

**PART – A**  
(Compulsory Question)

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

- What is a string? How to concatenate two strings?
- What is context free grammar?
- Describe the language generated by the regular expression:  $(a + b)^*aaa(a + b)^*$ .
- Let  $r_1$  be the regular expression representing the language  $L_1$ ,  $r_2$  be the regular expression representing the language  $L_2$ , what is the language represented by the regular expression  $r_2 + r_1$ .
- Identify the language generated by context free grammar:  $S \rightarrow (S)|()|SS$ .
- Define ambiguous grammar with example.
- Can push down automata accept the regular language?
- Give any two examples of languages that are accepted by PDA.
- Define linear bounded automata.
- Define multi-tape Turing machine.

**PART – B**  
(Answer all five units, 5 X 10 = 50 Marks)**UNIT – I**

- Construct the language generated by grammar  $S \rightarrow aSb/\epsilon$ .
  - Construct the language generated by the grammar  $S \rightarrow aCa; C \rightarrow aCa/b$ .

OR

- Design a minimal DFA over the alphabet  $\Sigma = \{0, 1\}$  to accept the language  $L = \{w | w \equiv 0 \pmod{3}\}$ .

**UNIT – II**

- State and prove Arden's theorem.

OR

- Write the identities of regular expressions.
  - Draw the NFSA to accept the languages generated by  $aa^*bb^*$

**UNIT – III**

- Remove unit productions in the following grammar:

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

- Remove unit productions in the following grammar:

$$\begin{aligned}
 S &\rightarrow aSb \\
 S &\rightarrow A \\
 A &\rightarrow cAd \\
 A &\rightarrow cd
 \end{aligned}$$

OR

- 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**

- Construct a PDA that accepts the language generated by the following grammar:  $S \rightarrow aB; B \rightarrow bA/b; A \rightarrow aB$ .

OR

- Construct a PDA to accept the language  $L = \{WCW^R | W \in (a, b)^+\}$  by the empty stack.

**UNIT – V**

- Design a Turing machine to accept the language  $= \{a^n b^n, n \geq 1\}$ . Show an ID for the string 'aaabbb' with tape symbols.

OR

- Write short notes on: (i) Instantaneous Description of TMs. (ii) Recursively Enumerable and Recursive Languages.

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