

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

**PAPER ID : 0112**

Roll No.

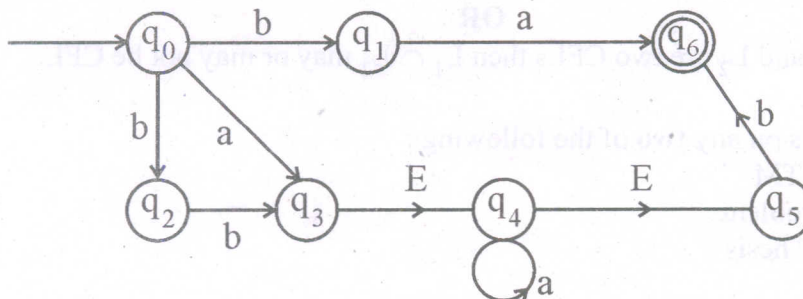
--	--	--	--	--	--	--	--	--	--

**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**

1. Attempt **all** questions. **All** questions carry equal marks : **2 × 10 = 20**
- Define deterministic finite automaton.
  - State Myhill-Nerode theorem.
  - Find a regular expression corresponding to the language of all strings over the alphabet  $\{0, 1\}$  that contains at least two 0's.
  - Differentiate between Mealy machine and Moore machine.
  - Show that the context-free grammar  $G$  given by productions  $S \rightarrow SBS/a, B \rightarrow b$ , is ambiguous.
  - What do you mean by inherent ambiguous CFL ?
  - Compare PDA with FA.
  - What do you mean by instantaneous description of PDA ?
  - When a language is said to be recursive or recursively enumerable ?
  - What are the ways of representations of TMs ?

**Section – B**

2. Attempt any **three** parts. **3 × 10 = 30**
- Design a Mealy machine that accepts binary string divisible by 3.
  - Construct an NFA without E-moves 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.

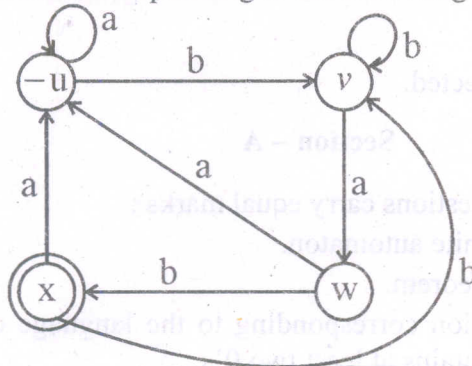
**5 × 10 = 50**

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  $\epsilon$ -transitions, then L is accepted by an NFA without  $\epsilon$ -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 :

$$S \rightarrow ABA$$

$$A \rightarrow aA \mid \epsilon$$

$$B \rightarrow bB \mid \epsilon$$

**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