ROLL NO.

## AMIETE – CS

Time: 3 Hours

**JUNE 2013** 

Max. Marks: 100

#### PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

#### Q.1 Choose the correct or the best alternative in the following:

 $(2 \times 10)$ 

- a. The grammar with production rules
  - $\{S \longrightarrow aab/bac/ab$  $S \longrightarrow abb/ab$  $S \longrightarrow aS/b$
  - $B \longrightarrow bab/b$  is
  - (A) CFG(B) Regular(C) Context Sensitive(D) None of these
- b. Which of the following is not regular:
  - (A) String of 0's whose length is a perfect square
  - (B) Set of all palindromones made up of 0's and 1's
  - (C) Strings of 0's, whose length is a prime number
  - (**D**) All of these
- c. The recognizing capability of Nondeterministic FSM and corresponding deterministic FSM

A) may be different	( <b>B</b> ) must be different
C) must be same	( <b>D</b> ) none of these

d. In context free languages, state the size of parse tree, if the length of longest path is n

(A) $2^{n-1}$	<b>(B)</b> 2 <sup>n</sup>
( <b>C</b> ) n	( <b>D</b> ) none of these

e. Which of the following pairs of regular expressions are equivalent?

(A) $1(01)^*$ and $(10)^*$	<b>(B)</b> $y(yy)^*$ and $(yy)^* y$
(C) $y + and y^*y +$	( <b>D</b> ) All of these

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	f.	Context free Grammar is not closed under			
		<ul><li>(A) Union</li><li>(C) Complementations</li></ul>		<ul><li>(B) Kleen star</li><li>(D) Concatenation</li></ul>	
	g.	The set A = { $a^n b^n a^n / n = 1, 2, 3$ } is an example of a grammar that is			
		<ul><li>(A) Regular</li><li>(C) Context Sensitive</li></ul>		<ul><li>(B) Context free</li><li>(D) None of these</li></ul>	
	h.	. Let $G = \{s\}, \{a, b\}, \{S \rightarrow GS   b, S\}$ find language generated by G			
		$(\mathbf{A}) \operatorname{L}(\operatorname{G}) = \phi$		<b>(B)</b> $L(G) = a^n b$	
		( <b>C</b> ) $L(G) = a^*$		$(\mathbf{D}) L(G) = a^n b^{a^n}$	
	i.	i. $L = \{ a^p   P \text{ is a prime} \}$ is			
		<ul><li>(A) Regular</li><li>(C) Accepted by DFA</li></ul>		<ul><li>(B) Not a regular</li><li>(D) Accepted by PDA</li></ul>	
	j.	. Grammar S $\rightarrow$ aAb, A $\rightarrow$ aAb   a is in			
		<ul><li>(A) L R(1) not in LR(0)</li><li>(C) LR(0) but not in LR(1)</li></ul>		<ul><li>(B) both LR(0) and LR(1)</li><li>(D) neither in LR(0) not in LR(1)</li></ul>	
Answer any FIVE Questions out of EIGHT Questions. Each question carries 16 marks.					
Q.2	a.	Use mathematical induction	to prov	e that for all positive integers n, (8)	
		$n(n^2 + 5)$ is an integer multiple of 6.			
	b.	. Define the terms - alphabet, power of alphabet, string and language. Provide one example for each. (8)			
Q.3	a.	For the following NFA, find the equivalent DFA. (8)			
			0	1	
		$\rightarrow$ q <sub>0</sub>	$\{q_0, q_1\}$	$\left\{ \mathbf{q}_{0}\right\}$	
		q <sub>1</sub>	$\{q_2\}$	$\{q_2\}$	
		$q_2$	{q <sub>3</sub> }	{q <sub>3</sub> }	
		q <sub>3</sub>	φ	φ	
	h	Write regular expression for	tha lan	guage defined over alphabet (a, b) as "The	

b. Write regular expression for the language defined over alphabet {a, b} as "The set of strings having at most one pair of consecutive a's and at most one pair of consecutive b's.

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**Q.4** a. Describe the languages accepted by the following DFAs

(8)



- b. Show that concatenation of two regular expression is a regular expression. (8)
- Q.5 a. Prove following is not a regular language:  $L = \{xx^{R} | x \in \{0,1\}^{+}\}$ (8)

b. If L is a Regular language then show that reverse of L i.e.  $L^{R}$  is also regular.

(8)

**Q.6** a. Let 
$$L = \{a^n b^n c^m d^m \mid n, m \ge 1\}$$
. Draw a PDA that accepts L. (8)

b. Define a Context Free Grammar that generates the language: (8)  $L = \left\{ a^{i}b^{j}c^{k}d^{\ell} \middle| i, j, k, \ell \ge 1, i = \ell, j = k \right\} Draw a PDA that accepts L.$ 

Q.7 a. Prove that the following language is not context free, (8)  

$$L_1 = \{a^p | p \text{ is a prime}\}$$

- b. What is Chomsky Normal form? Explain how a grammar can be put in CNF. Use an example to illustrate. (8)
- **Q.8** a. Consider the following TM M' with transitions as follows:  $\delta(q_0, 1) = (q_1, 0, R)$   $\delta(q_1, 1) = (q_1, 1, R)$   $\delta(q_1, 0) = (q_2, 1, R)$   $\delta(q_2, 0) = (q_3, 0, L)$   $\delta(q_3, 0) = (q_0, 0, R)$  $\delta(q_3, 1) = (q_3, 1, L)$

 $q_0$  is the initial state and 0 is taken as blank symbol. Trace the sequence of moves when the machine scan starts on ...00 1111 000 11 00...

b. Construct a TM with three character 0, 1, and # which locates a '1'under the following conditions. There is only one # on the tape and somewhere to the right of it is a '1'. The rest of the tape is blank. The head starts at or to the left of the #. When the TM halts, the tape is unchanged and head stops at the '1'. Zero is taken as the blank symbol.

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- Q.9 a. Define a Recursively Enumerable language. Give an example of it. Give an example of a language that is not recursively enumerable.(8)
  - b. Show that the following problem is undecidable. (8) "Given  $x_1, x_2$  and  $x_3$  determine whether  $f(x_1) = \pi^2(x_2, x_3)$ , where f is a fixed non total recursive function and  $\pi^2$  is cantor numbering function".