QP Code : **5419**
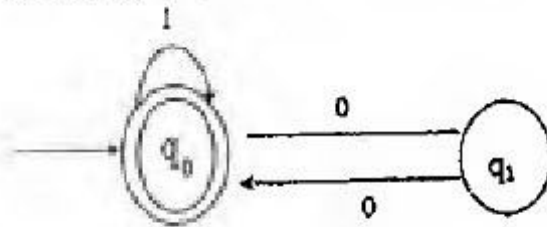
(3 Hours) [Total Marks : 80

N. B. : (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions from the entire paper.
(3) Draw **diagrams** wherever **necessary**.

1. (a) (2) Explain if the following machine M is a DFA? Is it NFA? Write 4
formally a definition for this M.

(b) Design moore machine to convert each occurrence of 100 to 101 3
(c) Write a CFG to generate strings Starting and ending with different letter 3
over the $\Sigma = \{a,b\}$
(d) What is Multi-Tape Turing Machine 3
(e) Difference between FA and PDA 4
(f) Give a regular expression for the language over the alphabet $\Sigma = \{a,b\}$ 3
containing at most two a's.

2. (a) Construct a minimal DFA which accepts $L=\{a^n b^m c^l \mid n,m,l >= 0\}$ 5
(b) State and explain Turing Machine Formalism. 5 5
(c) If $L(r)= \{$ aaa,aab,aba,abb,baa,bab,bba,bbb$\}$,find the regular expression 5
r which represents $L(r)$.
(d) Explain Chomsky Hierarchy. 5

3. (a) Construct a TM for accepting palindromes. 10
(b) Design PDA For recognizing $L= \{a^m b^n c^{m+n} \mid m,n >= 1\}$ 10

4. (a) Convert the following grammar to Chomsky Normal Form. Show all 10
the relevant Steps briefly.
S→bA | aB
A→bAA | aS | a
B→aBB | bS | b

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(b) Convert the following Grammar G to GNF.   10

$G=\{(A_1, A_2, A_3), (a,b), P, A_1\}$

Where, P consist of the Following Productions:

$A_1 \rightarrow A_2 A_3$

$A_2 \rightarrow A_3 A_1 \mid b$

$A_3 \rightarrow A_1 A_2 \mid a$

5. (a) State and Prove pumping lemma for regular languages and prove that following language is regular or not

$L = \{a^n b^n \mid n >= 1\}$

(b) Construct NFA, DFA for the regular Expression $R = ab(a+b) + abb$. Obtain minimized DFA   10

7. Write short notes on:- (any two)   20

   (a) Simplification OfCFG

   (b) Recursive and Recursively enumerable languages

   (c) Universal TM

   (d) Halting Problem