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 grammer is ambiguous :   5
    S --> aSbS | bSaS | ε   .

2. a) Convert the following RE into NFA with ε- moves and hence obtain the DFA :
    RE = (0 + ε) (1 0)*(ε + 1) .   10
  b) Consider the following grammer $G = \{ V , T , P , S \}$, $V = \{ S , X \}$, $T = \{ a , b \}$ and
    productions P are : S --> aSb | aX
               X --> Xa | Sa | a .
  Convert the grammer in Greibach Normal Form.   10

3. a) Construct PDA accepting the language $L = \{ a^{2n}b^n \mid n >= 0 \}$.   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 grammer :
          S --> i C t S | i C t S e S | a
          C --> b .
    For the string " ibtaeibta" , find the following :
             i) Left most derivation ,
             ii) Right most derivation ,
             iii) Parse tree ,
             iv) Check if the above grammer 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 :
    $L = \{ 0^m 1^{m+1} \mid m > 0 \}$.   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.