GIET UNIVERSITY, GUNUPUR – 765022

M. C. A (Second Semester) Regular Examinations, August – 2023

MCA20204 - Discrete Mathematics

Time: 3 hrs   Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

PART – A   **(2 x 10 = 20 Marks)**

Q.1. Answer *ALL* questions

		CO #	Blooms Level
a.	Define the disjunction operator with one example.	CO1	K2
b.	Get the contra positive of the statement "If it is raining then I get wet"	CO2	K2
c.	Construct the truth table for the compound proposition $(p \rightarrow q) \rightarrow (q \rightarrow p)$.	CO1	K2
d.	Define Universal quantification and Existential quantification.	CO1	K2
e.	Rewrite the following using quantifiers "Every student in the class studied calculus"	CO1	K2
f.	Write the recursive definition of the following sequences 2, 4, 8, 16, . . .	CO2	K1
g.	Explain Reflexive, Symmetric and transitive relation	CO2	K1
h.	Define poset.	CO3	K1
i.	Define semigroup and monoid. Give an example of a semigroup which is not a monoid.	CO2	K2
j.	Define regular graph with example.	CO2	K2

PART – B   **(10 x 5 = 50 Marks)**

Answer *ANY FIVE* questions

		Marks	CO #	Blooms Level
2. a.	Prove that [(p ∨ q) ∧ (p→ r) ∧ (q→ r)] →r is a tautology	5	CO2	K2
b.	Show that (p → r) ∧ (q → r) ≅ (p ∨ q) → r	5	CO4	K2
3.a.	Using mathematical induction prove that for every non-negative integer $1 + 2 + 2^2 + \cdots \ldots \ldots \ldots + 2^n = 2^{n+1} - 1$	5	CO3	K2
b.	Prove that if n is an integer and 3n + 2 is odd, then n is odd by contraposition method.	5	CO4	K2
4.	Solve the recurrence relation $a_n = -5a_{n-1} - 6\,a_{n-2} + 42\,4^n$ and the initial value $a_0 = 56, a_1 = 278$	10	CO4	K2
5.a.	Solve the recurrence relation $f_n = f_{n-1} + f_{n-2}$, $f_0 = 0, f_1 = 1$ by using	5	CO3	K1

generating functions.

b.	In a class of 50 students, there are 2 choices for optional subjects. It is found that 18 students have physics as an optional subject but not chemistry and 25 students have chemistry as an optional subject but not physics.	5	CO2	K2

     i.   How many students have both optional subjects?

     ii.   How many students have chemistry as an optional subject?

     iii.   How many students have physics as an optional subject?

6. a.	Let $A = \{a,\ b,\ c, d\}$ and $R = \{(a, c), (b, d), (c, a), (d, b), (e, d)\}$. Find the transitive closure of R using Warshall's algorithm.	5	CO3	K1
b.	Let R be a relation on a set of positive integers such that $for\ all\ x, y \in z^+, xRy$ if and only if $x \equiv y(mod\ n)$. Prove that R is an equivalence relation.	5	CO3	K2
7.a.	Draw the Hasse diagram of $(\{3,5,9,\ 15, 24, 45\}, /)$. Find the least element, greatest element, maximal element, minimal element, lower bounds, upper bounds, glb, lub of the set $\{3,5\}$.	5	CO4	K2
b.	Determine whether $(P(S), \subseteq)$ is a lattice where S is a set $S = \{a, b, c\}$	5	CO2	K2
8. a.	Let $(G, *)$ be a group, then prove that	5	CO3	K2

     i.   The inverse of any element of in a group G is unique.

     ii. The identity of any element of in a group G is unique.

b.	i. Define a complete bipartite graph draw $K_{2,\ 3}$ $and\ K_{3,3}$ ii. Draw simple graph with five vertices of the 1, 2, 2, 3, 4 degrees.	5	CO2	K2

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