D:-14·12·22 3Hd Sem / 1st half

GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022

DISCRETE MATHEMATICS

M(CSE) 301

TIME ALLOTTED: 3HR **FULL MARKS:70**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No
1.	(i)	The subgroup of the multiplicative group {1, -1, i, -i} is a) $\{1, i\}$ b) $\{i, -i\}$ c) $\{1, -1, i\}$ d) $\{1, -1\}$	1	CO2
	(ii)	The number of pendant vertices of binary tree having n vertices is a) $\frac{n}{2}+1$ b) $\frac{n}{2}-1$ c) $\frac{1}{2}(n+1)$ d) none of these	1	CO1
	(iii)	In the set of all real numbers the relation ρ is defined as ${}_a\rho_b$ hold if a-b < 3. Then ρ is a) reflexive b) antisymmetric c) transitive d) none of these	1	CO2
	(iv)	Let G be a graph with 12 vertices and 20 edges. Then the number of chords of spanning tree of G is a) 8 b) 9 c) 11 d) none of these	1	CO3
	(v)	The quotient group of a normal subgroup H of G is collection of all a) subgroup of H b) cosets of H c) elements in G - H d) subsets of G	1	CO1
	(vi)	$\sim(\sim p \vee \sim q) \equiv$ a) $(\sim p \vee \sim q)$ b) $(\sim p \wedge \sim q)$ c) $(p \wedge q)$ d) none of these	1	CO3

(vii)	A simple connected graph has a) no parallel edges b) no loops c) no parallel edges and no loops d) no isolated vertex	1	CO
(viii)	Every integer n is relatively prime to a) 1 b) 0 c) 2 d) None of these	1	CO2
(ix)	If $a_n = a_{n-1} + 9, n \geq 1 \; and \; a_0 = 5 \; then \; a_n =$ a) 9+5n b) 5+9n c) 9n d) 5n	1	CO3
(x)	The sum of the degrees of all vertices of the graph is 30. Then the number of edges is a) 20 b) 15 c) 10 d) none of these	1	CO3
(xi)	The remainder when the sum 4!+5!+6!+….+50! Is divided by 4 is a) 1 b) 2 c) 3 d) 0	1	CO3
(xii)	The number of minimal elements of POSet $< Z, '\leq' >$ is a) 0 b) 1 c) 2 d) 3	1	CO4

GROUP – B
(Short Answer Type Questions)

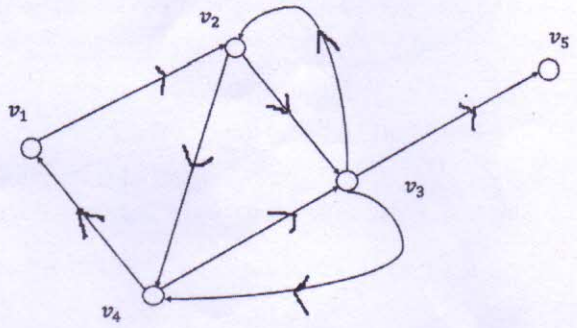
Answer any ***three*** from the following:**3×5=15**

		Marks	CO No
2.	Prove that the inverse of each element of a group is unique.	5	CO4
3.	Find number of divisors of 11250.	5	CO3
4	Show that $\{(p \wedge \sim q) \rightarrow r\} \rightarrow \{p \rightarrow (q \vee r)\}$is a tautology.	5	CO4
5.	Among 50 students in a class, 26 passed in first semester and 21 passed in second semester examinations. If 17 did not pass in either semester, how many passed in both the semester?	5	CO3
6	Prove that for a complete graph G with n vertices has $\frac{n(n-1)}{2}$number of edges.	5	CO3

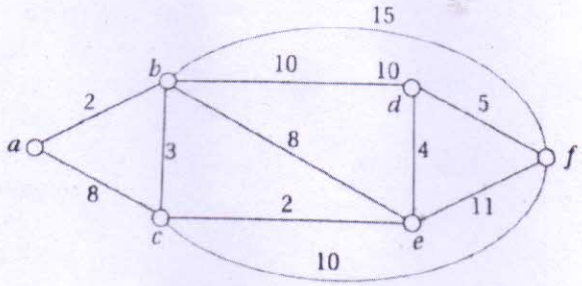
GROUP – C
(Long Answer Type Questions)

Answer any ***three*** from the following: **3×15=45**

			Marks	CO No
7.	(a)	Find generating sequence corresponding to the function $\frac{3x^3}{1-x}$	5	CO3
	(b)	Draw the incidence matrix of the following graph	5	CO3

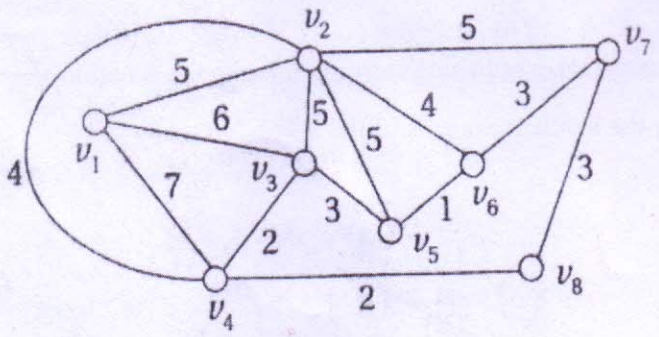


	(c)	Prove that in a group $(G,\circ)$, $(a \circ b)^{-1} = b^{-1} \circ a^{-1}$ $\forall a, b \in G$ i.e. the inverse of the product of two elements of a group G is the product of the inverse taken in the reverse order	5	CO4
8.	(a)	Show that $3^{302} \equiv 4 (\text{mod } 5)$	8	CO3
	(b)	Find the gcd(595,252) and express it in the form 252m+595n.	7	CO3
9.	(a)	Apply Dijkstra's Algorithm to determine a shortest path from a to f of the following graph.	9	CO3



	(b)	Draw Hasse diagrams of the posets (S,≤) for S={2,4,5,6,10,12,20,25} where ≤ be a partial ordering relation defined on S such that a≤b iff a divides b	6	CO4
10.	(a)	Draw the graph $K_{2,3}$. Hence draw the complement of the graph.	7	CO2
	(b)	Find the principal disjunctive normal form and principal conjunctive normal form of the following statement formula P(p,q,r) = $(q \vee (p \wedge q)) \wedge \sim ((p \vee r) \wedge q)$	8	CO2

11. (a) Using Kruskal's Algorithm find the minimals spanning tree and the corresponding cost of the following graph: 9 CO3



(b) A tree T has four vertices of degree 2, three vertices of degree 3 and three vertices of degree 4. How many vertices of degree 1 does it have? 6 CO3