CS/IT 313

Hall Ticket Number:

III/IV B.Tech (Supplementary) DEGREE EXAMINATION

March, 2017 **Common for CSE & IT**

Fifth Semester **Automata Theory & Formal Languages**

Time: Three Hours **Maximum :** 60 Marks

Answer Question No.1 compulsorily. (1X12 = 12 Marks)

Answer ONE question from each unit. (4X12=48 Marks)

1 Answer all questions (1X12=12 Marks)

a) What are the Components of Finite Automata Model?
b) List the operations on Strings and Languages?
c) Draw an NFA accepting the set of all strings whose second symbol from last is 1.
d) Give the DFA accepting the language over the alphabet 0, 1 that have the set of all strings such that the no. of zero's is divisible by 5 and the no. of 1's is divisible by 3.
e) What are the operators of Regular Expressions?
f) Write Regular Expression for the language that has the set of all strings of 0's and 1's such that no prefix has two more 0's than 1's, not two more 1's than 0's.
g) What is Arden's Theorem?
h) What are the uses of Context free grammars?
i) State the equivalence of acceptance by final state and empty stack.
j) State the pumping lemma for CFL's.
k) Define Modified PCP?
l) What properties of recursive enumerable sets are not decidable?

UNIT I

2 a) Construct NFAs for the following languages

i. The set of strings over alphabet {0,1,.....,9} such that the final digit has appeared before.
ii. The set of strings over alphabet {0,1,.....,9} such that the final digit has not appeared before.
iii. The set of strings of 0's and 1's such that there are two 0's separated by a number of positions that is a multiple of 4. Note that 0 is an allowable multiple of 4. 6M

b) Construct deterministic finite automata DFA, equivalent to the NFA given below. M=({q0,q1,q2,q3},δ,q0,{q3}), where δ is defined in the following transition table

δ	0	1
q_0	$\{q_0,q_1\}$	$\{q_0\}$
q_1	$\{q_2\}$	$\{q_1\}$
q_2	$\{q_3\}$	$\{q_3\}$
q_3	φ	$\{q_2\}$

6M

(OR)

3 a) Design DFA for the following over {0,1} 4M

i. All string containing not more than three 0's
ii. All strings that has at least two occurrences of 1 between any two occurrences of 0

b) Consider the following ε-NFA 8M

	ε	a	b	c
→p	φ	{p}	{q}	{r}
q	{p}	{q}	{r}	φ
r	{q}	{r}	φ	{p}

i. Compute ε-closure of each state
ii. Give all the strings of length three or less accepted by the automaton

UNIT II

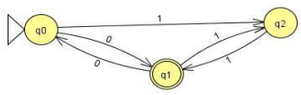
4 a) Construct transition diagram of a finite automaton corresponding to the regular expression (ab+c*)*b. 6M

b) Construct a minimum state automaton equivalent to a given automaton M whose transition table is given below.(where * indicates final state) 6M

State	Input	
	a	b
$\rightarrow q_0$	q_0	q_1
q_1	q_2	q_5
q_2	q_3	q_4
q_3	q_0	q_5
q_4	q_0	q_6
q_5	q_1	q_4
q_6*	q_1	q_3

(OR)

5 a) Obtain the regular Expression denoting the language accepted by the following DFA 8M



b) Find whether the languages (ww , w is in (1+0)*} and $\{1^k \mid k=n^2, n>=1\}$ are regular or not. 4M

UNIT III

6 a) Write the CFG to generate the set $\{a^m b^n c^p \mid m + n=p$ and $p>=1.\}$ 4M

b) Construct the grammar for the following PDA. 8M

M= ($\{q_0, q_1\}$,{0,1},δ,q_0,z_0, Φ) and where δ is given by

$\delta(q_0,0,z_0) = \{(q_0,Xz_0)\}$ $\delta(q_0,0,X) = \{(q_0,XX)\}$

$\delta(q_0,1,X) = \{(q_1,\varepsilon)\}$ $\delta(q_1,1,X) = \{(q_1,\varepsilon)\}$

$\delta(q_1,\varepsilon,X) = \{(q_1,\varepsilon)\}$ $\delta(q_1,\varepsilon,z_0) = \{(q_1,\varepsilon)\}$

(OR)

7 a) Let G be the grammar S->aS/aSbS/ ε. Prove that L (G)={x/each prefix of x has at least as many a's as b's} 4M

b) Explain the Construction of an equivalent grammar in CNF for the grammar G = ({S,A,B},{a,b},P,S) where P= {S->bA|aB, A->bAA|aS|a, B->aBB|bS|b} 8M

UNIT IV

8 a) State Pumping lemma for context free language σ show that language $\{a^i b^j c^i d^j / i>=1$, and $j>=1\}$ is not context-free. 6M

b) Construct turing machine for the language $L=\{a^n b^n c^n | n \geq 1\}$over the alphabet {a,b,c}. 6M

(OR)

9 a) Find whether the following languages are recursive or recursively enumerable.

(i) Union of two recursive languages.

(ii) Union of two recursively enumerable languages.

(iii) L if L and complement of L are recursively enumerable. 6M

(iv)L_u

b) Let ∑={0,1}.Let A and B be the lists of three strings each, defined as

	List A	List B
i	Wi	Xi
1	1	111
2	10111	10
3	10	0

6M

Does this PCP have a solution?