Year and Program: 2019-20	**School of Technology**	**SY B. Tech.**
B. Tech. Computer Science & Engg.	**Department of Computer Science & Engg.**	**Semester – IV**
Course Code: CST202	**Course Title: Theory of Computation**	
Day and Date: Monday		
Time: 30/12/19	**End Semester Examination (ESE)**	**Max Marks: 100**

3hr 10.30amto 1.30pm.

Instructions:
1) All questions are compulsory.
2) Assume suitable data wherever necessary.
3) Figures to the right indicate full marks.

		Marks	Bloom's Level	CO
Q.1	**Attempt following**			
A	$\Sigma = \{0,1\}$ and $L = \{w \mid w$ starts with $01\}$. Give formal definition and transition table for M. List strings in the language L. Construct finite automaton M accepting L.	**07**	L1	CO1
	-- OR --			
	Give regular expressions for i) The language of strings in $\{0, 1\}^*$ with an odd number of 0 ii) The language of strings in $\{a, b\}^*$ starting with letter 'a' iii) $L = \{ 00,01,10,11 \}$ iv) $L = \Sigma^*$, $\Sigma=\{0,1\}$	**07**	L3	CO1
B	Find $\delta^*(1, aba)$ for following NFA-null.	**08**	L3	CO1

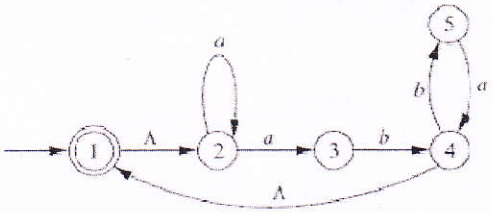


Fig. 1

-- OR --

	Draw NFA by applying Kleene's theorem for $L = (00+01)^*01$.	**08**	L3	CO1
Q.2	**Attempt following**			
A	Give recursive definition, formal definition and grammar rules for i) $L = \{$Palindromes based on $\Sigma = \{a,b\}\}$ ii) $L = \{ x \mid n_a(x) = n_b(x) \}$ and $x \in \{a,b\}^*$	**07**	L3	CO2

-- OR --

Explain the term - ambiguous grammar. Prove that following grammar G is ambiguous. Draw derivation trees. **07** L3 CO2

$$E \rightarrow a \mid E + E \mid E * E \mid (E)$$

B Describe working of top-down parser for language L having strings of balanced parenthesis. L is expresses by grammar rules. **08** L2 CO3

$S \rightarrow [S] \mid SS \mid \wedge$

-- OR --

Illustrate the processing of the string $a + a * a \$$ by a bottom-up PDA based on following grammar rules : **08** L3 CO3

$S \rightarrow S_1\$$

$S_1 \rightarrow S_1 + T \mid T$

$T \rightarrow T * a \mid a$

Q. 3 Attempt any TWO

A Construct finite automaton for the L having Σ = {a, b} that contains strings ending with "aa". Give formal definition of the automaton. **08** L3 CO1

B Explain Kleene's theorem part-I with examples. **08** L2 CO1

C Convert following grammar to Chomsky Normal Form **08** L4 CO2

S → TU | V T → aT b | ^

U → cU | ^ V → aVc | W W → bW | ^

D Design the PDA to accept language L = { $a^n b^n \mid n >= 0$ }. **08** L4 CO2

Q. 4 Attempt any TWO

A State pumping lemma property of CFL. Illustrate if CFL is closed under the operations of union, concatenation, Kleene*, intersection and complement. **09** L3 CO5

B Justify that L = {$a^i b^i c^j \mid j>=i$} is not a CFL. **09** L4 CO4

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C	Prove that L=(xx | x belongs to {a,b}* } is not CFL by using pumping lemma property.	09	L3	CO4

Q. 5 Attempt any TWO

A	Demonstrate the working of Turing machine to accept the language L having regular expression (a+ b)*ab.	09	L3	CO5
B	Describe variants of basic Turing machine.	09	L2	CO5
C	Draw a Turing machine to compute N mod 2 for a number N represented in unary format.	09	L3	CO5

Q.6 Attempt any THREE

A	Explain with examples the hierarchy of formal languages. Draw the Venn diagram of the hierarchy.	06	L2	CO4
B	Design a TM to find 1's complement of binary number.	06	L3	CO5
C	Describe working of basic Turing machine model proposed by Turing.	06	L2	CO5
D	Explain the concept of Universal Turing Machine.	06	L2	CO5

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