Total No. of Questions—**12**] [Total No. of Printed Pages—**4÷2**

Seat No.	

T.E. (Information Technology) (I Sem.) EXAMINATION, 2014

THEORY OF COMPUTATION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Answer any *three* questions from each Section.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Design a FSM to check given decimal number is divisible by 4 or not. [8]

(*b*) Prove that : [8]

(*i*) $(111^*)^* = (11 + 111)^*$

(*ii*) $(0^*1^*)^* = (0 + 1)^*$

P.T.O.

Or

2. (*a*) Describe in simple english the language defined by the following regular expressions : [8]

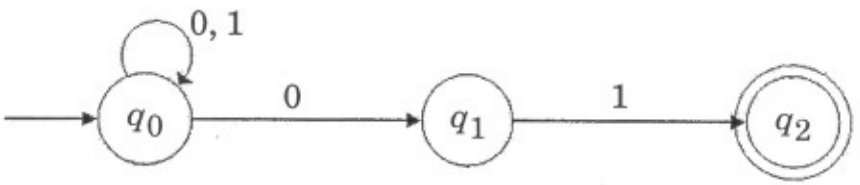
(*i*) $(a + b)^* \; aa(a + b)^{**}$

(*ii*) $(b + ba)^*$

(*iii*) $a(a + b)^*b$

(*iv*) $a + b^*c+$

(*b*) Construct RE by using Arden's Theorem for given DFA. [8]



3. (*a*) Construct NFA for given RE $(a + b)^* \; (aa + bb)$ and find equivalent DFA. [8]

(*b*) Construct Moore and convert it to Mealy Machine for 2's complement of any binary number. [8]

Or

4. (*a*) The transition table of a NFA is given below. Construct a DFA equivalent to it. [8]

δ_{NFA} is

	0	1	2
q_0	q_1, q_4	q_4	q_2, q_3
q_1	—	q_4	—
q_2	—	—	q_2, q_3
q_3	—	q_4	—
q_4	—	—	—

(*b*) (*i*) Compare NFA and DFA [8]

(*ii*) Compare Moore and Mealy machine

(*iii*) Limitations of FSM.

5. (*a*) Find CNF for the given CFG : [8]

$$S \rightarrow 0S1 \ S|1S0S|\varepsilon$$

(*b*) Prove that the following grammar is ambiguous and obtain unambiguous grammar. Consider w = ibtibtaea. [10]

$S \rightarrow iCtS$

$S \rightarrow iCtSeS$

$C \rightarrow b,$

$S \rightarrow a$

Or

6. (*a*) Find CFL defined by the following CFG : [8]

(*i*) All binary strings with equal no. of *a*'s and *b*'s.

(*ii*) All binary strings with no. of *a*'s are even.

(*b*) Simplify the following Grammar : [10]

$S \rightarrow Aa \mid bS \mid \varepsilon$

$A \rightarrow aA \mid bB \mid \varepsilon$

$B \rightarrow aA \mid bc \mid \varepsilon$

$C \rightarrow aC \mid bc$

SECTION II

7. (*a*) State and explain Pumping Lemma for CFLs. [6]

(*b*) If L_1 and L_2 are context-free languages over an alphabet Σ, then : [10]

$L_1 \cup L_2$,

$L_1 \cdot L_2$

and L^* are also CFLs.

Or

8. (*a*) Convert the following right linear grammar to left linear grammar : [8]

$S \rightarrow 0A \mid 1B$

$A \rightarrow 0C \mid 1A \mid 0$

$B \rightarrow 1B \mid 1A \mid 1$

$C \rightarrow 0 \mid 0A$

(*b*) Construct FA for the following grammar : [8]

$S \rightarrow Ab \mid ab$

$A \rightarrow Ab \mid Bb$

$B \rightarrow aB \mid a$

9. (*a*) Design a PDA to accept the language : [8]

$$L = \{a^n b^n \mid n >= 0\}$$

(*b*) Construct a PDA that accepts the language generated by the following grammar : [8]

$S \rightarrow aA$

$A \rightarrow aABc \mid bB \mid a$

$B \rightarrow b$

$C \rightarrow c$

Or

10. (*a*) Construct the PM that accepts the language : [8]

$$L = \{a^n b^n \mid m,\ n >= 1\}$$

(*b*) Construct the PDA that accepts the language : [8]

$$L = \{a^n b^m c^n \mid m,\ n >= 1\}$$

11. (*a*) Construct TM to calculate $a - b$ where $b > 0$ and a, b both are Unary Numbers. [10]

(*b*) Construct TM to replace 110 by 001 in any input binary strings. [8]

Or

12. (*a*) Write short notes on : [10]

(*i*) Multi Tape TM

(*ii*) Universal TM.

(*b*) Construct TM for addition of two unary numbers. [8]