

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 ϵ - 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 :
 $S \rightarrow i C t S \mid i C t S e S \mid a$
 $C \rightarrow b$.
 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 : 10
 $L = \{ 0^m 1^{m+1} \mid m > 0 \}$.
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.