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MCA
(SEM I) THEORY EXAMINATION 2023-24
DISCRETE MATHEMATICS

TIME: 3HRS**M.MARKS: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.**

Qno.	Question	Marks
a.	Define the Cartesian Product of sets with example.	2
b.	If set A has n elements, how many relations are there from A to A ?	2
c.	Draw the Hasse diagram of $(D_8, /)$.	2
d.	Express the following Boolean function in Sum of minterms: $F(x, y, z) = x + y'z$	2
e.	Prove the following Equivalences by using Truth table: $(p \rightarrow q) \rightarrow q \equiv p \vee q$	2
f.	Define Bound and Free variables with example.	2
g.	Define Order of an element of a Group with example	2
h.	What do you mean by Even and Odd Permutation?	2
i.	State the Mathematical Induction Law.	2
j.	Find the minimum number of students in a class so that three of them are born in the same month.	2

SECTION B**2. Attempt any three of the following:**

a.	Define the composition of function. If $f(x) = x^2 - 1$ and $g(x) = (3x + 1)$, find: i) $g \circ f$, ii) $f \circ g$, iii) $g \circ g$, iv) $f \circ f$	10
b.	IFA = (a, b, c) , show that $(P(A), \subseteq)$ is a Poset and draw its Hasse diagram.	10
c.	Rewrite the following argument using quantifiers, variables and predicate symbols. Prove the validity of the argument: "If it rains then it will be cold. If it is cold then I shall stay at home. Since it rains therefore, I shall stay home".	10
d.	Define the Subgroup. Prove that the additive group of even integers is a subgroup of the additive group of all integers.	10
e.	Prove that: $8^n - 3^n$ is a multiple of 5 for all $n \geq 1$ by mathematical induction.	10

SECTION C**3. Attempt any one part of the following:**

a.	In a group of 850 person, 600 can speak Hindi and 340 can speak Tamil. Find: i) How many can speak both Hindi and Tamil? ii) How many can speak Hindi only? iii) How many can speak Tamil only?	10
b.	If R be the relation on set $A = \{a, b, c, d\}$ and $R = \{(a, b), (b, c), (d, c), (d, a), (a, d), (d, d)\}$. Determine: i) Reflexive closure of R , ii) Symmetric closure of R , iii) Transitive closure of R	10

4. Attempt any one part of the following:

a.	Express the Boolean expression: $f(x, y, z) = (x'y)'(x + z)$ in both <i>disjunctive and conjunctive normal forms</i> .	10
b.	Use Karnaugh map representation to find minimal sum of products expression for the following Boolean function: $F(A, B, C) = \sum(0, 2, 3, 4, 7)$	10

5. Attempt any one part of the following:



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a.	Prove the following Equivalence: $p \rightarrow (q \vee r) \equiv (p \rightarrow q) \vee (p \rightarrow r)$	10
b.	Obtain the <i>disjunctive normal form(DNF)</i> of the following logical expression: $p \rightarrow ((p \rightarrow q) \wedge \sim (\sim q \vee \sim p))$.	10

6. Attempt any one part of the following:

a.	If the Inverse of an element “a” in a group is “ a^{-1} ”, then the Inverse a^{-1} is a, i.e. $(a^{-1})^{-1} = a$.	10
b.	Show that the set of fourth roots of unity forms an abelian group with respect to multiplication.	10

7. Attempt any one part of the following:

a.	Solve the following Recurrence Relation: $a_n - 7a_{n-1} + 10a_{n-2} = 0$ with initial conditions $a_0 = 0$ and $a_1 = 3$	10
b.	What do mean by Generating function. Find the Generating function of the following series: 1,1,1,1,1,1,1.	10

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