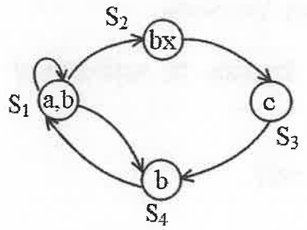
30. a.	Write the predicate logic for the following statements			2	3	2
	(i)	Some professor admires Ganesh	3			
	(ii)	No all birds can fly	3			
	(iii)	No class was attended by every student	3			
	(iv)	A boy won every prize	3			
		(OR)				
b.	Let ϕ be $\exists x(P(x,y) \wedge \forall y(\neg Q(y,x) \vee P(x,y)))$			2	3	2
	(i)	Draw the parse tree of ϕ	4			
	(ii)	Identify the free and bound variables	4			
	(iii)	Compute $\phi[w/x], \phi[a/y]$	4			
31. a.	Solve the following		12	3	4	2
	(i)	$\exists x\, \exists y\, \phi \dashv\vdash \exists y \exists x \phi$				
	(ii)	$\exists x\, \phi \vee \psi \dashv\vdash \exists x(\phi \vee \psi)$				
		(OR)				
b.	State and explain the natural deduction of first order logic.		12	1	4	2
32. a.	Demonstrate on modal logic with suitable example.		12	2	5	1
		(OR)				
b.	Consider the following diagram.			3	5	2



Check the following statics satisfiabily

$S_4 \Vdash A \times C$	2
$S_1 \Vdash EGb$	2
$S_3 \Vdash EF(a \vee b \vee c)$	2
$S_4 \Vdash A \times (a \vee b \vee c)$	2
$S_4 \Vdash A \times (a \cup b)$	2
$S_2 \Vdash E \times a$	2

* * * * *

Reg. No.														

B.Tech. DEGREE EXAMINATION, JUNE 2023

Fifth to Seventh Semester

18CSE351T – COMPUTATIONAL LOGIC

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
1.	Which of the following is an unary connective in propositional logic (A) $\wedge$ (B) $\neg$ (C) $\vee$ (D) $\rightarrow$	1	1	1	1
2.	The use of logic is to perform or reason about _____. (A) Induction (B) Insertion (C) Computation (D) Symbolization	1	1	1	1
3.	If P = T, Q = T then P $\leftrightarrow$ Q is (A) T (B) F (C) TT (D) FF	1	2	1	1
4.	A truth table is a convenient format for displaying the _____. (A) Statement with symbols (B) Values (C) Variables (D) Semantics of a formula	1	1	1	1
5.	Let us consider P, $\neg$P as premises, then valuations will be (A) $\top$ (B) $\bot$ (C) P $\wedge \neg$P (D) P $\vee \neg$P	1	1	2	1
6.	Find the missing propositional atom in the following formula $(p \wedge q) \rightarrow r \vdash ? \rightarrow (q \rightarrow r)$ (A) $(p \vee q)$ (B) r (C) q (D) p	1	1	1	1
7.	Which of the following denotes modus tollens? (A) p $\rightarrow$ q, $\neg$q $\vdash \neg$p (B) p $\rightarrow$ q, $\neg$p $\vdash \neg$q (C) p $\rightarrow$ q, p $\vdash$ q (D) p $\rightarrow$ q, q $\vdash$ p	1	1	2	1
8.	The height of the parse tree of (p $\wedge$ q) $\rightarrow$ r (A) 0 (B) 1 (C) 2 (D) 3	1	2	2	1

9. Universal quantifier can be denoted as	1	1	3	1
(A) $\models$ (B) $\vDash$				
(C) $\exists x$ (D) $\forall x$				
10. Let us consider the formula $\forall x \exists y \exists z [P(x,y) \rightarrow Q(y,z)]$. Find the number of free variables in the above formula.	1	1	3	1
(A) 1 (B) 2				
(C) 3 (D) 0				
11. "Some of my friends are not perfect". Pick out the FOL formula which suits for above sentence	1	2	3	1
(A) $\forall x(F(x) \wedge \neg P(x))$ (B) $\exists x(F(x) \rightarrow P(x))$				
(C) $\exists x(\neg F(x) \wedge \neg P(x))$ (D) $\exists x(F(x) \wedge \neg P(x))$				
12. Let A be sentence, interpretation $I = (D, \phi)$ and l be valuation under I, then _____.	1	1	3	1
(A) I $\vDash$ A iff $I_l \vDash$ A (B) I $\nvDash$ A iff $I_l \vDash$ A				
(C) I $\vDash$ A iff $I_l \in$ A (D) I $\vDash$ A iff $I_l \notin$ A				
13. Proof has the finite sequence of _____.	1	1	4	1
(A) Rules (B) Deductions				
(C) Variables (D) Proof				
14. $\forall x \phi \wedge \psi \dashv \vdash \forall x$ (_____)	1	1	4	1
(A) $\phi \vee \psi$ (B) $\phi \wedge \psi$				
(C) $\phi \rightarrow \psi$ (D) $\phi \leftrightarrow \psi$				
15. Look up tables consists of set of _____ values.	1	1	4	1
(A) Concrete (B) Finite				
(C) Permanent (D) Temporary				
16. Pick out the correct statement from the following	1	1	4	1
(A) $X \rightarrow (Y \rightarrow X)$ (B) $\neg X \rightarrow (Y \rightarrow X)$				
(C) $X \rightarrow (\neg Y \vdash X)$ (D) $X \rightarrow (Y \vdash \neg X)$				
17. The necessarily can be denoted as	1	1	5	1
(A) $\Box$ (B) $\Diamond$				
(C) $\forall x$ (D) $\exists x$				
18. Transitions are called as _____ structure.	1	1	5	1
(A) Static (B) Dynamic				
(C) Active (D) Passive				
19. Computational tree logic is _____.	1	1	5	1
(A) Predicate logic (B) Hash logic				
(C) Graph logic (D) Branching tree logic				
20. Some next state can be denoted as _____.	1	1	5	1
(A) EX (B) AX				
(C) AF (D) EF				

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

	Marks	BL	CO	PO
21. List out the connectives used in proportional logic and mention the binding priorities between them.	4	1	1	1
22. Check whether the following equations are semantically entails holds.	4	2	1	2
(i) $p \vee q \rightarrow r \models p \rightarrow r$				
(ii) $(p \wedge q) \vee r \models p \wedge (q \vee r)$				
23. "For every well formed formula the number of left brackets should be equal to number of right brackets". Prove the statement.	4	2	2	1
24. Define free variables and bound variables.	4	1	3	1
25. Discuss the need of richer language.	4	1	3	1
26. State the natural deduction of FOL.	4	1	4	1
27. Draw the parse tree for the following formula $(p \wedge \Diamond(p \rightarrow \Box\neg r)) \rightarrow r$. And also find its subformula and height of the parse tree.	4	2	5	1

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
28. a. Identify whether the given formula is well-formed formula with justification.		2	1	1
(i) $p \vee (q \vee r) \rightarrow (t \wedge s)$	3			
(ii) $(p \wedge q) \rightarrow (q \rightarrow (t \rightarrow \neg s))$	2			
(iii) $p \wedge \neg p \vee (s \rightarrow t)$	2			
(iv) $p \rightarrow q \rightarrow p \rightarrow q \rightarrow (s \rightarrow t)$	2			
(v) $p \rightarrow q \wedge ((s \rightarrow q) \vee (p \rightarrow s))$	3			
(OR)				
b. Draw the truth table for the following formal and identify whether it is tautology.		1	1	1
(i) $(p \wedge q) \vee (\neg s \wedge t)$	3			
(ii) $(p \rightarrow q) \leftrightarrow \neg (q \rightarrow p)$	3			
(iii) $(p \wedge q) \leftrightarrow \neg(q \wedge r) \leftrightarrow (p \wedge r)$	3			
(iv) $(p \wedge q) \vee \neg r$	3			
29. a. State and derive the derived rules of propositional logic.	12	2	2	1
(OR)				
b. Solve the following		3	2	2
(i) $p \rightarrow (q \wedge r) \vdash (p \rightarrow q) \wedge (p \rightarrow r)$	4			
(ii) $p \rightarrow (q \vee r), q \rightarrow s, r \rightarrow s \vdash p \rightarrow s$	4			
(iii) $p(q \vee r), \neg q, \neg r \vdash \neg p$	4			