

**UNIT – IV**

8. (a) State and explain Kleene closure using suitable examples of your own . 8  
(b) How can we convert a NFA to DFA ? 8
9. (a) What is a Moore Machine ? What is a Mealy machine ? Give two examples of both . 8  
(b) Show the relation between Regular Expressions and Transition graphs. 8

Roll No. ....

**67006**

**MCA 1st Semester (Current) CBCS**

**Scheme w.e.f. 2016-17**

**Examination – December, 2018**

**MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE**

**Paper : 16MCA-31C1**

*Time : Three Hours ]*

*[ Maximum Marks : 80*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

*Note : Attempt five questions in all, selecting one question from each Unit. Question No. 1 is compulsory. All questions carry equal marks.*

1. (a) Given  $A = \{1, 2, 3\}$  and  $B = \{a, b\}$ . Find (i)  $B \times A$  and (ii)  $B \times B$ .
- (b) Find the number of relations from  $A = \{a, b, c\}$  to  $B = \{1, 2\}$ .
- (c) Define Logical Implication.

(d) Determine truth value of following statements :

(i)  $4 + 2 = 5$  and  $6 + 3 = 9$

(ii)  $4 + 5 = 9$  and  $4 + 7 = 11$

(e) Write the dual of the statement

$$(a \wedge b) \vee a = a \wedge (b \vee a)$$

(f) Write the dual of Boolean equation

$$(a * 1) * (o + a') = 0.$$

(g) Give two Associative laws.

(h) Prove  $(a + b)' = a' * b'$ .  $8 \times 2 = 16$

### UNIT - I

2. (a) Given  $A = \{1, 2, 3, 4\}$ , draw the directed graph of relation in  $A : R = \{(1, 1), (2, 2), (2, 3), (3, 2), (4, 2), (4, 4)\}$ .

Also find  $R^2 = R \circ R$ . 8

(b) Prove that if  $R$  is an equivalence relation on a set  $A$ , then  $R^{-1}$  is also an equivalence relation on  $A$ . 8

3. (a) Let  $W = \{a, b, c, d\}$ . Determine whether each set of ordered pairs is a function from  $W$  into  $W$ . 8

(i)  $\{(b, a), (c, d), (d, a), (c, d), (a, d)\}$

(ii)  $\{(d, d), (c, a), (a, b), (d, b)\}$

(b) State and explain Lagrange's theorem. 8

### UNIT - II

4. (a) Find the truth table of  $\neg p \wedge q$ . 8

(b) Verify that the proposition  $p \vee \neg(p \wedge q)$  is tautology.

5. (a) Show that argument is a fallacy :  $p \rightarrow q, \neg p \vdash \neg q$ . 8

(b) State and explain De Morgan's Laws (theorems). 8

### UNIT - III

6. (a) Give the dual of each statements : 8

(i)  $(a \wedge b) \vee c = (b \vee c) \wedge (c \vee a)$ .

(ii)  $(a \wedge b) \vee a = a \wedge (b \vee a)$

(b) If  $A$  and  $B$  are well ordered isomorphic sets. Prove that there is only one similarity mapping  $f : A \rightarrow B$ . 8

7. (a) Let  $R$  be a ring. Let  $L$  be the collection of all ideals of  $R$ . For any ideals  $J$  and  $K$  of  $R$ ,  $J \vee K = J + K$  and  $J \wedge K = J \cap K$ . Prove that  $L$  is a bounded lattice. 8

(b) State and prove the following Boolean laws : 8

(i) Commutative

(ii) Distributive