



(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 110407**

Roll No.

--	--	--	--	--	--	--	--	--	--

**B. Tech.**

(SEM. IV) THEORY EXAMINATION, 2014-15

**THEORY OF AUTOMATA & FORMAL LANGUAGES**

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions. All questions carry equal marks.

1 Attempt any four parts of the following. **5x4=20**

(a) Let  $L_1$  be some language over  $\Sigma$  and  $L_2 = \Phi$ .

Then prove that

(i)  $L_1.L_2 \neq L_1$  (ii)  $L_1+L_2 \neq \Phi$

(b) For regular expression prove that,  $(a+b)^* \neq a^*+b^*$

(c) Construct a DFA accepting all strings over alphabet set  $\Sigma = \{0,1\}$  that are ended with 00.

(d) Describe the language to the given regular expression

$(1+01)^*(0+01)^*$

(e) Define the language of a NFA with  $\epsilon$ -moves.

(f) Describe the language accepted by the following finite automaton.

State	Input Symbol	
	a	b
$\rightarrow P$	Q	R
*Q	R	P
R	R	R

2 Attempt any two parts of the following. **10x2=20**

(a) What is a regular expression? Construct a DFA for the regular expression  $(00+001)^*1$ .

(b) Prove that the given set of language is not regular.

$$L = \{0^n 1 0^n \mid n \geq 1\}$$

(c) Describe the closure properties of regular languages. Prove that regular languages are closed under complementation.

3 Attempt any two parts of the following. **10x2=20**

(a) Construct the context free language (CFL) for the language  $\{a^n b^n \mid n \geq 0\}$ .

(b) Prove that the given language L is derived from a context free grammer.

$$L = \{a^i b^j c^j \mid i, j \geq 1\}$$

(c) (i) Show that the CFG with productions

$$S \rightarrow a \mid S a \mid b S S \mid S S b \mid S b S$$

is ambiguous.

(ii) Prove that every regular language is a CFL.

4 Attempt any two parts of the following. **10x2=20**

(a) Define a push down automation (PDA). Describe the language of a PDA.

(b) Construct the PDA for the language  $L = \{wcw^R \mid w \text{ in } \{a,b\}^*\}$ , where R stands for reverse string.

(c) Let G be a CFG and its language is L(G). How do you decide that L (G) is finite ?

5 Attempt any two parts of the following. **10x2=20**

(a) Define a Turing machine. Construct a Turing machine for the language

$$L = \{w c w \mid \{a,b\}^*\}$$

(b) Construct a Turing machine for the integer function that computes addition of two integers, i.e., if  $x$  and  $y$  are two integers then  $f(x,y) = x + y$ .

(c) Define the recursive language. Do you agree that every recursive language is recursive enumerable? Justify your answer.

---