

Time : 3.00 Hrs.

Marks : 80

- N.B. : (1) Question No. 1 is **compulsory**.  
 (2) Attempt any **three** questions out of the remaining **five** questions.  
 (3) Assumptions made should be clearly stated.  
 (4) **Figures** to the **right** indicate **full** marks.  
 (5) **Assume** suitable **data** whenever required but **justify** the same.

1. a) Differentiate between NFA and DFA. 5  
 b) Compare and contrast Moore and Mealy machines. 5  
 c) Explain variants of Turing Machine. 5  
 d) Show that the following grammar is ambiguous : 5  

$$S \rightarrow aSbS \mid bSaS \mid \epsilon$$
2. a) Convert the following RE into NFA with  $\epsilon$ - moves and hence obtain the DFA : 10  

$$RE = (0 + \epsilon)(10)^*(\epsilon + 1)$$
  
 b) Consider the following grammar  $G = \{V, T, P, S\}$ ,  $V = \{S, X\}$ ,  $T = \{a, b\}$  and productions P are :  $S \rightarrow aSb \mid aX$   
 $X \rightarrow Xa \mid Sa \mid a$ .  
 Convert the grammar in Greibach Normal Form. 10
3. a) Construct PDA accepting the language  $L = \{a^{2n}b^n \mid n \geq 0\}$ . 10  
 b) Construct TM to check well formedness of parenthesis. 10
4. a) Design Mealy machine to recognize  $r = (0 + 1)^*(00 + 11)$  and then convert it to Moore machine. 10  
 b) Consider the following grammar :  

$$S \rightarrow iCtS \mid iCtSeS \mid a$$
  

$$C \rightarrow b$$
  
 For the string "ibtaeibta", find the following :  
 i) Left most derivation ,  
 ii) Right most derivation ,  
 iii) Parse tree ,  
 iv) Check if the above grammar is ambiguous or not. 10
5. a) Design a Turing machine that computes a function  $f(m,n) = m + n$ , the addition of two integers. 10  
 b) Give the formal definition of pumping lemma for regular language and then prove that the following language is not regular :  

$$L = \{0^m1^{m+1} \mid m > 0\}$$
. 10
6. Write short note on following ( Any two ) : 20  
 a) Chomsky Hierarchy.  
 b) Decision properties of regular languages.  
 c) Rice's theorem.  
 d) Definition and working of PDA.