Government College of Engineering, Aurangabad

(An Autonomous Institute of Government of Maharashtra)

T.E. (CSE) Examination

End Semester Examination Nov 2016

CS 343: Theory of Computation

Time: Three Hours 17 NOV 2016 *Max Marks: 60*

"Verify the Course Code and check whether you have got correct question paper"

N.B:-

1. All questions are compulsory

2.Figures to the right indicate full marks

3.Assume suitable data if necessary and state it clearly

4.Use of non-programmable calculator is allowed

Q.1 Solve any Three **[15]**

a. Discuss different types of grammars and languages with proper example.

b. Define pumping lemma for Regular Language & Context Free Language.
Categorize following languages as regular or Context free with appropriate reason
1. $L=\{a^n b^n / 0<n<5\}$ 2. $L=\{a^n b^n / n>=0\}$

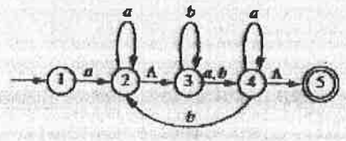
c. Differentiate between Finite Automata and Push Down Automata with suitable example

d. Show that the following grammar is ambiguous
$S \rightarrow aSbS \mid bSaS \mid \wedge$

e. Discuss Variations of Turing Machine.

Q.2 Solve any Four **[20]**

a. Given a transition diagram of an NFA-^. For each string below say whether the NFA-^ accepts it or not
i] aba ii] abab iii] aaabbb iv] abbbbb v]aabbaba



b. Consider the CFG with productions
$S \rightarrow aSbScS \mid aScSbS \mid bSaScS \mid bScSaS \mid cSaSbS \mid cSbSaS \mid \wedge$
Does this generates the language $\{ x <- \{ a,b,c \}^* \mid n_a(x) = n_b(x) = n_c(x) \}$?

c. For the given PDA draw the computation tree showing all possible sequences of moves for the two input strings abb and aab.

Move Number	State	Input	Stack Symbol	Move(s)
1	q_0	a	Z_0	(q_1, aZ_0)
2	q_1	a	a	(q_1, aa)
3	q_1	b	a	(q_2, Λ)
4	q_2	b	a	(q_2, Λ)
5	q_2	Λ	Z_0	(q_3, Z_0)
	(all other combinations)			none

d. Show the ID's of the Turing Machine given below if the input tape contains
i) 111000 ii)0011

State	Symbol 0	1	X	Y	B
q_0	(q_1, X, R)	–	–	(q_3, Y, R)	–
q_1	$(q_1, 0, R)$	(q_2, Y, L)	–	(q_1, Y, R)	–
q_2	$(q_2, 0, L)$	–	(q_0, X, R)	(q_2, Y, L)	–
q_3	–	–	–	(q_3, Y, R)	(q_4, B, R)
q_4	–	–	–	–	–

e. Find a regular expression over {0,1}*that denotes
i] all strings ending in 01
ii] all strings not ending in 01

Q.3 Solve any two **[10]**

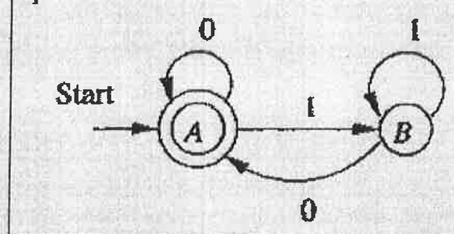
a. Find a grammar for a certain type of scientific notation for real numbers on which the following rules hold:
i] The number can be preceded by a + or – sign , or the sign may be absent.
ii] Numeric values must be of the form a.b1b2…n , where bi is any digit , but a must be a nonzero digit.
iii]The number may be followed by an exponent field of the form e +yy or e –yy , where y can be any digit.

b. Find a grammar that generates the language L= { ww^R : w<-{a, b}$^+$ } Give complete justification for your answer

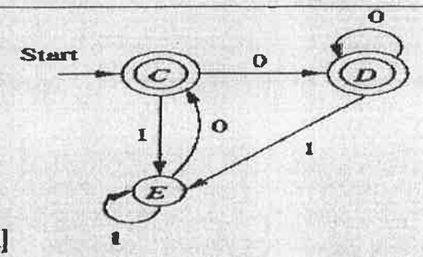
c. Define CFG. Find a Context Free Grammar generating the given languages
i. The set of even length strings in {a,b}* with two middle symbols equal.
ii. The set of even or odd palindrome strings

Q.4 Identify the languages accepted by following Finite automata/Push down Automata/Turing Machine/ Grammar **[5]**

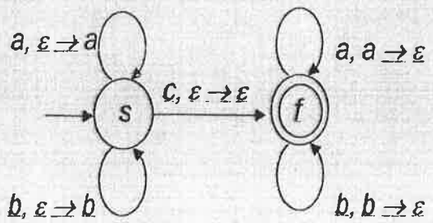
i]



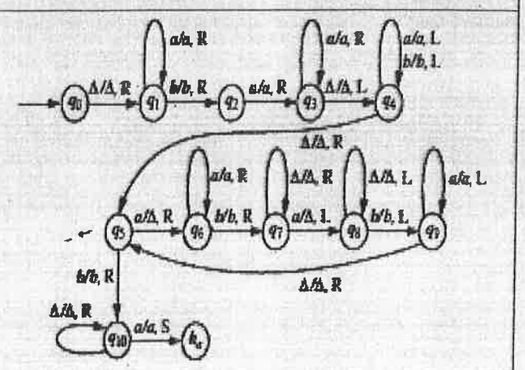
ii]



iii]



iv]



v] S → aSAb/ ^
A→ bA / ^

Q.5 Solve any Two **[10]**

i] Construct Deterministic Finite Automata for the following Language
L={ aa* + aba*b*}

ii] Describe Push Down Automata for L = { w : $n_a(w) + n_b(w) = n_c(w)$ }

iii] Construct a Turing Machine that will accept the following language on {a, b}
L= { $a^n b^n$: n ≥1}