Subject Code: RCA103

PAPER ID-311084

Roll No: | | | | | | | | | | | | | |

MCA
(SEM. I) THEORY EXAMINATION 2020-21
DISCRETE MATHEMATICS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a.	State the Commutative and Distributive Laws of Set theory.
b.	Define the Equivalence Relation.
c.	Define the following terms (any two) with example: i) DNF, ii) CNF, iii) Universal Gates
d.	State the Idempotent, Involution laws of Boolean Algebra.
e.	State the Modus Ponens and Hypothetical Syllogism Inference Rules.
f.	What do you mean by Bound and Free variable with example?
g.	State Generating Function.

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a.	Show that relation " xRy iff (x-y) is divisible by 3" is an equivalence relation on the set of integers.
b.	Let S = {x, y, z} and P(S) be its power set. Show that (P(S), ⊆) is a Lattice.
c.	State and Prove the Associative Laws of Boolean Algebra.
d.	If $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ *Determine* the truth value of each of the following statement: i) $(\forall x \in A)\, x + 4 < 15$ ii) $(\exists\, x \in A)\, x + 4 = 10$ iii) $(\forall x \in A)\, x + 4 \leq 10$
e.	An examination paper containing 12 questions consists of two parts, A and B, part A contains 7 questions and part B contains 5 questions. A candidate is required to attempt 8 questions, selecting at least 3 from each part. In how many ways the candidate selects the questions?

SECTION C

3. Attempt any *one* part of the following: **7 x 1 = 7**

(a)	For any set A and B, Prove that : $P(A \cap B) = P(A) \cap P(B)$.
(b)	Define the function. And also explain the various types of functions.

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4. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	Define Dual Lattice. And Show that Dual of a lattice is a lattice.
(b)	If D = {1, 2, 4, 8, 16, 32, 64} be ordered by the relation "a divides b". Then show that D is a Poset. Also draw the Hasse diagram.

5. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	Draw Karnaugh map (K-map) and simplify the following Boolean expression**:** $f(a,b,c,d) = \sum(0,2,6,8,10,12,14,15)$.
(b)	Show that $A \oplus B = ((A.B')'.(A'.B)')'$ and hence design a logic circuit of XOR gate using $NAND$ only.

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	Show that: $(p \rightarrow q) \wedge (r \rightarrow q) \equiv (p \vee r) \rightarrow q$.
(b)	Construct the truth table: $((p \Rightarrow q) \vee (q \Rightarrow p)) \Leftrightarrow p$ Is the preposition: Tautology, Contradiction or Contingency?

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a)	Solve the following recurrence relation: $a_n - 7a_{n-1} + 10a_{n-2} = 0$ *with initial conditions* $a_0 = 0$ *and* $a_1 = 3$
(b)	Explain the difference between Permutation and Combination. And solve: Everybody in a room shakes hands with everybody else. The total number of handshakes is 66. Find how many people are there in the room?