**Roll No.** **Total No. of Pages : 02**

**Total No. of Questions : 09**

**MCA (Elective-I) (2013 and 2014 Batch) (Sem.–3)**

# THEORY OF COMPUTATION

**Subject Code : MCA-305B**

**M.Code : 70777**

**Time : 3 Hrs.** **Max. Marks : 100**

**INSTRUCTIONS TO CANDIDATES :**

1. **SECTIONS-A, B, C & D contains TWO questions each carrying TWENTY marks each and students has to attempt any ONE question from each SECTION.**
2. **SECTION-E is COMPULSORY consisting of TEN questions carrying TWENTY marks in all.**

## SECTION-A

1. Using the principle of mathematical induction, prove that :

   $1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + n^3 = \{[n \times (n+1)]/2\}^2$ for all $n \in N$.

2. Consider the regular expression R (a+b)*(aa+bb) (a+b)* Which describes the set of all the words over $\Sigma = \{a, b\}$, containing either two consecutive a's or two b's. Construct a Deterministic Finite Automata A that will accept the same set of words.

## SECTION-B

3. What is Non-Deterministic Finite Automata (NFA)? Discuss its properties with a graph.

4. What are Derivation Trees? For grammar G, $S \rightarrow 0B|1A$, $A \rightarrow 0|0S|1AA$, $B \rightarrow 1|1S|0BB$. Find the leftmost and rightmost derivation.

## SECTION-C

5. For the PDA M, design the corresponding CFG G :

   $M = (\{q_0\ q_1\}, \{0,1\}, \{Z_0, K\}, \delta, q_0, Z_0, \Phi)$ with the transition function defined as follows:

   a. $\delta(q_0, 1, Z_0)$ |--( $q_0$, KK $Z_0$)
   b. $\delta(q_0, 0, K)$ |--( $q_1$, K)
   c. $\delta(q_0, \wedge, Z_0)$ |--( $q_0$, $\wedge$)
   d. $\delta(q_1, 0, K)$ |--( $q_1$, $\wedge$)
   e. $\delta(q_0, 1, K)$ |--( $q_0$, KK)
   f. $\delta(q_1, 0, Z_0)$ |-( $q_0$, $Z_0$)

6. Prove the Lemma: If a language is accepted by a pushdown automata, it is a context-free language.

## SECTION-D

7. Define Turing Machine. What are the applications of Turing machines? Construct a Turing Machine that can accept the set of all even palindromes over {0,1}.

8. Explain the Chomsky's hierarchy of languages.

## SECTION-E

**9. Write briefly :**

a. Define Finite Automation.

b. Differentiate between DFA and NDFA

c. Define Yield and ambiguity in CFG.

d. What are context-free languages?

e. Show that L = {a p | p is a prime} is not a context free language.

f. Define Terminal and non-terminal symbol.

g. What is Greibach Normal Form?

h. What are recursive languages? Give example of language that is recursive.

i. How Turing machine is different from FA and PDA in terms of capability?

j. How is CFG converted into CNF?

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**