b) Solve the recurrence relation

$$a_r - 4a_{r-1} + 4a_{r-2} = (r+1)^2, r \geq 2$$

**Unit - V**

9. a) Write the definition of the following :

i) Subgraph

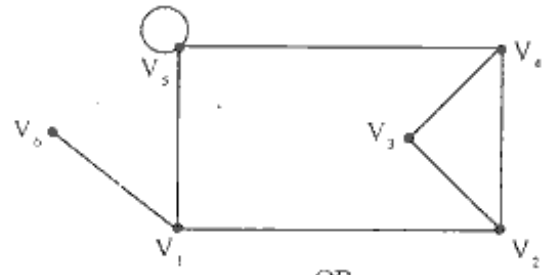
ii) Incidence and degree of graph

iii) Hamilton graph

iv) Isomorphism

v) Centre of tree

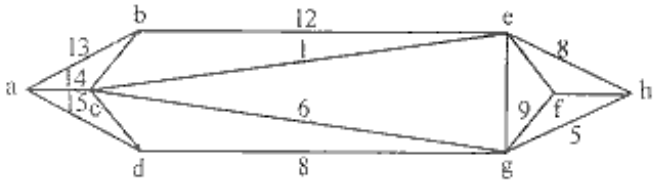
b) Write the adjacency matrix of the following graph.




OR

10. a) Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$.

b) Find the minimum spanning tree for the graph shown below using Kruskal's algorithm.

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*Total No. of Questions :10]* *[Total No. of Printed Pages :4*

**Roll No** .....

# MCTA-101

## M.E/M.Tech., I Semester

Examination, December 2013

## Mathematical Foundation of Computer Application

***Time : Three Hours***

***Maximum Marks : 70***

***Note***: Attempt any one question from each unit (inclusive of both parts). All questions carry equal marks.

**Unit - I**

1. a) If $A, B, C$ are any three sets, prove that

i) $A-(B\cap C)=(A-B)\cup(A-C)$

ii) $A-(B\cup C)=(A-B)\cap(A-C)$

b) Let $L = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24\}$ be ordered by the relation '$l$' where $x/y$ means '$x$ divides $y$'. Show that $D_{24}$ the set of all divisors of the integer 24 of $L$ is a sublattice of the lattice $(L, 1)$.

OR

2. a) Show that the relation $R = \{(a,b) : a-b$=even integer and $a, b \in I\}$ in the set I of integers is an equivalence relation.

b) Prove that the product of any invertible mapping $f$ with its inverse mapping $f^{-1}$ is an identity mapping.

## Unit - II

3. a) Prove that $(p \Leftrightarrow q) \wedge (q \Leftrightarrow r) \Rightarrow (p \Leftrightarrow r)$ is a tautology.

   b) Express the following formula into conjunctive normal form $\sim (p \vee q) \leftrightarrow (p \wedge q)$.

OR

4. a) Prove by truth table that the following is tautology $(p \Rightarrow q) \vee (r \Rightarrow p)$

   b) Distinguish between tautology and contradiction.

## Unit - III

5. a) What are the six parts of finite state machine and how machine M is denoted?

   b) Let $A = \{a, b\}$. Construct an automation $M$ which will accept precisely those words from $A$ which have an even number of a's?

OR

6. a) Minimize the finite state machine given by the following state table.

| | State | Input | | Output |
|---|---|---|---|---|
| | | 0 | 1 | |
| ⇒ | A | D | B | 1 |
| | B | E | B | 0 |
| | C | D | A | 1 |
| | D | C | D | 0 |
| | E | B | A | 1 |





   b) For the finite state machine shown below, find all equivalent states and obtain an equivalent finite state machine with the smallest number of states:

| | State | Input | | Output |
|---|---|---|---|---|
| | | 0 | 1 | |
| ⇒ | A | F | B | 0 |
| | B | D | C | 0 |
| | C | G | B | 0 |
| | D | E | A | 1 |
| | E | D | A | 0 |
| | F | A | G | 1 |
| | G | C | H | 1 |
| | H | A | H | 1 |

## Unit - IV

7. a) Determine the generating function of the numeric function $a_r$,

$$a_r = \begin{cases} 2^r, & \text{if } r \text{ is even} \\ -2^r, & \text{if } r \text{ is odd} \end{cases}$$

   b) Solve the recurrence relation $a_r - 5a_{r-1} + 6a_{r-2} = 2 + r$, $r \geq 2$ with boundary conditions $a_0 = 0$ and $a_1 = 1$.

OR

8. a) Determine the numeric function corresponding to the generating function $A(z) = \frac{1}{1 - 9z^2}$.