

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 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**

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

OR

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

UNIT – II

- 4 State and prove Arden's theorem.

OR

- 5 (a) Write the identities of regular expressions.
(b) Draw the NFSA to accept the languages generated by aa^*bb^*

UNIT – III

- 6 (a) Remove unit productions in the following grammar:

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

- (b) Remove unit productions in the following grammar:

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

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

OR

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

UNIT – V

- 10 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.

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