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

PAPER ID : 0112   Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

B.Tech.
(SEMESTER-IV) THEORY EXAMINATION, 2011-12
THEORY OF AUTOMATA & FORMAL LANGUAGES

*Time : 3 Hours]*   *[Total Marks : 100*

Note :   Attempt **all** Section as directed.

Section – A

2 × 10 = 20

1.   Attempt **all** questions. **All** questions carry equal marks :
   (a)   Define deterministic finite automaton.
   (b)   State Mxhill-Nerode theorem.
   (c)   Find a regular expression corresponding to the language of all strings over the alphabet {0, 1} that contains at least two 0's.
   (d)   Differentiate between Mealy machine and Moore machine.
   (e)   Show that the context-free gramma G given by productions S → SBS/a, B → b, is ambiguous.
   (f)   What do you mean by inherent ambiguous CFL ?
   (g)   Compare PDA with FA.
   (h)   What do you mean by instantaneous description of PDA ?
   (i)   When a language is said to be recursive or recursively enumerable ?
   (j)   What are the ways of representations of TMs ?

Section – B

3 × 10 = 30

2.   Attempt any **three** parts.
   (a)   Design a Mealy machine that accepts binary string divisible by 3.
   (b)   Construct an NFA without E-mores corresponding to the following NFA.
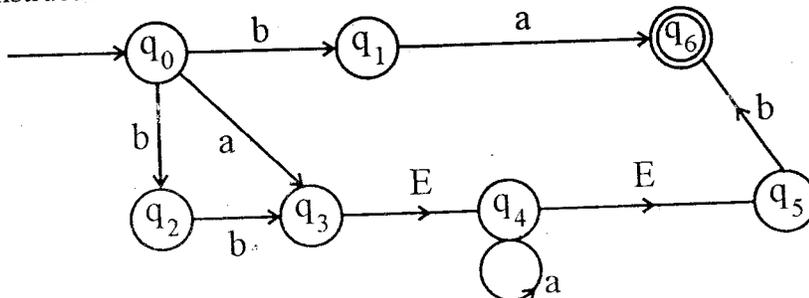
(c)　Show that the language $\{0^n 1^n 2^n \mid n \geq 1\}$ is not a context free language.

(d)　Construct PDA by empty stack which accepts the following :

$$\{a^m b^m c^n \mid m, n \geq 1\}$$

(e)　For $\Sigma = \{a, b\}$ design a TM that accepts $L = \{a^n b^n \mid n \geq 1\}$.

Section – C
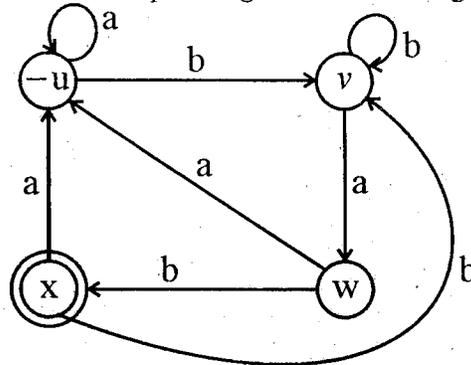
Attempt **all** questions.　　　　　　　　　　　　　　　　　　　$5 \times 10 = 50$

3.　Prove that if a language L is accepted by an NFA then there is a DFA that accepts L.

OR

Prove that if L is accepted by an NFA with $\in$-transitions, then L is accepted by an NFA without $\in$-transitions.

4.　Find the regular expression corresponding to the following Finite Automaton :

OR

Show that $L = \{ ww \mid w \in \{a, b\}^* \}$ is not regular.

5.　Construct a PDA M equivalent to the grammar with the following productions :

　　$S \rightarrow aAA$

　　$A \rightarrow bS \mid aS \mid a$

Also check whether the string abaaaa is in N(M) or not.

　　　　　　OR

Design 2-stack PDA for language

$L = \{a^n b^n c^n \mid n \geq 0\}$.

6.　Convert the following grammar to GNF :

　　$S \rightarrow ABA$

　　$A \rightarrow aA \mid \in$

　　$B \rightarrow bB \mid \in$

　　　　　　　　　　OR

Prove that if L_1 and L_2 are two CFLs then $L_1 \cap L_2$ may or may not be CFL.

7.　Write short notes on any **two** of the following :

(a)　Universal TM

(b)　Halting Problem

(c)　Church's Thesis

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