Code: 13A05404 **R13**

B.Tech II Year II Semester (R13) Supplementary Examinations December/January 2015/2016

FORMAL LANGUAGES & AUTOMATA THEORY

(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) Give the mathematical definition of the grammar.
(b) What is context sensitive grammar.
(c) Describe the language generated by the regular expression :$(b + ab)^*(\epsilon + a)$.
(d) State the Arden's theorem.
(e) Identify the type of the grammar: $S \rightarrow aSa \mid bSb \mid c$.
(f) Show that the following CFG is ambiguous.
$S \rightarrow SS \mid a$
(g) Write the definition of push down automata (PDA).
(h) Give any two examples of languages that are accepted by PDA.
(i) Define multi- tape turing machine.
(j) What is unrestricted grammar? Give an example.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Construct the Grammar for palindrome of binary numbers
(b) Construct the Grammar for the language $a^n b^n, n > 0$

OR

3 Design a minimal DFA over the alphabet $\Sigma = \{0, 1, 2\}$ to accept the language $L = \{w \mid w \cong 0 \ mod \ 4\}$.

UNIT – II

4 State the pumping lemma for regular expressions.

(a) (i) Show that $L = \{a^{i^2} / i \geq 1\}$ is not regular by using pumping Lemma.
(b) (ii) Show that $L = \{a^i b^j \ / i, j \geq 1, i \neq j\}$ is not regular by using pumping lemma.

OR

5 Prove that the family of regular languages is closed under the following operations:

(a) Union.
(b) Intersection.
(c) Complementation.
(d) Reversal.
(e) Concatenation.

UNIT – III

6 Define the following terms: (i) Useless symbol. (ii) Null – production. (iii) Unit production.
Remove Null – productions in the following grammar.

$S \rightarrow ABaC$
$A \rightarrow BC$
$B \rightarrow b \mid \epsilon$
$C \rightarrow D \mid \epsilon$
$D \rightarrow \epsilon$

OR

7 Define Chomsky Normal Form, Convert the following grammar into CNF:
$S \rightarrow bA|aB; A \rightarrow bAA|aS|a; B \rightarrow aBB|bS|a.$

UNIT – IV

8 (a) Construct a PDA to accept the language $L = \{WCW^R / W \in (a, b)^+\}$ by the empty stack.
(b) Construct a PDA to accept the language $L = \{a^n b^{2n}, n \geq 1\}$ by the final state.

OR

9 Prove that "L is accepted by a PDA M_1 by empty store, if and only if L is accepted by a PDA M_2 by final state".

UNIT – V

10 Prove that the problem that a string w is accepted by a DFA M is decidable.

OR

11 Construct linear bounded automata for the following context-sensitive language $L = \{a^n b^n c^n : n \geq 0\}$.

*****