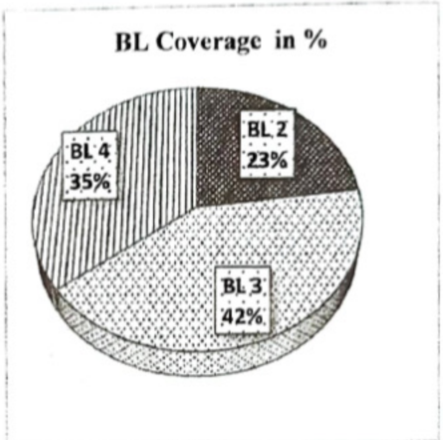
Part – A (2 x 8 = 16 Marks)
Answer any TWO questions

Q. No.	Questions	Marks	BL	CO	PO	PI Code
1	i. Simplify using set identities $$\bar{A} \cup \bar{B} \cup (A \cap B \cap \bar{C}).$$ ii. Draw Hasse diagram for the partial ordering R defined as aRb if and only if "a divides b" on the set $A = \{2,4,5,10,12,20,25\}$.	8 (4+4)	2	1	1	1.2.1
2	If R be a relation defined on the natural number set such that aRb if and only if $a^2 + b$ is even. Show that R is an equivalence relation.	8	3	1	2	2.8.1
3	If $f, g, h: \mathbb{R} \to \mathbb{R}$, defined by $f(x) = 3x + 1$, $g(x) = x^2$ and $h(x) = \frac{1}{x}$, then verify that $$f \circ (g \circ h) = (f \circ g) \circ h.$$	8	3	1	2	2.8.1

Part – B (1 x 14 = 14 Marks) Answer any one question						
4 a)	Find the transitive closure of the relation $R = \{(1,2),(2,1),(2,3),(3,4),(4,5),(5,5)\}$ on the set $A = \{1,2,3,4,5\}$ using Warshall's algorithm.	14	4	1	2	2.8.1
5 a)	i. Prove that the necessary and sufficient condition for a function $f: A \to B$ to be invertible is that f is one-one and onto. ii. Show the function $f: \mathbb{R} \to \mathbb{R}$ defined by $f = \{(x,y) \mid ax + by = c,\ b \neq 0\}$ is invertible and then find the inverse.	14 (7+7)	4	1	2	2.8.1

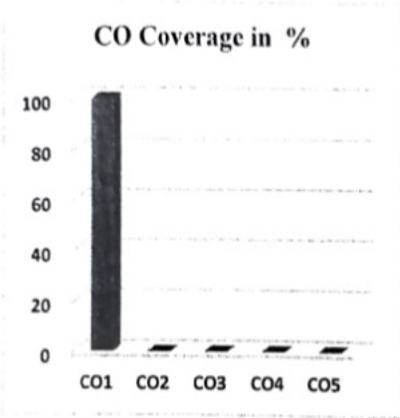


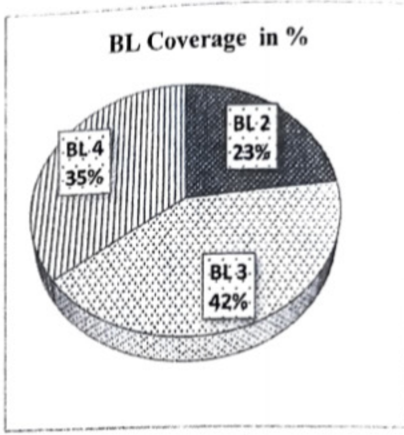


CO5	Apply graph theory techniques to solve wide variety of real world problems	3	3										

Part – A (2 x 8 = 16 Marks) Answer any TWO questions						
Q. No.	**Questions**	**Marks**	**BL**	**CO**	**PO**	**PI Code**
1	i. Simplify the following expression $\overline{(A \cup B)} \cap \overline{(\bar{A} \cup \bar{C})} \cap \overline{(\bar{B} \cup C)}$ using set identities. ii. Draw the Hasse diagram for $(D_{12}, \mid)$ where D_{12} is the set of positive divisors of 12.	8 (4+4)	2	1	1	1.2.1
2	If R be a relation defined on the set of integers such that aRb if and only if $3a + 4b = 7n$ for some integer n, then prove that R is an equivalence relation.	8	3	1	2	2.8.1
3	If $f, g, h: \mathbb{R} \to \mathbb{R}$, defined by $f(x) = x + 2$, $g(x) = \frac{1}{x^2+1}$ and $h(x) = 5$, find $\big(f \circ (g \circ h)\big)(x)$ and $((f \circ g) \circ h)(x)$ and then verify that $f \circ (g \circ h) = (f \circ g) \circ h$.	8	3	1	2	2.8.1

Part – B (1 x 14 = 14 Marks) **Answer any one question**						
4	Find the transitive closure of the relation $R = \{(a,e),(b,d),(c,c),(d,b),(e,a)\}$ on the set $A = \{a,b,c,d,e\}$ using Warshall's algorithm.	14	4	1	2	2.8.1
5	i. If $f: A \to B$ and $g: B \to C$ are invertible functions, then prove that $g \circ f: A \to C$ is also invertible and $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$. ii. Show that the function $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x) = 2x + 3$ is invertible and then find the inverse.	14 (7+7)	4	1	2	2.8.1





Part – A (2 x 8 = 16 Marks)
Answer any TWO questions

Q. No.	Questions	Marks	BL	CO	PO	PI Code
1	*(i)* If A, B and C are sets, then prove that $\overline{A \cup (B \cap C)} = (\bar{C} \cup \bar{B}) \cap \bar{A}$ using set identities. *(ii)* Let D be a set of all positive divisor of 30. A relation is defined on D as "a R b iff a divides b", for a, b in D. Draw the Hasse diagram of R.	8 (4+4)	2	1	1	1.2.1
2	Verify $f \circ (g \circ h) = (f \circ g) \circ h$, when $f, g, h : Z \to Z$ defined by $f(n) = n^2,\ \ g(n) = n + 1$ and $h(n) = n - 1$.	8	3	1	2	2.8.1
3	Given $R_1 = \{(1,1), (1,3), (2,1), (3,2)\}$ and $R_2 = \{(1,2), (1,3), (2,1), (2,3), (3,2)\}$ be relations on a set $A = \{1,2,3\}$, find $(i)\ M_{R_1 \cup R_2}$ $(ii) M_{R_1 \cap R_2}$ $(iii) M_{R_1 o R_2}$	8	3	1	2	2.8.1

Part – B (1 x 14 = 14 Marks)
Answer any one question

4	Find the transitive closure of the relation $R = \{(a, d), (b, a), (b, c), (c, a), (c, d), (d, c), (e, b), (e, d)\}$	14	4	1	2	2.8.1

5	(i) Prove that the function $g \circ f : A \to C$ is injection, surjection and bijection if the functions $f : A \to B$ and $g : B \to C$ are injection, surjection and bijection functions. (ii) If $S = \{1,2,3,4,5\}$, and the functions $f, g : S \to S$ are given by $f = \{(1,2),(2,1),(3,4),(4,5),(5,3)\}$ $g = \{(1,3),(2,5),(3,1),(4,2),(5,4)\}$. (a) find f^{-1} and g^{-1} (b) show that $(f \circ g)^{-1} = g^{-1} \circ f^{-1}$	14 (7+7)	4	1	2	1,2,1