October 2025
B.A./B.Sc.
Fifth Semester
CORE – 12
COMPUTER SCIENCE
Course Code: CSC 5.21
(Theory of Computation)

Total Mark: 70   *Pass Mark: 28*
Time: 3 hours

Answer <u>five</u> *questions, taking* <u>one</u> *from each unit.*

UNIT–I

1. (a) Write a note on symbol, alphabet, string, and length of string.   4
   (b) Explain the various set operations on formal languages.   10

2. (a) Explain concatenation and reversal operations on languages.   4
   (b) What is theory of computation? Explain complexity and computational theory.   1+4=5
   (c) Explain the power of Σ (sigma) on formal languages.   5

UNIT–II

3. (a) Minimize the given DFA: 6
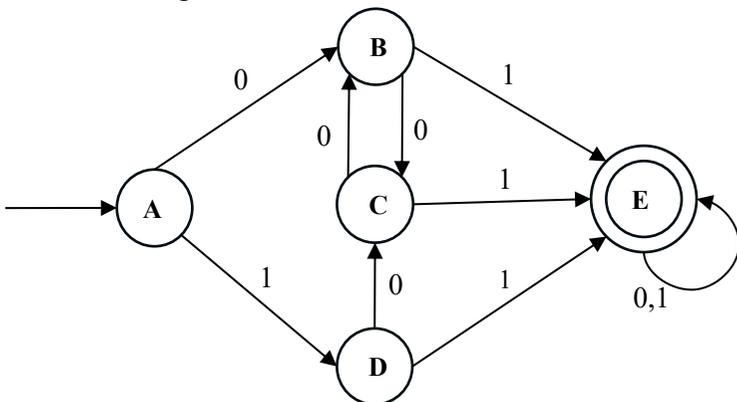
   (b) Write the formal definition of finite automata. Explain transition table and transition diagram.   4+4=8

4. (a) Construct a DFA which accepts set of all strings over {0,1} which when interpreted as binary number is divisible by 3. 4
   (b) Write down the rules in state elimination method. 4
   (c) Describe pumping lemma for regular language. 6

UNIT–III

5. (a) Prove that the following grammar is ambiguous by tracking the string "aabbabba": 6
   S-> aB/bA
   A->a/aS/bAA
   B->b/bS/aBB
   (b) Design a PDA for the language $L = \{a^n b^{n+m} c^m | n, m \geq 1\}$. 8

6. (a) Explain parse tree. 3
   (b) What is derivation? Explain the two types of derivation. 1+4=5
   (c) What is a pushdown automata? Write the formal definition of pushdown automata. 1+5=6

UNIT–IV

7. Write down the various variants of Turing machine. 14

8. (a) Describe the universal Turing machine. 6
   (b) Design a Turing machine for subtraction of two unary numbers. 8

UNIT–V

9. (a) Write down Chomsky hierarchy of formal languages. 4
   (b) Describe recursive and recursive enumerable languages and their properties. 10

10. (a) Describe Post correspondence problem. 7
    (b) Describe Halting problem. 7

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