

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

Term-End Examination

December, 2024

MCS-013 : DISCRETE MATHEMATICS

Time : 2 Hours

Maximum Marks : 50

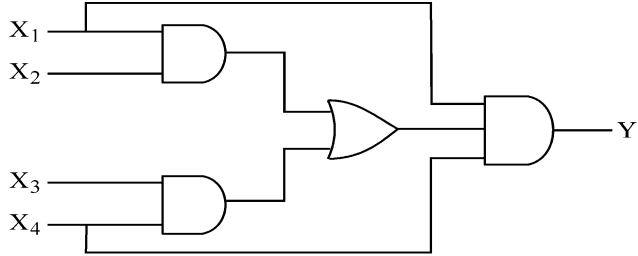
Note : *Question No. 1 is compulsory. Attempt any
three questions from the rest.*

1. (a) Verify the following, using truth table : 4

(i) $x \leftrightarrow y \equiv (x \rightarrow y) \wedge (y \rightarrow x)$

(ii) $\sim(x \rightarrow y) \equiv x \wedge \sim y$

- (b) Prove that $\sqrt{17}$ is irrational. 3
- (c) Find the Boolean expression for the output (y) of the circuit given below : 3



- (d) Make Venn diagram for the following expressions : 2
- (i) $\bar{X}$
- (ii) $X \Delta Y$ (Symmetric Difference)
- (iii) $X \cap Y \cap Z$
- (iv) $X \cup Y - Z$
- (e) Verify that a relation ' f ' given below is a function or not. Give suitable reason in support of your answer : 2

$$f = \{(x,1), (x,2), (y,3), (z,4)\}$$

- (f) How many distinct three letter words can be formed from the letters of the word “MASTER” ? 2
- (g) In how many ways can a student choose 8 questions out of 10 in an examination ? 2
- (h) A coin is tossed n times. What is the probability of getting exactly r heads ? 2
2. (a) Prove the following : 4
- $$\sim(\exists xP(x)) \equiv (\sim P(x))$$
- $$\sim(\forall xP(x)) \equiv \exists x(\sim P(x))$$
- (b) Use mathematical induction to prove the following : 4
- $$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$
- (c) Write the contrapositive and converse of the following sentence : 2
- “If $2 + 2 = 5$, then I am captain of cricket team.”

3. (a) Explain proof by contradiction with the help of an example. 2

(b) Reduce the following equations to simpler forms : 4

$$(i) \quad F(x, y) = (x' \wedge y') \vee (x' \wedge y) \vee (x \wedge y')$$

$$(ii) \quad F(x, y, z) = (x' \wedge y' \wedge z') \vee$$

$$(x' \wedge y' \wedge z) \vee (x \wedge y \wedge z')$$

(c) Construct the logic circuit for the Boolean expressions : 4

$$(i) \quad (x \wedge y \wedge z) \vee (x \wedge y)' \vee (y \wedge z)'$$

$$(ii) \quad (x' \wedge y') \vee (y' \wedge z) \vee x$$

4. (a) Prove that : 5

$${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r \quad (0 \leq r \leq n)$$

(b) Explain Conjunctive Normal Form (CNF) and Disjunctive Normal Form (DNF) with suitable example for each. 5

5. (a) Let X and Y be two mutually exclusive events such that $P(X) = 0.6$ and $P(Y) = 0.3$. What is the probability that : 4

(i) X does not occur ?

(ii) X and Y both occur simultaneously ?

- (b) Let $X = \{1, 2, 3, 4\}$ be a set, and a relation R is defined on X such that xRy if $x \geq y$.

Check if R is : 4

(i) Reflective,

(ii) Symmetric,

(iii) Transitive, and

(iv) Asymmetric

- (c) Prove that $A - (A - B) = A \cap B$ using Venn diagram. 2

x x x x x x x