H Roll No. .....

TBC–103/TBD–103

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

(FIRST SEMESTER) END SEMESTER EXAMINATION, Dec., 2023

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any ***two*** sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) State and prove De-Morgan's law. (CO1)

(b) If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $A = \{1, 2, 3, 4, 5\}$, $B = \{1, 3, 5, 7, 9\}$, then find the following : (CO1)

(i) $A^c \cap B^c$

(ii) $A - B$

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

(iv) $A \oplus B$

(c) In the survey of the group of 80 people, it is found that 60 like to eat egg and 30 like fish. Find the number of people that like both fish and egg. (CO1)

2. (a) Define types of Relation with proper example. (CO2)

(b) Let $A = \{1, 2, 3, 4, 6\}$ be a set and R be a relation on set A defined by :

$$R = \{(x, y) : a, b \in A,$$

$$b \text{ is exactly divisibl by } a\}$$

Write R and find the domain and range. Also check it for partial order relation.

(CO2)

(c) Let : (CO2)

$$f(x) = x + 3,$$

$$g(x) = x - 4,$$

$$h(x) = 2x.$$

Then find the following :

(i) $h \circ f(x)$

(ii) $g \circ f(x)$

(iii) $g \circ f \circ h(x)$

(iv) $f \circ g \circ h(x)$

3. (a) Explain any *five* properties of lintegers with proper example. (CO3)

(b) Define GCD and also find the GCD of the following using Euclidean algorithm :

(CO3)

(i) 1025, 35

(ii) 600, 45

(iii) 24,36

(c) Define Prime number and LCM. Also test whether the number is prime or not 241, 2457, 881, 63. (CO3)

4. (a) Define the Probability and Sample space. It two coins are tossed simultaneously, then find the probability of getting head on both the coins. (CO4)

(b) Define the mathematical induction and with the help of it prove that $(ab)^n = a^n b^n$ is true for every natural number n. (CO4)

(c) One card is drawn form a well shuffled deck of 52 cards. Find the probability of getting : (CO4)

(i) a king of red colour

(ii) a face card

(iii) a red face card

5. (a) Define any *five* types of matrices with example. (CO5)

(b) Find the determinant of the given matrices and verify it with the help of Sarrus rule : (CO5)

(i) $A = \begin{pmatrix} 2 & -3 & 1 \\ 2 & 0 & -1 \\ 1 & 4 & 5 \end{pmatrix}$

(ii) $B = \begin{pmatrix} 10 & 20 & 10 \\ 4 & 5 & 6 \\ 2 & 3 & 5 \end{pmatrix}$

(c) If : (CO5)

$$A = \begin{pmatrix} 2 & 4 \\ 5 & 7 \end{pmatrix} \text{ and } B = \begin{pmatrix} 1 & 0 \\ 2 & 4 \end{pmatrix},$$

then calculate $A \times B = B \times A$.