24U313 (Pages: 2) Name : ....

Reg. No : ....

THIRD SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025

(FYUGP)

CC24UMAT3FV109(2) - COMPUTATIONAL LOGIC

(Mathematics - VAC)

(2024 Admission - Regular)

Time: 1.5 Hours Maximum : 50 Marks

Credit: 3

Part A (Short answer questions)

Answer ***all*** questions. Each question carries 2 marks.

1. Obtain the DNF of the formula $F = (A \wedge (B \vee C))$. [Level:3] [CO1]
2. State True or False.Justify your answer. [Level:2] [CO1]
   a) Every Horn formula is satisfiable.
   b) A Horn clause has at most one **positive literal**.
3. Define Structure in predicate logic. [Level:2] [CO2]
4. Define free and bound variable with an example. [Level:2] [CO1]
5. Define a Herbrand Expansion. [Level:1] [CO3]
6. State Lowenheim - Skolem theorem. [Level:1] [CO3]
7. State True or False " The validity problem for formula in predicate logic is not semidecidable" . Justify your answer. [Level:2] [CO3]
8. State the lifting lemma in resolution. [Level:1] [CO4]
9. Define instance and ground instance of a formula F in predicate logic. [Level:1] [CO4]
10. State Robinson unification theorem. [Level:1] [CO4]

(Ceiling: 16 Marks)

Part B (Paragraph questions/Problem)

Answer ***all*** questions. Each question carries 6 marks.

11. Simplify the formula $((A \vee (B \vee C)) \wedge (C \vee \neg A))$ and show that it is equivalent to $((B \wedge \neg A) \vee C)$ [Level:3] [CO1]
12. Draw the truth table for $(A \wedge B) \wedge (\neg B \vee C)$. [Level:3] [CO1]

13. Prove that for each formula F in RPF, " If F is satisfiable then the Skolem form of F is satisfiable". [Level:3] [CO2]

14. For $G = \forall x \forall y Q(c, f(x), h(y, b))$ [Level:3] [CO3]

(a) Find Herbrand universe D(G) .

(b) Find a suitable Herbrand structure for G.

15. (a) State ground resolution theorem. [Level:2] [CO4]

(b) Explain the satisfiability of $\forall x((\neg P(x) \vee Q(x)) \wedge P(a) \wedge \neg Q(a))$

(Ceiling: 24 Marks)

Part C (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

16. State and prove Resolution theorem of propositional logic. [Level:3] [CO1]

17. (a) Convert the formula $F = (\forall x \exists y \forall z \exists w(\neg P(a, w) \vee Q(f(x), y))$ into skolem form and write it as clause set. [Level:3] [CO2]

(b) Describe the axiomatic method to define a theory.

(1 × 10 = 10 Marks)

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