Time : 3 hours Maximum marks: 80

Part A

(Answer all. Each question carries 1 mark.)

1. Define the terms: **Tautology , Proposition**
2. Define **TOSET**
3. Draw the Venn diagram of $A \cap B$, where A and B are any sets.
4. State the De Morgan's Laws
5. The contrapositive of $p \Rightarrow q$ is
6. Give an example of two non empty sets which are disjoint.

(6 x 1 = 6)

Part B

(Answer any seven questions. Each question carries 2 marks)

7. Define Partial Order Relation.
8. Let $A = \{1, 2, 3\}$ and $B = \{4, 5\}$.Find $A \times B$ and $B \times A$.
9. Let $f: X \to X$,where $X = \{x | \, x \in IR\}$ where $f(x) = 3x + 2$.
   Check whether f is one-one and onto
10. Explain Roaster form and Set Builder form with an example each.
11. Let $P = \{\phi, \{a\}, \{a, b\}, \{a, b, c\}\}$ and let $\subseteq$ be the relation of inclusion on P.Draw the Hasse diagram of $(P, \subseteq)$
12. Define an equivalence relation.
13. Define a Lattice with an example
14. Translate the given english sentence into logical form:
    (a) There exists a horse such that it can add
    (b) Every bird can fly
15. Let $P = \{\phi, \{a\}, \{a, b\}, \{a, b, c\}\}$ and let $\subseteq$ be the relation of inclusion on P.Then the GLB of $\{a\}$ and $\{a, b\}$ is
16. Let $A = \{2, 3, 4, 5, 6\}$ and $B = \{3, 4, 7, 10, 12\}$.
    (a) Then $A - B =$?
    (b) Then $B - A =$?

(7 x 2 = 14)

Part C

(Answer any five questions. Each question carries 6 marks.)

17. Prove that: $A - B = \phi$ iff $A \subseteq B$
18. Let S be any collection of sets.Then prove that the relation $\subseteq$ of set inclusion is a partial order relation on S.
19. Let D_{36} denote the set of all divisors of 36. Draw the Hasse diagram of D_{36} under divisibility.
20. Factorise $x^7 - 1$ into real factors.
21. Prove that: $cosh^2 x - sinh^2 x = 1$
22. Prove that: $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
23. Separate $log(\alpha + i\beta)$ into real and imaginary parts.
24. Let the relation R be defined on the set IN of natural numbers by $R = \{(a, b) | \ a|b\}$. Show that R is a partial ordering of IN.

(5 x 6 = 30)

Part D

(Answer any two questions. Each question carries 15 marks.)

25. Define Product Set with order and show that it is a partial order relation
26. Prove that

(a) $\overline{A \cup B} = \overline{A} \cap \overline{B}$

(b) $\overline{A \cap B} = \overline{A} \cup \overline{B}$

27. If $-1 < r < 1$, show that $\sum_{n=1}^{\infty} r^n sin(n\,x) = \frac{r\,sin\,x}{1-2r\,cos\,x+r^2}$
28. Factorise :$x^8 - 2x^4 cos\,60^\circ + 1$

(2 x 15 = 30)