MCA/IIIS/302/13

MCA 3rd Semester Examination, 2013

THEORY OF FORMAL LANGUAGE AND AUTOMATA

PAPER – 302

Full Marks : 100

Time : 3 hours

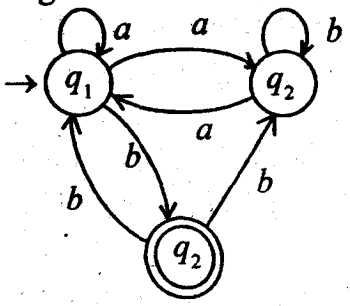
Answer any **five** questions

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. (*a*) Find the deterministic acceptor equivalent to the following NFA : 7



(*b*) Define Moore machine. How does a mealy machine differ with it ? 2 + 1

(*c*) Construct a DFA accepting all strings w over $\{0, 1\}$ such that the number of 1's in w is always divisible by 3. 4

2. (*a*) Construct a context free grammar generating $L = \{a^m b^n \mid m > n, m, n \geq 1\}$. 7

(*b*) Classify grammar according to Chomsky. Define each one with suitable examples. 7

3. (*a*) Construct a finite Automaton (FA) equivalent to the regular expression : 7

$$(1 + 00^*1) + (1 + 00^*1)(0 + 10^*1)^*(0 + 10^*1)$$

(*b*) Construct a regular grammar G generating the regular set represented by

$$P = a^*b(a + b)^*$$ 4

(*c*) Find the regular expression over $\{a, b\}$. For the set of all strings containing the substring aa. 3

4. (*a*) Find a reduced grammar equivalent to the following grammar : 7

$S \rightarrow aAa \mid D$

$A \rightarrow bBB$

$B \rightarrow ab$

$C \rightarrow aB$

$D \rightarrow cE$

(*b*) Show that the set $L = \{a^{i^2} \mid i \geq 1\}$ is not regular. 7

5. (*a*) Consider the grammar G whose productions are : 7

$S \rightarrow aS \mid AB$

$A \rightarrow \wedge$

$B \rightarrow \wedge$

$D \rightarrow b$

construct an equivalent grammar G_1 without null production.

(*b*) What do you mean by Ambiguous Grammar ? Determine if the following grammar is ambiguous or not : 2 + 5

$S \rightarrow OB \mid 1A$

$A \rightarrow O \mid OS \mid 1AA$

$B \rightarrow 1 \mid 1S \mid OBB$

6. (*a*) Reduce the following grammar to CNF : 7

$S \rightarrow aAD$

$A \rightarrow aB \mid bAB$

$B \rightarrow b$

$D \rightarrow d$

(*b*) Construct a grammar in Greibach Normal Form (GNF) equivalent to the grammar : 7

$S \rightarrow AA \mid a$

$A \rightarrow SS \mid b.$

7. Construct PDA's that accept the following languages on $\Sigma = \{ a, b \}$

(*i*) $L = \{ w \in \{a, b\}^*, \ h_a(w) = h_b(w) \}$

(*ii*) $L = \{a^n b^{2n} : n \geq 0\}.$ 7 + 7

8. (*a*) Design a Turing Machine that accepts $\{ 0^n 1^n \mid n \geq 1 \}$. 7

(*b*) Design a Turing Machine that copies strings of 1's. 7

[*Internal Assessment* : 30]