



**Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026**  
**Automata Theory and Computability**

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

**Module-1**

- 1 a. Define the following terms along with the examples.  
 i) Alphabet ii) Power of an alphabet  
 iii) Strings iv) Languages (10 Marks)
- b. i) What is Finite State Machine? Explain the working of FSM. (05 Marks)  
 ii) Obtain a DFA to accept strings of a's and b's ending with the string ab. (05 Marks)

**OR**

- 2 a. Apply NFA to accept strings of a's and b's ending with ab or ba. Convert this NFA to its equivalent DFA. (10 Marks)  
 b. Apply technique to find the minimized DFA for the following.

$\delta$	a	b
A	B	A
B	A	C
C	D	B
D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

(10 Marks)

**Module-2**

- 3 a. i) Obtain a regular expression for the language  $L(R) = \{ W / W \in \{0, 1\}^* \}$  with at least 3 consecutive 0's. (05 Marks)  
 ii) Obtain a regular expression for the language  $L = \{ W : |W| \bmod 3 = 0 \text{ where } W \in (a, b)^* \}$  (05 Marks)
- b. i) Prove that there exists a finite automation to accept the language  $L(R)$  corresponding to the regular expression R. (05 Marks)  
 ii) Build a regular expression from the following FSM. (05 Marks)

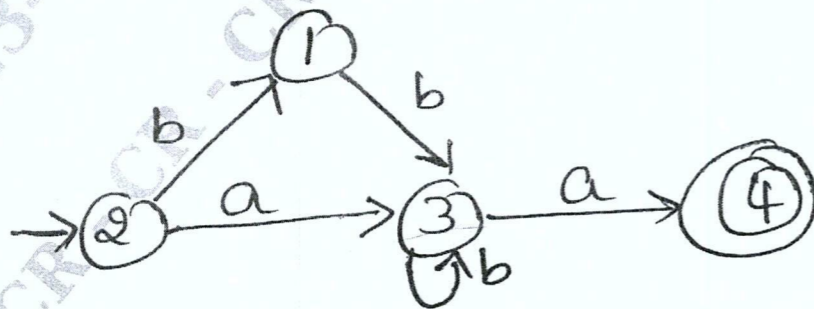


Fig. Q. 3 (b) (ii)

**OR**

- 4 a. i) Obtain grammar to generate string consisting of multiples of three a's. (05 Marks)  
 ii) State and prove pumping lemma for regular languages? (05 Marks)
- b. i) Show that  $L = \{ a^i b^j \mid i > j \}$  is not regular. (05 Marks)  
 ii) Show that if L & M are regular language then show that  $L \cap M$  are regular. (05 Marks)

**Module-3**

- 5 a. What is Derivation? Explain leftmost and rightmost derivation for the string aaabbabba using the following grammar.  
 $S \rightarrow aB \mid bA$   
 $A \rightarrow aS \mid bAA \mid a$   
 $B \rightarrow bS \mid aBB \mid b$  (10 Marks)
- b. Convert the following grammar into CNF.  
 $S \rightarrow OA \mid 1B$   
 $A \rightarrow OAA \mid 1S \mid 1$   
 $B \rightarrow 1BB \mid OS \mid 0$  (10 Marks)

**OR**

- 6 a. Convert the following ambiguous grammar into unambiguous grammar.  
 $E \rightarrow E * E \mid E - E$   
 $E \rightarrow E \wedge E \mid E / E$   
 $E \rightarrow E + E$   
 $E \rightarrow (E) \mid id.$  (10 Marks)
- b. Obtain a PDA to accept  
 $L = \{ a^n b^n \mid n \geq 0 \}$  (10 Marks)

**Module-4**

- 7 a. Prove that context free language are under union, concatenation and star operations. (10 Marks)  
 b. Explain Turing machine model. What are the techniques for TM constructions? (10 Marks)
- OR**
- 8 a. Design a TM to accept the following Language.  $L = \{ W / W \in (0+1)^* \}$  containing the substring 001. (10 Marks)  
 b. Design a TM to accept the following language  $L = \{ 0^n 1^n 2^n \mid n \geq 1 \}$  (10 Marks)

**Module-5**

- 9 a. Define Decidable language and undecidable language. P.T DFA is decidable language. (10 Marks)  
 b. What is Halting problem. P.T halting problem of turing machine is undecidable. (10 Marks)
- OR**
- 10 a. i) What is post correspondence problem? (05 Marks)  
 ii) Define class P and class NP with respect to turing machine. (05 Marks)
- b. i) What is quantum computer? Explain. (05 Marks)  
 ii) P.T. If  $P(n) = a_k n^k + a_{k-1} n^{k-1} + \dots + a_1 n^1 + a_0$  with  $a_k > 0$ , then  $P(n) = 0 (n^k)$  (05 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.