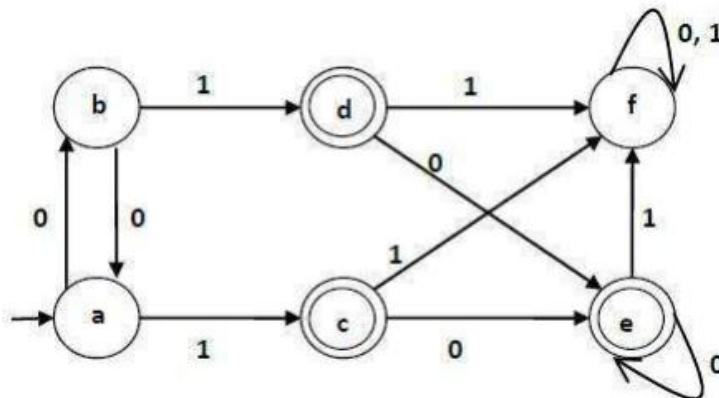


**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER- VI EXAMINATION – SUMMER 2026****Subject Code:3164203****Date:29-05-2026****Subject Name:Theory of Computation****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

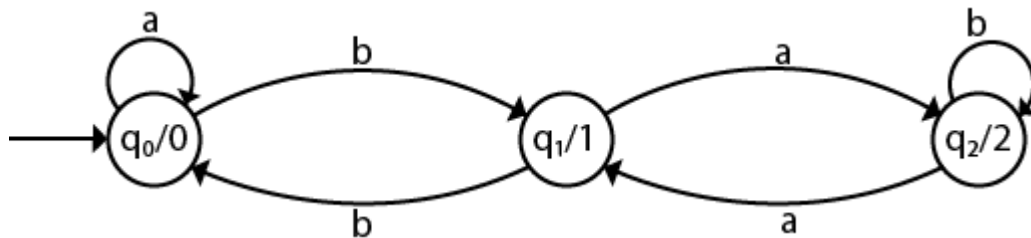
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

|     |                                                                                                                                                     | MARKS |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Q.1 | (a) Define: Set, Subset, Complement                                                                                                                 | 03    |
|     | (b) Write Regular Expressions corresponding to each of the following subsets of $\{a,b\}^*$                                                         | 04    |
|     | (i) Third character from right end is always a.                                                                                                     |       |
|     | (ii) Set of strings consisting of even number of a's followed by odd number of b's                                                                  |       |
|     | (c) State the principle of mathematical induction and prove by mathematical induction that for all positive integers $n$ $1+2+3+\dots+n = n(n+1)/2$ | 07    |
| Q.2 | (a) Define FA and Write recursive definition of NFA.                                                                                                | 03    |
|     | (b) Draw FA for accepting: The strings with odd no of 1's and odd no of 0's.                                                                        | 04    |
|     | (c) Explain procedure to minimize finite automata.                                                                                                  | 07    |
|     | <b>OR</b>                                                                                                                                           |       |
|     | (c) Minimize the DFA shown in Fig:                                                                                                                  | 07    |

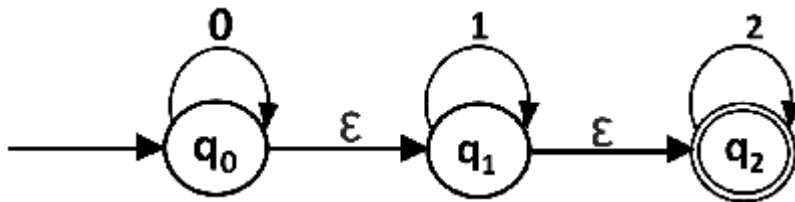


|     |                                                                                                                                                                                                    |    |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Q.3 | (a) Define Context free grammar & context free language.                                                                                                                                           | 03 |
|     | (b) State pumping lemma for regular languages.                                                                                                                                                     | 04 |
|     | (c) Construct a PDA for language $L = \{0^n 1^m \mid n \geq 1, m \geq 1, m > n+2\}$                                                                                                                | 07 |
|     | <b>OR</b>                                                                                                                                                                                          |    |
| Q.3 | (a) Define the following operations for Push Down Automata: PUSH, POP, and SKIP.                                                                                                                   | 03 |
|     | (b) Define Ambiguous grammar. for following grammar say whether the grammar is ambiguous or not. Give reason.<br>$S \rightarrow ABA, A \rightarrow aA \mid \Lambda, B \rightarrow bB \mid \Lambda$ | 04 |
|     | (c) Convert the following grammar to CNF.<br>$S \rightarrow ABA$<br>$A \rightarrow aA \mid \epsilon$<br>$B \rightarrow bB \mid \epsilon$                                                           | 07 |
|     |                                                                                                                                                                                                    |    |
| Q.4 | (a) Compare and contrast push down automata and Turing machine.                                                                                                                                    | 03 |
|     | (b) Explain in detail: Class P and Class NP                                                                                                                                                        | 04 |

- (c) Design a Turing machine to copy a string. 07
- OR**
- Q.4** (a) What are similarities and differences between Moore machines and Mealy machines? 03
- (b) Describe the language generated by the following grammars: 04
- (i)  $S \rightarrow aSb | \epsilon$
- (ii)  $S \rightarrow aSa | bSb | a | b$
- (c) Define:  $\mu$ -Recursive functions and show how all computable functions are  $\mu$ -recursive. 07
- Q.5** (a) Explain Universal Turing machine. 03
- (b) Convert the given Moore machine into its equivalent Mealy machine. 04



- (c) What is decidability? How to prove that the given language is undecidable? List some undecidable problems. 07
- OR**
- Q.5** (a) Define PDA. State whether a PDA can accept a CFL or not. 03
- (b) Discuss - recursively enumerable languages. 04
- (c) Convert following NFA-  $\Lambda$  to DFA. 07



\*\*\*\*\*