ii. Demonstrate which can be named as terms and formula with their Backus Naur Form. 8 1 3 1

(OR)

b. Consider the sentence $\phi \underline{\underline{def}} \forall_x \exists_y \exists_z \left(P(x,y) \vee P(x,z) \rightarrow P(z,x)\right)$ which of the following models satisfies ϕ. with respect to set of natural numbers. 10 4 3 2

$P^M \underline{\underline{def}} \{(m,n) \mid (m < n)\}$

$P^{M'} \underline{\underline{def}} \{(m, n*2 \mid m \text{ natural number}\}$

$P^{M''} \underline{\underline{def}} \{m,n \mid m < n+1\}$

$P^{M'''} \underline{\underline{def}} \{m,n \mid m > n-1\}$

29. a. State and explain the natural deduction of predicate logic. 10 2 4 1

(OR)

b. Solve the following

(i) $\exists_x \exists_y \phi \dashv\vdash \exists_y \exists_x \phi$

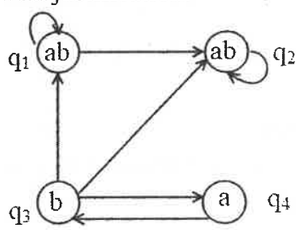
(ii) $\neg \exists_x \phi \dashv\vdash \forall_x \neg \phi$

(iii) $\exists_x \phi \vee \psi \dashv\vdash \exists_x (\phi \vee \psi)$

30. a. Demonstrate the K-model with suitable example. 10 2 5 1

(OR)

b. Consider the state transition diagram and check which of the following states satisfies. Explain with justification. 10 3 5 2



$q_4 \models XXa$

$q_3 \models Xb$

$q_1 \models \text{AF}(a \wedge b)$

$q_2 \models X(a \rightarrow b)$

$q_3 \models E(a \cup b)$

* * * * *

Reg. No.														

B.Tech. DEGREE EXAMINATION, NOVEMBER 2022

Sixth/ Seventh Semester

18CSE351T – COMPUTATIONAL LOGIC

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

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** should be answered in answer booklet.

Time: 2½ Hours Max. Marks: 75

PART – A (25 × 1 = 25 Marks) Marks BL CO PO

Answer **ALL** Questions

1. The binding priority of propositional logic is 1 1 1 1

(A) $\vee \wedge, \rightarrow, \neg$ (B) $\neg, \rightarrow, \vee \wedge$

(C) $\neg, \vee \wedge, \rightarrow \leftrightarrow$ (D) $\neg, \rightarrow \vee \wedge$

2. Symbolic representation of "B_1 is logically equivalent to Z_1" is 1 1 1 1

(A) $B_1 > Z_1$ (B) $B_1 \equiv Z_1$

(C) $B_1 \wedge Z_1$ (D) $B_1 \vee Z_1$

3. Which of the following is not true? 1 1 1 1

(A) $A \equiv \neg A$ (B) $A \leftrightarrow A$

(C) $A \rightarrow A$ (D) $A \wedge \neg A$

4. A truth table is a convenient format for displaying the _____ of formula. 1 1 1 1

(A) Statement (B) Symbol

(C) Values (D) Semantics

5. $p \rightarrow q, q \rightarrow s, s \rightarrow r \vdash$ 1 2 1 1

(A) $p \vee r$ (B) $p \wedge r$

(C) $p \rightarrow r$ (D) $\neg p \wedge \neg r$

6. If $\Sigma \vdash W$ where Σ - any set of propositions, W - any proposition, then 1 2 2 1

(A) $\Sigma \models W$ (B) $\Sigma \nvdash W$

(C) $\Sigma \not\models W$ (D) $\Sigma \equiv W$

7. In a formula $\neg p \rightarrow \left(q \rightarrow (s \vee t)\right)$. Which of the following is not a sub formula. 1 2 2 1

(A) s (B) t

(C) q (D) p

8. $A \rightarrow B$ is equivalent to 1 1 2 1

(A) $\neg A \vee B$ (B) $A \vee B$

(C) $A \vee \neg B$ (D) $\neg A \vee \neg B$

9. Propositions accepted without further questions are called as — 1 1 2 1
(A) Semantics (B) Rule
(C) Derivation (D) Axioms

10. Pick out the equation for bottom up elimination rule — 1 1 2 1
(A) $\overline{T}$ (B) $\dfrac{P,\neg P}{\bot}$
(C) $\dfrac{\bot}{P}$ (D) $\dfrac{T}{P\vee\neg P}$

11. A function with zero arity can be called as _____ function. — 1 1 3 1
(A) Algebraic (B) Nullary
(C) Predicate (D) Logic

12. Find the number of argumcnts in givcn cquation $\forall_x\forall_y P(f(x),y)$ — 1 2 3 1
(A) 0 (B) 2
(C) 1 (D) 3

13. Existential quantifiers can be denoted as — 1 1 3 1
(A) $\forall x$ (B) $\urcorner$
(C) $\leftrightarrow$ (D) $\exists x$

14. Law of remainder can be denoted as — 1 1 3 1
(A) $\forall_x X\rightarrow Y\equiv\forall_x X$ (B) $\exists_x X\rightarrow Y\equiv\forall_x X$
(C) $\forall_x X\equiv\forall_x X[x/y]$ (D) $\forall_x X[x/y]\equiv\exists_x X[x/y]$

15. If $A=B\rightarrow C$, then $I_l\vDash$ A iff — 1 1 3 1
(A) $I_l\nvDash$ B holds or $I_l\vDash$ C holds (B) $I_l\vDash$ B holds
(C) $I_l\vDash$ A holds (D) $I_l\nvDash$ A holds

16. Which one of the following is not a term? — 1 1 4 1
(A) Any variable (B) A function with zero arity
(C) Nullary function (D) A function with 1 arity

17. The deduction rule is essential proving theorems from — 1 1 4 1
(A) Constants (B) Assumptions
(C) Variables (D) Symbols

18. Completeness means that every valid formula has a — 1 1 4 1
(A) Literals (B) Variables
(C) Symbols (D) Proof

19. Validity in predicate logic is — 1 1 4 1
(A) Decidable (B) Undecidable
(C) Predictable (D) Usable

20. All conjunctions are _____ literals. — 1 1 4 1
(A) Single (B) Multiple
(C) Double (D) None

21. A state transition diagram is a — 1 1 5 1
(A) Undirected graph (B) Weighted graph
(C) Unweighted graph (D) Directed graph

22. Temporal logic is a formal system for reasoning about _____. — 1 1 5 1
(A) Velocity (B) Time
(C) Speed (D) Acceleration

23. □ can be read as — 1 1 5 1
(A) Always (B) Partially
(C) Eventually (D) Rarely

24. Transitions arc called as — 1 1 5 1
(A) Active state (B) Passive state
(C) Active structure (D) Static structure

25. CTL is _____. — 1 1 5 1
(A) Branching tree logic (B) Graph
(C) Logical (D) Hash

PART – B (5 × 10 = 50 Marks) — Marks BL CO PO
Answer **ALL** Questions

26. a. Draw the parse tree for the following formula.
(i) $\big((p\wedge q)\rightarrow(\neg q\vee s)\big)\vee t$ — 3 1 1
(ii) $\big(p\rightarrow(q\rightarrow r)\big)\wedge\big((p\wedge q)\vee s\big)$ — 2
(iii) $\big(\neg p\rightarrow\neg q\big)\rightarrow\big(\neg(p\wedge s)\rightarrow\neg t\big)$ — 3
(iv) $\neg\big(\neg(p\rightarrow q)(\wedge q\vee(s\rightarrow\neg t))\big)$ — 3

(OR)

b. Draw the truth table for the following formula and check whether it is tautology — 3 1 1
(i) $\big((p\wedge q)\vee s\big)\rightarrow q$ — 3
(ii) $(p\rightarrow q\rightarrow t)\leftrightarrow s$ — 4
(iii) $(p\wedge q)\leftrightarrow(q\wedge p)$ — 3

27. a. State and derive the derived rules of propositional logic. — 10 2 2 1

(OR)

b. Solve the following — 10 3 2 2
(i) $p\rightarrow q,s\rightarrow t\vdash(p\vee s)(q\wedge t)$
(ii) $p\rightarrow q,\neg p\rightarrow r,\neg q\rightarrow\neg r\vdash q$
(iii) $p\rightarrow(q\vee r),\neg q,\neg r\vdash\neg p$
(iv) $(p\wedge q)\rightarrow r,r\rightarrow s,q\wedge\neg s\vdash\neg p$

28. a.i. Write the need of first order logic. — 2 1 3 1