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MCS-013

**MASTER OF COMPUTER
APPLICATIONS/ BACHELOR OF
COMPUTER APPLICATIONS (REVISED)**

(MCA/BCA)

Term-End Examination

December, 2025

MCS-013 : DISCRETE MATHEMATICS

Time : 2 Hours

Maximum Marks : 50

*Note : Question No. 1 is compulsory. Attempt
any **three** questions from the rest.*

1. (a) Show using truth table whether $(p \wedge q \wedge r)$ and $(p \vee r) \wedge (q \vee r)$ are equivalent or not. 2

(b) Using mathematical induction, prove that : 4

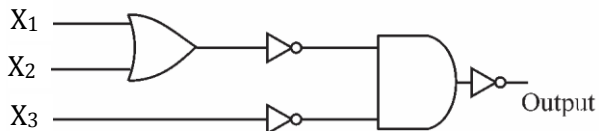
$$1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$$

(c) Prove that : 3

$$(A \cup B)' = A' \cap B'$$

(d) Every function is a relation. Is every relation a function ? Why ? 3

(e) Find Boolean expression for the output of the following logic circuits : 2



(f) If $F : \mathbb{R} \rightarrow \mathbb{R}$ be a function given by

$$f(x) = \frac{x-2}{x-3}, \text{ find whether } F^{-1} \text{ exists or}$$

not. If F^{-1} exists, find it. 3

(g) Suppose we want to choose two players from a team of 15 players, as captain and vice captain. In how many ways can this be done? 3

2. (a) How many words can be formed using letters of the word "DEPARTMENT", if each letter must be used at most once? 4

(b) Give geometric representation for $\{1, 3\} \times \{-2, 3\}$. 2

(c) Verify that : 2

$$\{p \rightarrow q\} \rightarrow q = p \vee q$$

- (d) Find the number of ways to distribute 20 distinct objects into 10 distinct boxes with at least 4 boxes remaining empty. 2
3. (a) Reduce the following Boolean expression to simpler form : 4
- $$E[x_1, x_2, x_3] = [X_1 \wedge X_2 \wedge X_3] \vee [X_1 \wedge X_2] \vee [X_2 \wedge X_3]$$
- (b) Show that $\sim (p \rightarrow q) \rightarrow p$ is a tautology. 2
- (c) Prove that $\sqrt{2}$ is irrational. 4
4. (a) Find CNF of $\sim(p \vee q) \leftrightarrow (p \wedge q)$. 4
- (b) Write Pigeonhole principle and Generalized Pigeonhole principle. 3
- (c) Draw the circuit for the following Boolean expression using logic gates : 3

$$Y = A'BC + A'BC' + ABC'$$

5. (a) Explain the Identity Laws of Boolean Algebra. 2
- (b) State and prove the Addition Theorem of Probability. 3
- (c) Verify that $p \wedge q \wedge \sim p$ is a contradiction. 2
- (d) Suppose A and B are mutually exclusive events, such that $P(A) = 0.3$ and $P(B) = 0.4$. What is the probability that :
- 3
- (i) A does not occur ?
- (ii) A or B occurs ?
- (iii) Either A or B does not occur ?

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