$(a_1, a_2) \in A \times A$

$a_1, a_2 \in A$ $\quad A \subseteq B$

$a_1, a_2 \in B$

$(a_1, a_2) \in A \times B$

$(a_1, a_2) \in B \times A$

$(a_1, a_2) \in (A \times B) \cap (B \times A)$

$A \times A \subseteq (A \times B) \cap (B \times A)$

$(x, y) \in (A \times B) \cap (B \times A)$

$(x, y) \in (A \times B)$ and $(x, y) \in (B \times A)$

$x \in A, y \in B$ and $x \in B, y \in A$

$(x, y) \in A \times A$

$(A \times B) \cap (B \times A) \subseteq A \times A$

Poset

Reflexe

antisym $\quad a|b \quad b|a$ X

Transit

H $\quad$ Roll No. ....

TBC–103/TBD–103

B. C. A./B. C. A. (DS & AI)

(FIRST SEMESTER)

MID SEMESTER

EXAMINATION, Oct., 2023

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCES

Time : 1½ Hours

Maximum Marks : 50

Note : (i) Answer all the questions by choosing any *one* of the sub-questions.

(ii) Each sub-question carries 10 marks.

1\. (a) Prove the both distributive laws of algebra on the basis of set theory. (CO1)

OR

(b) Let A, B, C $\subseteq R^2$, where :

$$A = \{(x, y)/y = 2x + 1\},$$

$$B = \{(x, y)/y = 3x\} \text{ and}$$

$$C = \{(x, y)/x - y = 7\}.$$

Determine : (CO1)

(i) $A \cap B$

(ii) $(A^c \cup B^c)^c$

2. (a) Prove that : (CO1)

(i) $A - (B - C) = (A - B) \cup (A \cap C)$

(ii) $\{x : |x - 1| > 0.5\} = \{x : x > 1.5\} \cup \{x : x < 0.5\}$

OR

(b) Out of 80 students in a class, 60 play football, 53 play hockey, and 35 both the games. How many students : (CO1)

(i) do not play these games,

(ii) play only hockey but not football ?

3. (a) If $A \subseteq B$, then prove that : (CO1)

$$(A \times B) \cap (B \times A) = A^2.$$

OR

(b) Let $A = \{2, 3, 5\}$ and $B = \{6, 8, 10\}$ and define a binary relation R from A to B as $R = \{(a, b) : a \in A, b \in B$ and a divides $b\}$. Write each R and R^{-1} as a set of ordered pairs. Then find the domain and range for each R and R^{-1}. (CO2)

4. (a) Define the following with proper examples : (CO2)

(i) Irreflexive Relation → Not

(ii) Antisymmetric Relation →

OR

(b) If the function $f : R \to R$ defined by :

$$f(x) = \begin{cases} 3x - 4, & \text{where } x > 0 \\ -3x + 2, & \text{where } x \le 0 \end{cases}$$

Determine :

(i) $f(0), f(2/3)$

(ii) $f^{-1}(0), f^{-1}(-7)$. (CO2)

5. (a) Let $R = \{(1, 2), (2, 3), (3, 1)\}$ and $A = \{1, 2, 3\}$, find the reflexive, symmetric and transitive closure of R, using : (CO2)

(i) Composition of relation R

(ii) Graphical representation of R

OR

(b) Let f and g be functions from the positive integers to the positive integers defined by

$$f(n) = n^2, g(n) = 2^n.$$

Find $f \circ f, g \circ g, f \circ g, g \circ f$ (CO2)