2023
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 five *questions, taking* one *from each unit.*

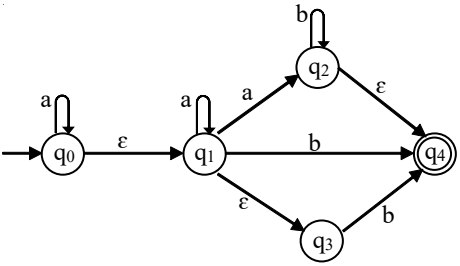
UNIT–I

1. (a) Define a symbol and an alphabet. 2
   (b) What is the theory of computation? Explain complexity and computability theory. 1+4=5
   (c) What is a language? Explain the set operations on a language. 1+6=7

2. (a) Write a note on automated theory. Explain Kleene star and Kleene plus. 3+4=7
   (b) Define automata. Explain power of an alphabet and concatenation of a string with examples. 3+4=7

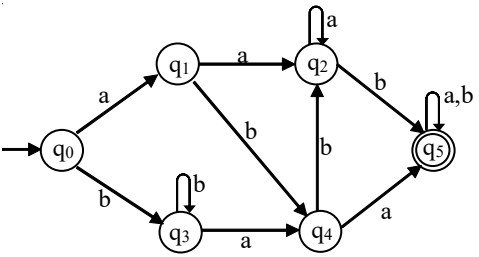
UNIT–II

3. (a) Define DFA. What is a transition table and transition diagram? 4+4=8
   (b) Convert the given ε-NFA to DFA: 6

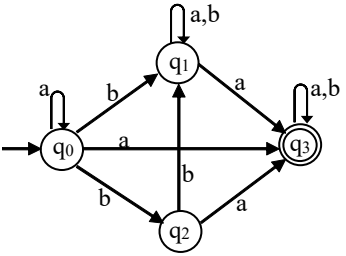


4. (a) Define NFA. 4

(b) Minimize the given DFA: 5



(c) Convert the NFA to DFA. 5



UNIT–III

5. (a) List and explain Chomsky classification of grammar. 8

(b) Show that a language $L = \{a^n b^n c^n, n \geq 1\}$ is not a context free language. 6

6. (a) Define a CFG. Explain the closure properties of a context free languages. 4+4=8

(b) Derive the regular grammar G which produces $L(G) = \{a^m b^n \mid m \geq 0 \text{ and } n > 0\}$. 3

(c) Construct a CFG over the language $L = \{a^n b^n c^m d^m, n, m >= 1\}$. 3

UNIT–IV

7. (a) List and explain the properties of a CSL. 4

(b) Define linear bounded automaton. Design an LBA for the language $L = (a^n b^{2n}, n > 0\}$. 4+6=10

8. (a) Explain a context sensitive language. 4

(b) Define a push down automaton. Design a PDA for the language $L = (a^n b^n, n>0\}$. 4+6=10

UNIT–V

9. (a) Write a note on recursive enumerable languages and list its properties. 6

(b) Define a Turing machine. Design a Turing machine for addition of two unary numbers. 3+5=8

10. (a) Differentiate between a decidable and undecidable language. 6

(b) Design a Turing machine for the language $L = \{a^n b^n c^n\}$ where $n > 0$. 8