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

Total No. of Questions : 09

M.Sc. (IT) (2015 Onwards) (Sem.–4)

THEORY OF COMPUTATION

Subject Code : MSIT-403

Paper ID : [74115]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTIONS-A, B, C & D contains TWO questions each carrying TEN marks each and students have 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. Construct the finite automata corresponding to the following regular expression :

$$(0 + 1)^*(00+11)(0+1)^*$$

2. Prove that the class of languages accepted by finite automata is closed under :

   a. Union.

   b. Complementation.

   c. Intersection.

SECTION-B

3. What are Context Free Grammars? How are they different from context free language? Discuss various normal forms for context free grammars in brief.

4. a. State the principle of pumping lemma. Also discuss its various applications.

   b. Reduce the given CFG $S \rightarrow abSb/a/aAb$ and $A \rightarrow bS/aAAb$ to Chomsky Normal Form (CNF)

SECTION-C

5. Construct a push down automata that accepts the language $\{a^{2n}\ b^{n} \mid n \geq 0\}$ with empty stack. Prove the correctness of your construction.

6. Discuss Pushdown Automata in detail. How is it suitable for context free languages? Explain with the help of suitable examples.

SECTION-D

7. Define a Turing machine. State the guidelines for the design of a Turing machine. What are the applications of Turing machine in language accepting and computing?

8. Elaborate the Chomsky's hierarchy in detail.

SECTION-E

9. Answer the following questions briefly :

a) Give an example of infinite set.

b) What is primitive recursive function?

c) Differentiate between DFA and NDFA.

d) Define Universal Turing Machine.

e) Differentiate between CFG and CSG.

f) State Kleene theorem.

g) What is top down parsing?

h) What do you mean by ambiguity in context free grammars?

i) Prove the following property of regular expressions: $R + R = R$.

j) State whether the following statement is true or not. Justify your answer as well : If L and M are regular languages then $L + M$, LM and L^* are also regular.