

**3 SEM TDC L & S (CBCS) SEC 3.1**

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( Held in April–May, 2021 )

MATHEMATICS

( Skill Enhancement Course )

Paper : SEC–3.1

**( Logic and Sets )**

Full Marks : 40

Pass Marks : 16

Time : 2 hours

*The figures in the margin indicate full marks  
for the questions*

1. Write the converse, inverse and contra-positive statements of the conditional statement  $P \rightarrow Q$ . 1+1+1=3
2. Express the following statements involving predicates in symbolic form (any four) : 1×4=4
  - (a) All students are clever.
  - (b) Some students are not successful.

- (c) Every clever student is successful.
- (d) There are some successful students who are not clever.
- (e) Some students are clever and successful.

3. Prove that  $\sim(p \wedge q) \equiv \sim p \vee \sim q$ . 4
4. Define five sentential connectives. 1×5=5
5. Answer any two of the following : 4×2=8  
Let  $A$  and  $B$  be two finite sets. Prove that—
  - (a)  $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ ;
  - (b)  $(A \cup B)^c = A^c \cap B^c$ ;
  - (c)  $A \setminus B = A \cap B^c$ .
6. Let  $A$  is the empty set  $\phi$ . Find  $P(A)$ , where  $P(A)$  is the power set of  $A$ . Show that  $n(P(P(P(\phi)))) = 4$ . 1+3=4
7. Define composition of relation. If  $A = \{1, 2, 3, 4\}$ ,  $B = \{a, b, c, d\}$ ,  $C = \{x, y, z\}$  and  
 $R = \{(1, a) (2, b) (3, a) (3, b) (3, d)\}$   
 $S = \{(b, x) (b, z) (c, y) (d, z)\}$   
 find  $R \cdot S$ . 2+2=4

( 3 )

8. Prove that the relation ' $a$  divides  $b$ ' is a partial ordering on the set  $\mathbb{N}$  (the set of positive integer). 3
9. Prove that congruence modulo  $m$  on  $\mathbb{Z}$  defined as  $a \equiv b \pmod{m}$ , if  $a - b$  is divisible by  $m$ , is an equivalence relation. 5

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