8. (a) Define Deterministic Finite Automata (DFA) and construct a DFA that accepts the language of all strings of 0's and 1's which contains 000 as substring.

(b) Describe Moore machine with the help of example.

Roll No. .....

67011

MCA 1st Semester (with old notes)

Examination – December, 2016

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Paper : MCA-101

Time : Three Hours] *[Maximum Marks : 80*

Before answering the question, 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 at least ***one*** question from each Unit. All questions carry equal marks.

UNIT – I

1. (a) Show that the relation R defined by R = {(a, b) : a – b is divisible by 3; a, b $\in$ Z } is an equivalence relation.

(b) Prove that the function f : R $\rightarrow$ R defined as f(x) = 2x – 3 is invertible. Also find its inverse.

2. (a) Discuss the commutative and associative properties of the binary operation '*' on R defined by $a * b = a + b + ab$ for all $a, b \in R$.

(b) Define a group and show that the set {1, 2, 3, 4, 5} is not a group with respect to addition modulo 6.

UNIT – II

3. (a) Consider the following statements :

p : He is coward; q : He is lazy; r : He is rich

Write the following compound statements in the symbolic form

(i) He is coward or lazy but not rich

(ii) He is neither coward nor lazy

(b) Using truth table prove that $p \leftrightarrow q$ is equivalent to $(p \rightarrow q) \wedge (q \rightarrow p)$.

(c) Write the contrapositive and inverse of the following statement :

If today is Easter, Then tomorrow is Monday

(d) Prove that the implication $(p \wedge q) \wedge \sim (p \vee q)$ is a fallacy.

4. (a) Determine the validity of the following argument using deductive method :

If I study, then I will pass the examination. If I go to picnic, then I will study. But I failed examination. Therefore, I went to picnic.

(b) Using principle of mathematical induction prove that

$1 + 3 + 5 \ldots\ldots\ldots + (2n - 1) = n^2$ for all values of $n \in N$.

UNIT – III

5. (a) Consider the poset A = ({ 1, 2, 3, 4, 6, 9, 12, 18, 36}, /). Draw the Hasse diagram and find the greatest lower bound and least upper bound of the sets {6, 18} and {4, 6, 9}.

(b) Consider a set D = {1, 3, 5, 15}. Prove that partially order set D under the relation 'divides' is a lattice. Also draw its Hasse diagram.

6. (a) What do you mean by distributive lattice ? Consider a poset L = (1, 2, 3, 5, 30) under the relation 'divides'. Show that (L, ^, v) is a distributive lattice.

(b) Describe Boolean algebra. What are its applications ?

UNIT – IV

7. (a) Define the terms Alphabet, Kleene Closure of an Alphabet, Language and Kleene Closure of a Language with the help of example.

(b) Describe the set represented by regular expressions :
(i) $ab(bc)^*$ (ii) $(0 + 1)^*11$