Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt _five_ questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.

x-x-x

I. Answer the following:-
   a) Write a regular expression over $\Sigma = \{a, b\}$ containing at least one 'a'.
   b) Discuss the applications of Pumping Lemma.
   c) Write production rules for Greibach Normal Form.
   d) Define DPDA.
   e) What is Universal Turing Machine?

   (5x2)

UNIT – I

II. Design a DFA over $\Sigma = \{a, b\}$ which accepts all strings having:

   a) Even number of a's and even number of b's

   b) Odd number of a's and even number of b's   (2x5)

III. a) Discuss the equivalence between regular expression and finite automata.

   b) What is left linear grammar? Write left linear grammar for (a+b)*ab.   (2x5)

IV. Write short notes on following:-

   a) Moore and Mealy machines

   b) Closure properties of Regular languages   (2x5)

UNIT – II

V. a) Define CFG. Write a CFG for all palindromes over $\Sigma = \{a, b\}$.

   b) For above CFG perform Left most derivation and Right most derivation for a string abbba. Also draw derivation trees.   (2x5)

VI. Design a Turing Machine for L= $\{1^n 2^n 3^n / n \geq 1\}$. Further, show the processing of string 112233.   (10)

VII. Write short notes on following:-

   a) Chomsky hierarchy of formal languages

   b) Undecidability   (2x5)

x-x-x