



VIT

Vellore Institute of Technology

Final Assessment Test – April 2025

Course: ISWE203L - Theory of Computation

Class NBR(s): 3416/3419/3422/3426/3428

Time: Three Hours

Slot: A2+TA2+TAA2

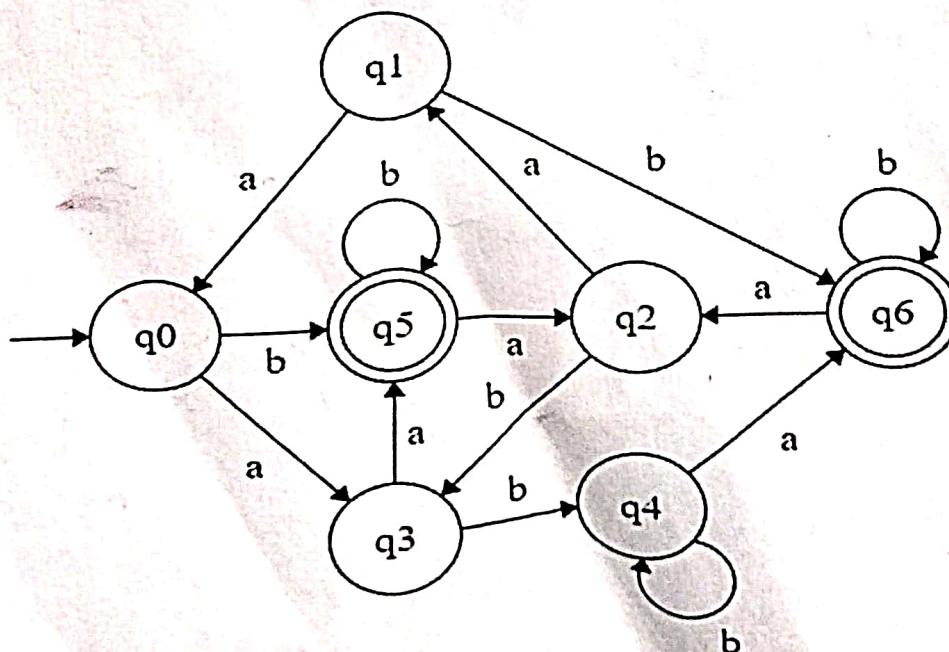
Max. Marks: 100

➤ KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE

➤ DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions
(10 X 10 = 100 Marks)

1. a) Define DFA and NFA. [4]
- b) Construct a DFA whose number of a's are divisible by 7. [6]
2. Obtain a NFA to accept a language L which has strings of a's and b's ending with 'ab' or 'ba'. Convert the resultant NFA obtained to its equivalent DFA.
3. Write regular expression for the following over $\Sigma=\{0,1\}$.
 - a) All possible strings containing odd number of 1's. [2.5]
 - b) All possible strings that does not include '1010' or '0101'. [2.5]
 - c) All possible strings of length divisible by 3. [2.5]
 - d) All strings where substring 11 never occurs after a substring '00'. [2.5]
4. a) Define Pumping Lemma. [2]
- b) Apply pumping lemma to prove $L = \{ a^i b^j c^k \mid k \geq i+j \}$ is not regular. [8]
5. Minimize the states in the DFA depicted in the following diagram.



6. Are CFL's closed with respect to union? Prove your answer.
7. a) Check whether the following grammar is ambiguous for $w=aab$ [3]
- $$S \rightarrow AB \mid aab$$
- $$A \rightarrow a \mid Aa$$
- $$B \rightarrow b$$
- b) Find the Griebach Normal Form grammar equivalent to the following CFG: [7]
- $$S \rightarrow bA \mid aB$$
- $$A \rightarrow bAA \mid aS \mid a$$
- $$B \rightarrow aBB \mid bS \mid b$$
8. Construct a PDA accepting $L=\{wcw^R \mid w \in \{0,1\}^* \& c \text{ is a special symbol}\}$ by reaching the final state as well as empty stack.
- 9.a) Design a Turing Machine for recognizing the language $L = \{0^n 1^{3n} \mid n > 1\}$.
- OR
- 9.b) Construct a Turing Machine as an acceptor to recognize odd length palindrome over $\Sigma = \{a, b\}$.
- 10.a) i. What do you mean by 'decidable' and 'undecidable' problems? Give [5]
examples.
- ii. List the extensive applications areas of Turing machine and its [5]
usefulness.

OR

- 10.b) Define PCP. Does PCP with two lists
 $X = (abab, aaabbb, aab, ba, ab, aa)$ and
 $Y = (ababaaa, bb, baab, baa, ba, a)$ have a solution?

$\Leftrightarrow \Leftrightarrow \Leftrightarrow V/D/TY \Leftrightarrow \Leftrightarrow \Leftrightarrow$