

Roll No.

23067

**M. Tech. 1st Semester
(Computer Sc. Engg.)
Examination-May, 2015**

**MATHEMATICAL FOUNDATION OF
COMPUTER SCIENCE**

Paper : MTCE-603-A

Time : 3 hours

Max. Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard will be entertained after the examination.

Note : Attempt any **five** questions. All questions carry equal marks.

1. (a) What do you mean by PDA ? How are PDA different from FA ? Also discuss some applications of PDA.

- (b) Design a pushdown automata for the following language = $\{a^n b^{2n} : n > 0\}$
2. (a) Design a Turing Machine to accept the language $L = \{0^n / n \geq 1\}$
- (b) Discuss Halting problem of Turing machine.
3. (a) Let G be $S \rightarrow AB$, $A \rightarrow a$, $B \rightarrow C|b$, $C \rightarrow D$, $D \rightarrow E$ and $E \rightarrow a$. Eliminate unit production and get an equivalent grammar.
- (b) Reduce the following grammar to CNF
 $S \rightarrow ASA|bA$, $A \rightarrow B|S$, $B \rightarrow c$.
4. (a) Using the concept of Pumping Lemma prove that the set $L = \{0^i 1^j | i \geq j\}$ is not regular
- (b) State and prove Rice's theorem.

5. What is primitive recursive function ?
Explain. Show that $f(x,y) = x + y$ is a primitive recursive function.

6. Write and briefly explain the characteristics of each class of grammar classified according to Chowmsky Hierarchy. Determine the type of the grammar G.

(i) $S \rightarrow aA, A \rightarrow aAB, B \rightarrow b, A \rightarrow a$

(ii) $S \rightarrow aAB, AB \rightarrow C, A \rightarrow b, B \rightarrow AB$

7. Explain :

(i) Linear bounded Automata

(ii) Universal Turing Machine

8. (a) Construct FA equivalent to following regular expression : $(0 + 1)^* (00 + 11) (0 + 1)^*$

(b) What is the difference between NFA and DFA. Given NFA is

δ/Σ	A	b
$\rightarrow q_0$	(q_0, q_1)	(q_2)
q_1	(q_0)	(q_1)
q_2	$\textcircled{1}$	(q_0, q_1)

Convert it into DFA.
