GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022-2023
DISCRETE MATHEMATICS AND GRAPH THEORY
MCA20-104

TIME ALLOTTED: 3Hours   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: $10 \times 1 = 10$

		Marks	CO No.
1. i)	If A={a,b,c,d}, then how many elements are there in P(A) (the power set of A)? a. 13 b. 16 c. 18 d. 19	1	CO2
ii)	Which of these is not a group? a. $(Z,+)$ b. $(R,-)$ c. $(Q,+)$ d. all of the above	1	CO4
iii)	Which group is a cyclic group? a. $(R,+)$ b. $(Q,+)$ c. $(Z,+)$ d. none	1	CO4
iv)	How many distinct left cosets does $(Z_5,+)$ have? a. 5 b. 3 c. 4 d. 1	1	CO4
v)	A symmetric and transitive relation implies a reflexive relation. a. True b. False	1	CO2
vi)	How many elements does the permutation group S3 has? a. 6 b. 3 c. 5 d. None	1	CO4

vii) Which is the group generated by an element of order 3   1   CO4
   a. $(Z_6,+)$
   b. $(Z_3,+)$
   c. $(Z_5,+)$
   d. None

viii) The degree of isolated vertex is   1   CO5
   a. 2
   b. 1
   c. 2
   d. none

ix) The degree of the common vertex of two edges in series is   1   CO6
   a. 0
   b. 1
   c. 2
   d. May be more than 2

x) A $p \lor (p \land q)$ 1   CO1
   a. p
   b. q
   c. $p \land q$
   d. none of these

xi) If the truth table of p and q are F and F respectively then the truth table value is   1   CO1
   $\sim p$ $\sim q$
   a. T
   b. F
   c. Both T and F
   d. None of these

xii) Solve the linear congruence $4x \equiv 3 \pmod 5$ 1   CO3
   a. 2
   b. 1
   c. 4
   d. 5

xiii) Find the number of integers less than and prime to 256 is   1   CO3
   a. 125
   b. 128
   c. 120
   d. 130

GROUP – B
(Short Answer Type Questions)
(Answer any *three* of the following)   3 x 5 = 15

                                                  Marks   CO No.

2. A relation R is defined on the set of integers by "a R b if and only if a-b if divisible by 4". Prove that the relation is an equivalence relation.   5   CO2

3. Find the inverse function of $f(x)=(x/5)+8$.   5   CO2

		Marks	CO No.
4.	Show that (R,+) forms a commutative group.	5	CO4
5.	Solve the linear congruence $5x \equiv 3 \pmod{11}$	5	CO3
6.	Show that $4(29)! + 5!$ Is divisible by 31.	5	CO3

GROUP – C
(Long Answer Type Questions)
(Answer any *three* of the following) $3 \times 15 = 45$

		Marks	CO No.
7. a)	S is the set of all lines on a plane and a relation R is defined on S by "l R m if and only if l is perpendicular to m" for l,m belong to S. Check if the relation is an equivalence relation.	5	CO2
b)	Show that the function $f(x) = 1/x$ is injective but not surjective	5	CO2
c)	Show that (R,.) is a monoid but not a group.	5	CO4
8. a)	Show that $(Z_3, +)$ forms a cyclic group.	5	CO4
b)	Define partial order relation. Show that the relation on the natural number set defined as "m is a divisor of n" for a,b $\in$ N is a partial order relation.	5	CO2
c)	In how many ways can you rearrange the word JUMBLE such that the rearranged word starts with a vowel?	5	CO3
9. a)	A box contains three white balls, four black balls and three red balls. Find the number of ways in which three balls can be drawn from the box so that at least one of the balls is black.	5	CO3
b)	Solve the linear congruence $x \equiv 1 \pmod 3$, $x \equiv 2 \pmod 5$, $x \equiv 3 \pmod 7$		CO3
10. a)	$3^{2n+2} - 8n - 9$ is divisible by 64.	5	CO3
b)	Show that $\{(p \wedge \sim q) \to r\} \to \{p \to (q \vee r)\}$ is a tautology	5	CO1
c)	Find the CNF of the following statement $\sim(p \vee q) \leftrightarrow (p \wedge q)$	5	CO1
11. a)	A simple graph with n number of vertices and k number of components can have maximum (n-k)(n-k+1)/2 number of edges.	5	CO6
b)	By Kruskal algorithm find a minimal spanning tree and the corresponding weight of the spanning tree.	5	CO5
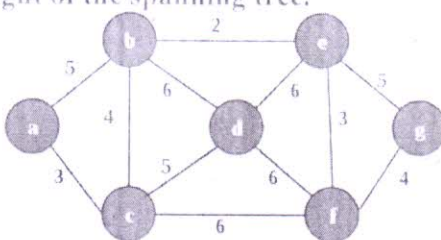
		Marks	CO No.
c)	Construct a graph corresponding to the following incidence matrix	5	CO5

-1	-1	1	1	0	0	0	0
0	1	0	-1	0	0	0	0
1	0	-1	0	0	0	0	0
0	0	0	0	-1	1	1	-1
0	0	0	0	0	-1	-1	0
0	0	0	0	1	0	0	1