MID-TERM EXAMINATION EVEN SEMESTER 2021-22

COURSE CODE	CSET106	**MAX. DURATION**	1 HRS
COURSE TITLE	Discrete Mathematical Structures		
COURSE CREDIT	4(3L-1T-0P)	**TOTAL MARKS:**	20

GENERAL INSTRUCTIONS: -

1. Do not write anything on the question paper except **name, enrolment number** and **department/school.**
2. Carrying mobile phone, smart watch and any other non-permissible materials in the examination hall is an act of **UFM.**

Note: **Attempt any 5 questions out of given 6 questions. All questions carry equal marks (4×5=20). If require any missing data; then choose suitably**

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1. Explain the use of rule of inferences. List all the rules of inferences (with correct name) with an example in English.
2. Using mathematical induction to prove that for each positive integer n, the sum of the first n positive integers is $\frac{n(n+1)}{2}$.
3. Let F(x, y) be the statement "x can fool y", where the domain of discourse for both x and y is all people.

   (i) Use quantifiers to express each of the following statements:

   a) I can fool everyone.

   b) No one can fool himself.

   c) There is someone who can fool everybody.

   d) Ralph can fool two different people.

   (ii) Negate each of the statements given in (i) and write the statement in English with logical expressions.

4. Is $(p \to q) \to [(p \to q) \to q]$ a tautology? Why or why not? (using laws of logic)

5. In addition to union (∪), intersection (∩), difference (-) and power set (2^A), let us add the following two operations to our dealings with sets:

- Pairwise addition: $A \oplus B := \{a + b : a \in A, b \in B\}$ (This is also called the Minkowski addition of sets A and B.)
- Pairwise multiplication: $A \otimes B := \{a \times b : a \in A, b \in B\}$

For example, if $A = \{1, 2\}$ and $B = \{10, 100\}$, then

$A \oplus B = \{11, 12, 101, 102\}$ and $A \otimes B = \{10, 20, 100, 200\}$.

Now answer the following questions:

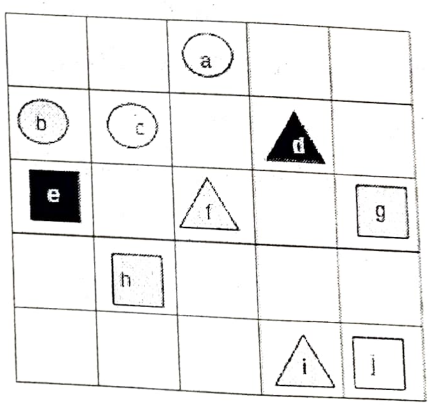
(a) Briefly describe the following sets:

i). $I \oplus \emptyset$ ii). $I \oplus I$ iii). $I^+ \oplus I^+$ iv). $I^+ \otimes I^+$

where I is a set of all integer numbers and I^+ is a set of all positive integer numbers.

(b) If E is the set of all positive even numbers, what's the shortest way to write the set of all positive multiples of 4? (Use pairwise multiplication).

6.



Let Triangle(x), Circle(x), and Square(x) mean "x is a triangle," "x is a circle," and "x is a square"; let White(x), Gray(x), and Black(x) mean "x is white," "x is gray," and "x is black";

Let RightOf(x, y), Above(x, y), and SameColourAs(x, y) mean "x is to the right of y," "x is above y," and "x has the same colour as y";

and use the notation x = y to denote the predicate "x is equal to y".

Let the common domain D of all variables be the set of all the objects in the Tarski world.

Use formal, logical notation to write each of the following statements, and write a formal negation for each statement.

a. For all circles x, x is above f.

b. There is a square x such that x is black.

c. For all circles x, there is a square y such that x and y have the same colour.

d. There is a square x such that for all triangles y, x is to right of y.