12. (a) Describe an efficient algorithm for comparing distances in graphs.

(b) Draw the graph represented by incidence matrix :

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

Or

(a) State and prove associative laws in Boolean algebra.

(b) Explain logical connectives :

Conjunction, Disjunction and Negative. **12**

13. (a) Discuss switching circuits along with examples.

(b) Prove that every field is an integral domain.

Subject Code—0411

M.C.A. (Second Year) EXAMINATION

(Batch 2009 Onwards)

(5 Years Integrated Course)

MATHEMATICS-II

MCA-205

Time : 3 *Hours* *Maximum Marks :* 70

Section A

Note : Attempt any *Seven* questions. **7×5=35**

1. Define a group. Show that the set $G = \left\{a + b\sqrt{2}; a, b \in Q\right\}$ is a group with respect to addition.

2. Define : Cosets, Normal Subgroup and Free-semigroup.

3. Define a grammar and language of a grammar.

4. Describe the cut-points and bridges, paths and cycles along with one example for each.

5. Draw the undirected graph corresponding to adjacency matrix :

$$\begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

6. Define partial ordering. Show that "≤" (less than or equal to) is a partial ordering on the set of positive integers.

7. Consider the set A = {4, 5, 6, 7}. Let R be the relation ≤ on A. Draw the Hasse diagram of R.

8. Let *a, b* be any elements of Boolean algebra, prove that $(a*b)' = a' + b'$

9. Construct truth table for the following :

(i) $(\sim p \wedge q)$

(ii) $(\sim p \vee \sim q)$

(iii) $\sim(p \vee q) \vee (\sim p \vee \sim q)$

10. Explain irreducible polynomials and splitting field.

Section B

Note : Attempt all the questions.

11. (a) State and prove Lagrange' theorem on groups.

(b) If H be a subgroup and K be a normal subgroup of G, prove that HK is a subgroup of G.

Or

(a) Write a short note on finite state machine.

(b) Define a subgroup. Let H be a subgroup of G, then prove that the right cosets Ha form a partition of G. **12**

Or

(a) Let $f(t) = t^4 - 3t^3 + 3t^2 + 3t - 20$, find all the roots of $f(t)$ given that $t = (1 + 2i)$ is a root.

(b) Let *a, b* be elements of Boolean algebra B, then prove that :

(i) $a + a = a$

(ii) $(a')' = a$

(iii) $0' = 1$ **11**

Or

(a) Let $f(t) = t^4 - 3t^3 + 3t^2 + 3t - 20$, find all the roots of $f(t)$ given that $t = (1 + 2i)$ is a root.

(b) Let *a, b* be elements of Boolean algebra B, then prove that :

(i) $a + a = a$

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(iii) $0' = 1$ **11**