(b) Explain different types of grammar with the help of example.

8. (a) Define Non-Deterministic Finite Automata (NFA) and construct a NFA to accept all string that ends with 1.

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

M CA. 1st Semester with old notes Maximum Marks Scheme 80 Examination, December–2015

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Paper–MCA-101

Time allowed : 3 hours] *[Maximum marks : 80*

Note : *Attempt* ***five*** *questions in all, selecting* ***one*** *question from each unit.*

All questions carry equal marks.

1. (a) Prove that the relation R on the set Z of all integers numbers defined by

$(x,y) \in R \Leftrightarrow X - y$ is divisible by 'n' is an equivalence relation on Z.

(b) Define compostion of function and find (i) fog(2), (ii) gof(1), (iii) fof(3) and (iv) gog(2) when $f : R \to R$; $f(x) = x^2 + 8$ and $g : R \to R$; $g(x)\ 3x^3 + 1$.

2. (a) On Z, the set of integers, a binary operation * is defined by $a * b = a + 3b - 4$. Prove that * is neither commutative nor associative on Z.

(b) Define a cyclic group. Show that the set $\{1, \omega, \omega^2\}$ is a cyclic group of order 3 with generators ω and ω^2 with respect to multiplication, where ω being the cube root of unity.

3. (a) Let p be "It is hot day" and q be "The temperature is 45° C". Write in simple sentences the meaning of the following :

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

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

(b) Using truth table prove that the following propositions are equivalent to $p \rightarrow q$

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

(ii) $\sim q \rightarrow q$

(c) Prove by constructing truth table that

$\sim p \rightarrow (p \rightarrow q)$ is a tautology.

(d) Write the converse and inverse of the following statement :

If you are mathematician then you are algebraist.

4. (a) Show that 't' is valid conclusion from the given premises

$\sim p \wedge q$, $r \rightarrow p$, $\sim r \rightarrow s$ and $s \rightarrow t$.

(b) Using principle of mathematical induction prove that

$10^{2n-1} + 1$ is divisible by 11 for all values of $n \in N$.

5. (a) Define partially ordered set. Consider a set $S = \{a, b, c\}$. Is the relation of set inclusion '$\subseteq$' is a partial order on P(S) where P(S) is a power set of S ?

(b) Consider the set $D_{50} = \{1, 2, 5, 10, 25, 50\}$ and the relation divides (/) be a partial ordering relation on D_{50}.

(i) Draw the Hasse diagram of D_{50} with relation divides.

(ii) Determine all upper bounds and lower bounds of 5 and 10.

6. Explain the following terms :

(a) Boolean algebra

(b) Bounded Lattice

(c) Distributive Lattice

(d) Complemented Lattice.

7. (a) Find the Language L(r) for the regular expressions:

(i) abb*a

(ii) a (a+b)* ab