

**B.Tech. – VIEP – COMPUTER SCIENCE AND
ENGINEERING (BTCSVI)**

Term-End Examination

00954

June, 2017

BICS-018 : THEORY OF COMPUTATION

Time : 3 hours

Maximum Marks : 70

Note : Attempt any **seven** questions. All questions carry equal marks.

1. (a) Give the mathematical definition of NFA. How does NFA differ from DFA ? 5
- (b) Construct DFA and NFA for $L = \{w \in (0, 1)^* \mid w \text{ contains the substring } 0101\}$. 5
2. (a) What are Regular Expressions ? Construct the transition systems equivalent to the regular expression $(ab + a)^*(aa + b)$. 5
- (b) Write the applications of Automata. Prove the identity $(a^* ab + ba)^* a^* = (a + ab + ba)^*$. 5
3. (a) Explain the term Deterministic Pushdown Automata with the help of suitable example. 5

- (b) Differentiate between CFG and CSG. Convert the following CFG to pushdown automata : 5
- $$S \rightarrow aAA; A \rightarrow aS \mid bS \mid a$$
4. (a) Explain the concept of Turing machine with the help of a suitable diagram. Discuss the importance of Turing machine with the help of suitable example. 5
- (b) Construct a Turing machine that accepts the language $L = \{w \in \{a, b, c\}^* \mid w \text{ contains an equal number of } a\text{'s, } b\text{'s and } c\text{'s}\}$. 5
5. (a) Explain Church's Hypothesis in detail. 6
- (b) Explain RAM machines. Explain their utility with the help of suitable example. 4
6. (a) What is a Moore machine ? Design a Moore machine to determine the residue mod 4 for each binary string, treated as integer. 5
- (b) What is a Mealy machine ? Design a Mealy machine that uses its states to remember the last symbol read and emits the output 'Y', whenever the current input matches to the previous ones and emits 'N' otherwise. 5

7. (a) What do you understand by the reduced form of the grammar ? When is a grammar said to be in reduced form ? 5

(b) Define the term 'ambiguous grammar' with the help of suitable example. Show that the grammar S given below is ambiguous : 5

$$S \rightarrow aSbS \mid bSaS \mid \epsilon$$

8. (a) Differentiate between Chomsky and Greibach Normal Form (GNF). Convert the grammar given below to GNF : 5

$$S \rightarrow ABb \mid a; A \rightarrow aaA \mid B; B \rightarrow bAb$$

(b) What is Pumping Lemma of regular sets ? Using Pumping Lemma, show that the set comprising of elements a and b, such that $a^n b^{2n} \mid n > 0$, is not regular. 5

9. Write short notes on the following : 10

- (a) Hamiltonian Path Problem
- (b) Chromatic Number Problem
- (c) Rice's Theorem
- (d) Hypothesis of Church

10. Differentiate between the following. Also give examples for each :

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- (a) Recursive and Recursively Enumerable Languages
 - (b) NP-Complete and NP-Hard Problems
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