

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note: Attempt five questions in all, select one question each from section A, B, C, D. Section E (Question-9) is compulsory.

Section A

(12)

1. Prove that if $p \rightarrow q$ and $\neg q \rightarrow \neg r$ are both true, then $p \rightarrow r$ is true.
2. Prove that $P(A \cap B) = P(A) + P(B) - P(A \cup B)$, where P denotes the power set of a set. Provide examples to illustrate your proof.

Section B

(12)

3. Suppose that the white tiger population of Orissa forest is 30 at time $n=0$ and 32 at time $n=1$, the increase from time $(n-1)$ to time n is twice the increase from time $(n-2)$ to time $(n-1)$, find the tiger population at time n . Hence find the tiger population when $n=6$.
4. Solve the recurrence relation $a_n = a_{n-1} + a_{n-2}$ using generating function.*

Section C

(12)

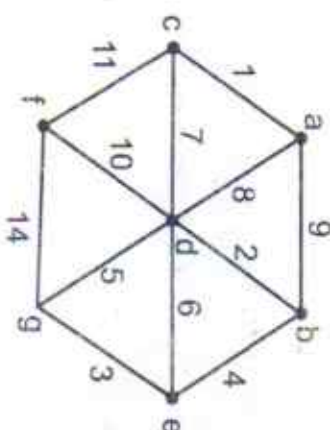
5. Define the following graph with one suitable example for each graph.
(i) Complement graph (ii) Subgraph (iii) Induced subgraph (iv) Spanning subgraph

6. Suppose a graph has vertices of degree 0, 2, 2, 3 and 9. How many edges does the graph have?

Section D

(12)

7. State and prove the fundamental theorem on homomorphism of groups.
8. Show how Kruskal's algorithm find a minimal spanning tree for the following graph



SECTION E (Compulsory)

9. a. Determine if the following graph is bipartite: $V = \{1, 2, 3, 4\}$
 $E = \{(1, 2), (2, 3), (3, 4), (4, 1)\}$
b. Define a cyclic group.
c. What is the degree of a vertex in a graph?
d. State the principle of mathematical induction.
e. Define a recursive function for the factorial of a number n .
f. Translate the following English statement into a logical expression using predicates and quantifiers: "Every student in the class has submitted their assignment." (6×2=12)