**Time: 3 Hours**   **Total Marks: 80**

N.B.: (1) Question No.1 is compulsory.
    (2) Attempt any three questions from the remaining five questions.
    (3) Make suitable assumptions wherever necessary but justify your assumptions.

1. (a) Differentiate DFA and NFA.   **05**
   (b) Design a DFA to accept string of 0's and 1's ending with the string 100.   **05**

   (c) Explain the applications of Regular Expressions.   **05**
   (d) What are Recursive and Recursively Enumerable Languages?   **05**

2. (a) Design NFA for recognizing the strings that end in "aa" over $\sum = \{a,b\}$ & convert   **10**
   above NFA to DFA.
   (b) Design moore m/c for following:-   **10**
If input ends in '101' then output should be A, if input ends in '110' output should be
B, otherwise output should be C and convert it into mealy m/c.

3. (a) Obtain a regular expression for the FA shown below: **10**
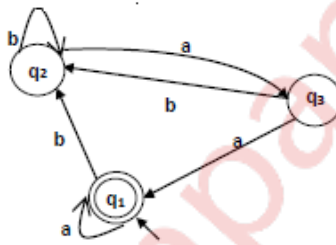
   (b) Explain the types of Turing machine in detail.   **10**

4. (a) Design a turing machine that computes a function $f(m,n)=m+n$ i.e. addition of two   **10**
   integers.
   (b) State and explain pumping Lemma for Context Free Languages. Find out whether   **10**
the language $L= \{x^n y^n z^n \mid n \geq 1\}$ is context free or not.

5. (a) Design PDA for the following language: **10**

$L(M) = \{wcw^R \mid w \ \{a,b\}^*\}$ where w^R is reverse of w & c is a constant.
   (b) Convert the following Grammars to the Chomsky normal form (CNF).   **10**
      $S \rightarrow 0A0 \mid 1B1 \mid BB$
     $A \rightarrow C$
     $B \rightarrow S \mid A$
     $C \rightarrow S \mid \varepsilon$

6. Write detailed note on (any two):-   **20**
   (a) Post Correspondence Problem
   (b) Halting Problem.
   (c) Rice's Theorem.

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