FINAL EXAMINATION

ATTEMPT ALL THE QUESTIONS

QUESTION 1.

Define the following terms: -

a. Tautology **(2 Marks)**
b. Contradiction **(2 Marks)**
c. Proposition **(2 Marks)**
d. A directed tree **(2 Marks)**
e. A rooted tree **(2 Marks)**

QUESTION 2.

Briefly discuss what you understand by the following terms: -

a. Duality principle **(5 Marks)**
b. Normal Forms **(5 Marks)**
c. Predicate logic **(5 Marks)**
d. Modus Ponens **(5 Marks)**
e. Modus Tollens **(5 Marks)**
f. Disjunctive Syllogism **(5 Marks)**

QUESTION 3.

Write the truth table for the formula $(p \wedge q) \vee (\neg p \wedge \neg q)$ **(10 Marks)**

QUESTION 4.

Without using a truth table, show that

$((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$ is a tautology.

(10 Marks)

QUESTION 5.

Prove the following equivalences by proving the equivalences of the dual **(10 Marks)**

$$\neg((\neg P \wedge Q) \vee (\neg P \wedge \neg Q)) \vee (P \wedge Q) \equiv P$$

QUESTION 6.

Let R denotes a relation on the set of pairs of positive $N \times N$ integers such that $\langle x, y\rangle R \langle u, v\rangle$ if and only if $xv = yu$. Show that R is an equivalence relations.

(10 Marks)

QUESTION 7.

Test whether the following relations are transitive or not on

$X = \{1,2,3\}$

$R = \{\langle 1,1\rangle, \langle 2,2\rangle\}$

$S = \{\langle 1,1\rangle, \langle 1,2\rangle, \langle 2,2\rangle, \langle 2,2\rangle, \langle 2,3\rangle\}$

$T = \{\langle 1,1\rangle, \langle 1,2\rangle, \langle 1,3\rangle, \langle 2,1\rangle, \langle 2,2\rangle, \langle 2,3\rangle\}$.

(10 Marks)

QUESTION 8.

Let $X = \{1,2,3,4\}$ and $R = \{\langle x, y\rangle \mid x, y \in X\ and\ (x - y)\ is\ an\ integeral$ $non\ zeromultiple\ of\ 2\}$ $S = \{\langle x, y\rangle \mid x, y \in X\ and\ (x - y)\ is\ an\ integeral$ $non\ zeromultiple\ of\ 3\}$. Find $R \cup S$ and $R \cap S$?

(10 Marks)