

January 2023

B.Tech- III SEMESTER

Theory of Automata & Computation (CE-209C)

Time: 3 Hours

Max. Marks:75

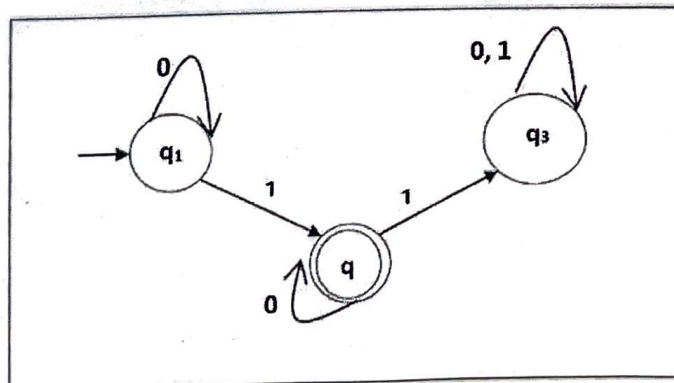
- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) Define Kleene closure and Positive closure. (1.5)
- (b) Define NDPDA. (1.5)
- (c) What are undecidable problems? Give an example. (1.5)
- (d) Write a regular expression for the language that accepts the strings of even length. (1.5)
- (e) What do you mean by context sensitive languages? (1.5)
- (f) Compare the computational power of a pushdown automata and a finite automata. (1.5)
- (g) Define grammar and language. (1.5)
- (h) What is a recursively enumerable language? (1.5)
- (i) What is the halting problem of a turing machine? (1.5)
- (j) Write the closure properties of regular sets. (1.5)

PART -B

- Q2 (a) Convert the following finite automata to it's corresponding regular expression (10) using Arden's theorem:



- (b) Explain Chomsky Hierarchy of formal languages in detail. (5)

- Q3 (a) Explain pumping lemma for regular expressions. (5)

Normal form:

$S \rightarrow bS \mid BcA$

$A \rightarrow aA \mid BBa$

$B \rightarrow ba \mid \epsilon$

- Q4 Define Pushdown Automata. Construct a PDA for $0^n 1^m 2^n 3^n$ where $n, m \geq 1$. (15)
- Q5 (a) Write a regular expression for the language that accepts all the strings of 0's and 1's such that (5)
- i) the strings begin with 1 and do not contain a substring 001.
 - ii) The strings start with 00 or end with 00.
- (b) What are parse trees? Explain the concept of ambiguity in CFG. (10)
- Q6 (a) Differentiate between Mealy machine and Moore machine. Design a Mealy machine to find out 2's complement of a binary number. (10)
- (b) Check if the following grammar is ambiguous or not: (5)
- $S \rightarrow aB \mid bA$
 $A \rightarrow aS \mid bAA \mid a$
 $B \rightarrow bS \mid aBB \mid b$
- Also determine if it accepts the string "aaabbabbba".
- Q7 Design a turing machine that accepts the strings containing equal no. of a's and b's. (15)
