5 Attempt any two parts of the following. **10x2=20**

(a) Write short notes on the following.

(1) Universal Turing machine

(2) Post correspondence problem.

(b) Does the PCP with two lists X=(10, 011, 101), Y = (101, 11, 011) have a solution?

(c) Design Turing machine for the language $L=\{a^{n+2}\ b^n \mid n > 0\}$.

Printed Pages : 4

NCS402

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 110410

Roll No.

B. Tech.

(SEM. IV) THEORY EXAMINATION, 2014-15

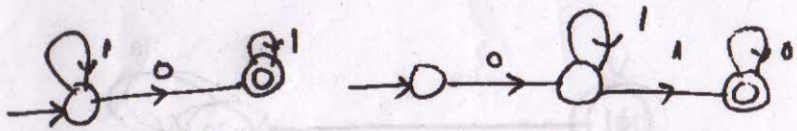
THEORY OF AUTOMATA AND FORMAL LANGUAGE

Time : 3 Hours] [Total Marks : 100

Notes : Attempt all questions.

1 Attempt any four parts of the following. **5x4=20**

(a) Explain the condition in which two machines M1 and M2 are said to be equivalent. Show that the following automatas are not equivalent.



(a) (b)

(b) Explain the modification done in finite automata (FA) to make it.

(i) PDA

(ii) Turing Machine.

(c) Explain the Chomsky hierarchy of languages. Determine the type of the following grammar.
$S \rightarrow aAb/\varepsilon$, $A \rightarrow aA/Ab/a/b$

(d) Find the language generated by the following grammar :

$S \rightarrow aAb/ab, \quad A \rightarrow bAa, \quad A \rightarrow \varepsilon$

(e) Discuss the halting problem of a Turing machine.

2 Attempt any four parts of the following. **5×4=20**

(a) Design a FA which accepts set of strings containing exactly four 1's in every string over $\Sigma = \{0, 1\}$.

(b) Design the Turing machine that accepts the language of even integers written in binary.

(c) Convert the CFG into GNF.

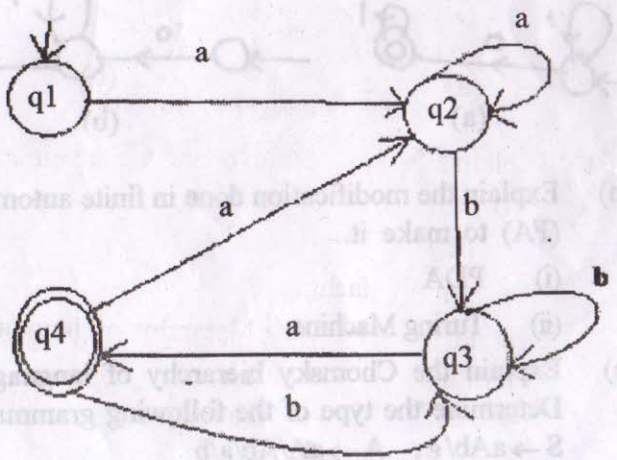
$S \rightarrow aSbA$

$A \rightarrow Sa/a$

(d) Define context free grammar. Find a context free grammar for the following language.

$L=\{a^n b^{2n} c^m \mid n, m>=0\}$

(e) Find the regular expression using Arden's theorem of FA given below.



3 Attempt any four parts of the following. **5x4=20**

(a) Prove that the language $L=\{ 0^n \mid n$ is perfect cube$\}$ is not regular.

(b) Find the CFG for the language $L=\{a^n b^n \mid n+m$ is even$\}$.

(c) Convert the following CFG into PDA

$S \rightarrow aSa/aA/Bb, \quad A \rightarrow aA/a, \quad B \rightarrow Bb/A$

(d) Design PDA for palindrome strips.

(e) Discuss tractable and non tractable problems.

4 Attempt any two parts of the following. **10x2=20**

(a) Define push down automata. Design a PDA for the following language.

$L=\{a^i b^j c^k \mid i=j$ or $j=k\}$

(b) Write the regular expression for the language containing the strings over {0,1} in which there are at least two occurences of 1's between any two occurences of 0's.

(c) Construct a CFG for the following language s.t.

$L = \{a^m b^n \mid m \neq n\}$.