

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)
- Give the mathematical definition of the grammar.
 - What is context sensitive grammar.
 - Describe the language generated by the regular expression $(b + ab)^*(\epsilon + a)$.
 - State the Arden's theorem.
 - Identify the type of the grammar: $S \rightarrow aSa \mid bSb \mid c$.
 - Show that the following CFG is ambiguous.
 $S \rightarrow SS \mid a$
 - Write the definition of push down automata (PDA).
 - Give any two examples of languages that are accepted by PDA.
 - Define multi- tape turing machine.
 - 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 $L = \{w \mid w \equiv 0 \pmod{4}\}$.

UNIT – II

- 4 State the pumping lemma for regular expressions.
- (i) Show that $L = \{a^{i^2} \mid i \geq 1\}$ is not regular by using pumping Lemma.
 - (ii) Show that $L = \{a^i b^j \mid i, j \geq 1, i \neq j\}$ is not regular by using pumping lemma.

OR

- 5 Prove that the family of regular languages is closed under the following operations:
- Union.
 - Intersection.
 - Complementation.
 - Reversal.
 - Concatenation.

UNIT – III

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

$$\begin{aligned} S &\rightarrow ABaC \\ A &\rightarrow BC \\ B &\rightarrow b \mid \epsilon \\ C &\rightarrow D \mid \epsilon \\ D &\rightarrow \epsilon \end{aligned}$$

OR

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

UNIT – IV

- 8 (a) Construct a PDA to accept the language $L = \{WCW^R \mid W \in (a, b)^+\}$ 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”.

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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 $L = \{a^n b^n c^n \mid n \geq 0\}$.
