No. of Printed Pages : 7 **MCS–013**

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

Term-End Examination

June, 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) What is dual of a Boolean expression ? Explain the principle of duality with the help of an example. 2

(b) Let there be a function $f : X \rightarrow Y$, where X and Y are sets as given below :

$$X = \{a, b, c, d\},\ Y = \{p, q, r, s\}$$

$$f = \{(a, p), (b, q), (c, r), (d, s)\}$$

Explain whether f is : 3

(i) one-to-one

(ii) onto

(iii) bijective.

(c) Show that : 4

$$\sim (p \vee q) = \sim p \wedge \sim q$$

and $\sim (p \wedge q) = \sim p \vee \sim q$

(d) Determine the domain for which the functions :

$$f(x) = 3x^2 - 1$$

and $$g(x) = 1 - 5x$$

are equal. Also, find a domain for which the functions are not equal. 3

(e) Prove that : 2

$$(A - B) \cup B = A \cup B$$

(f) Determine n, if $2P(n, 2) + 50 = P(2n, 2)$ .2

(g) Draw Venn diagram to represent $(A \Delta B)$ and $(A \cap B \cup C)$ for sets A, B and C. 2

(h) If there are 12 persons in a party, and if each two of them shake hands with each other, how many handshakes will happen in the party ? 2

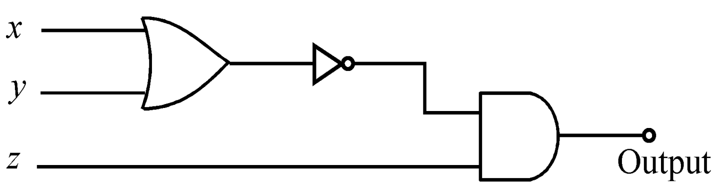
2. (a) Show that for integers greater than zero : 2

$$2^n >= (n+1)$$

(b) If $f : \mathrm{R} \to \mathrm{R}$ is a function such that $f(x) = 3x + 5$, prove that if f is one-one onto. 4

(c) Verify that $p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$ is a tautology. 2

(d) Find the Boolean expression for the output of the circuit given below : 2



3. (a) Verify whether $\sqrt{5}$ is rational or irrational. 3

(b) Explain pigeonhole principle with example. 2

(c) Given X = {1, 3, 5, 7} and Y = {2, 3, 5, 8} : 3

(i) List the elements of (A × B) × (B – A).

(ii) Is (A × B) × (B – A) a subset of A × B ?

(d) If $P(X) = \frac{1}{4}$ and $P(Y) = \frac{2}{5}$, find : 2

(i) $P(A \cap B)$

(ii) $P(A \cap B')$

4\. (a) How many solutions are there of : 3

$$x + y + z = 17$$

subject to the constraints :

$$x \geq 1;\ y \geq 2;\ z \geq 3$$

(b) Let $A = \{a, b, c, d\}$, $B = \{1, 2, 3\}$ and $R\{(a, 2), (b, 1), (c, 2), (d, 1)\}$. Tell whether R is a function or relation ? Justify your answer. 2

(c) Determine in how many ways can 25 identical books be placed in 5 identical boxes. 3

(d) Find how many 4-digit numbers are odd. 2

5. (a) Show that : 3

$$(1 \times 2) + (2 \times 3) + ... + n(n+1)$$

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

(b) Write negation of the following statement, using propositional logic : 2

"If it is raining, then the game is cancelled."

(c) From the digits 1, 2, 3, 4, 5, 6; how many three-digit odd numbers can be formed ? 3

(i) When the repetition of digits is allowed ?

(ii) When the repetition of digits is not allowed ?

(d) Show that in any group of 30 people, we can always find 5 people who were born on the same day of the week. 2

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