B.Tech II Year II Semester (R09) Supplementary Examinations May/June 2016

FORMAL LANGUAGES \& AUTOMATA THEORY
(Computer Science \& Engineering)
Time: 3 hours
Max. Marks: 70

> Answer any FIVE questions
> All questions carry equal marks
> $* * * * *$

1 Draw a DFA that recognizes the language of all strings of 0's and 1's for length $\geq 1$ that, if they were interpreted as binary representations of integers, would represent integers evenly divisible by 3. Leading 0's are permissible.

2 Prove the theorem 'Let L be a set accepted by non-deterministic finite automata, then there exists a DFA that accepts L'.

3 Using the pumping lemma show that each of these languages is not regular:
(a) $L=\left\{a^{n} b a^{2 n} \mid n>=0\right\}$.
(b) $L=\left\{a^{i} b^{i} c^{c} \mid k>i+j\right\}$.

4 (a) Construct CFG without $\in$ production form $\mathrm{S} \rightarrow \mathrm{a}|\mathrm{Ab}| \mathrm{aBa}, \mathrm{A} \rightarrow \mathrm{b}|\in, \mathrm{B} \rightarrow \mathrm{b}| \mathrm{A}$.
(b) Explain the relationship between derivation and derivation tree with an example.

5 (a) Show that the Context Free Languages are not closed under intersection.
(b) State whether $\mathrm{S} \rightarrow \mathrm{aSbS} / \mathrm{bSaS} / \epsilon$ is ambiguous or not. Support your answer by giving any two examples.

6 (a) Show that if $L$ is accepted by a PDA in which no symbols are ever removed from the stack, then $L$ is regular.
(b) Design a PDA for recognizing $\mathrm{L} \stackrel{\rightleftharpoons}{\rightleftharpoons} \mathrm{a}^{\mathrm{h}} \mathrm{b}^{\mathrm{j}} / \mathrm{j}<=\mathrm{i}$ and $\left.\mathrm{i}, \mathrm{j}>0\right\}$. Show the moves of the PDA for the string 'aabb'.

7 Write short notes on:
(a) Multitape TMs.
(b) Universal TM.
(c) Counter machine.

8 (a) Define P and NP problems with examples.
(b) What is PCP? Explain why PCP with two lists $x=(01,1,1)$ and $y=(0101,10,11)$ has no solution.

