

Duration: 3 hrs

[Max Marks: 80]

- N.B. : (1) Question No 1 is Compulsory.  
 (2) Attempt any three questions out of the remaining five.  
 (3) All questions carry equal marks.  
 (4) Assume suitable data, if required and state it clearly.

- 1 [20]
- a Differentiate Finite Automata, Push Down Automata and Turing Machine.
- b Discuss different applications of Finite Automata
- c Design DFA that accepts Strings with at least 3 a's. over  $\Sigma = \{a,b\}$ .
- d Simplify the given grammar  
 $S \rightarrow ASB \mid \epsilon$   
 $A \rightarrow aAS \mid a$   
 $B \rightarrow SbS \mid A \mid bb$
- 2 a Compare and Contrast Moore and Mealy Machines. Design Moore machine for  $\Sigma = \{0,1\}$ ,  
 print the residue modulo 3 for binary numbers. [10]
- b Design Push Down Machine that accepts  $L = \{a^m b^n c^n d^m \mid m, n > 0\}$  [10]
- 3 a i) Construct CFG for given language.  $L = \{0^i 1^j 0^k \mid j > i+k\}$  [10]  
 ii) The grammar G is  $S \rightarrow aB \mid bA$   $A \rightarrow a \mid aS \mid bAA$   $B \rightarrow b \mid bS \mid aBB$   
 Obtain parse tree for the following string "aababb" and check if the grammar is  
 ambiguous.
- b Explain Pumping Lemma with the help of a diagram to prove that given language is not a  
 regular language.  $L = \{0^m 1^{m+1} \mid m > 0\}$  [10]
- 4 a i) Design DFA that accepts Strings that ends in either "110" or "101" over  $\Sigma = \{0,1\}$ . [10]  
 ii) Design NFA that accepts strings starting with "abb" or "bba"
- b Given NFA with epsilon, Find equivalent DFA. q1 is the initial state, q3 is final state [10]
- |                  |      |      |      |            |
|------------------|------|------|------|------------|
|                  | 0    | 1    | 2    | $\epsilon$ |
| $\rightarrow q1$ | {q1} | -    | -    | {q2}       |
| q2               | -    | {q2} | -    | {q3}       |
| *q3              | -    | -    | {q3} | -          |
- 5 a Find Equivalent Greibach Normal Form (GNF) for given CFG. [10]  
 $S \rightarrow AA \mid a$   
 $A \rightarrow SS \mid b$
- b Define and design Turing Machine to accept  $0^n 1^n 2^n$  over  $\Sigma = \{0,1,2\}$ . [10]
- 6 Write Short notes (Any Two) [20]
- a Explain with example Chomsky Hierarchy.
- b Post Correspondence Problem.
- c Recursive and Recursive enumerable languages.
- d TM-Halting Problem.