(3 Hours) [Total Marks : 80

N.B. : (1) Attempt any **Four** questions.
     (2) Draw suitable **diagram** whenever **necessary**.
     (3) Assume suitable **data**, if **necessary**.

1. Attempt **four** sub questions.
   (a) State applications where Automata Theory is used.   5
   (b) What are limitations of finite automata.   5
   (c) Develop an NFA to accept strings ending with 'aba' over {a , b}   5
   (d) Explain with example equivalence between NFA & DFA.   5

2. (a) Consider the grammar G = { (S, A), (0, 1), P, S }, where P consists of :   10
     (i) $S \to 0AS \mid 0$ (ii) $A \to S1A \mid SS \mid 10$
     Show the leftmost and rightmost derivation for the input string '001100'. Is given G Ambiguous?
  (b) Construct deterministic PDA to recognize $a^n abb^n$, n > 0 over{ a,b}   10

3. (a) Define Normal form and its types and Convert given grammar to CNF: 10
     (i) $S \to bA \mid aB$ (ii) $A \to bAA \mid aS \mid a$ (iii) $B \to aBB \mid bS \mid b$
  (b) Define CFG and construct a CFG for $a^{2n}b^n$ 10

4. (a) Design mealy machine to accept all strings ending with aa or bb   10
  (b) Minimize given DFA-   10

5. (a) Develope ε-NFA to accept $0^n 1^n 2^n$, where n >= 0 over { 0,1 ,2}   5
  (b) Define Halting problem   5
  (c) Give Regular Expressions for-   6
     (i) Binary strings containing atleast one 11 & atleast one 00
     (ii) Strings with even number of a's
     (iii) Strings in which third symbol from end is 'c' over { a,b,c}
  (d) Describe Regular Language for given Regular Expressions   4
     (i) $(ab+ba)^*$,
     (ii) $1(0+1)(0+1) (0+1) (0+1)^* 0$

6. (a) Write short note on - Chomsky Hierarchy   7
  (b) Explain Post correspondence problem   7
  (c) Explain Pumping Lemma for Regular Language   6