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**Roll No. ....**

**TCS-402**

**B. TECH. (FOURTH SEMESTER)  
MID SEMESTER EXAMINATION,  
April/May, 2022**

**FINITE AUTOMATA AND FORMAL  
LANGUAGE**

**Time : 1½ Hours**

**Maximum Marks : 50**

**Note :** (i) Answer all the questions by choosing any *one* of the sub-questions.

(ii) Each question carries 10 marks.

1. (a) (i) Construct a DFA recognizing the following language (or strings) :  $\{a^n b^m | n \text{ is divisible by } 3 \text{ and } m \text{ is divisible by } 2 \text{ or } n - m \geq 1\}$ .

10 Marks (CO1)

- (ii) Find a DFA machine that accepts the language which has either odd

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(2)

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number of 0's or even number of 1's  
but not both together over alphabet  
 $\Sigma = \{0,1\}$ .

OR

- (b) Construct a minimum state automaton equivalent to the finite automaton given in the following table :

State	Input $[\Sigma] \rightarrow$	
	a	b
$\rightarrow q_0$	$q_0$	$q_3$
$q_1$	$q_2$	$q_5$
$q_2$	$q_3$	$q_4$
$q_3$	$q_0$	$q_5$
$q_4$	$q_0$	$q_6$
$q_5$	$q_1$	$q_4$
$(q_6)$	$q_1$	$q_3$

10 Marks (CO1)

2. (a) Write short notes on the following :

10 Marks (CO1)

- (i) Kleene Closures
- (ii) Generalized Transition Graph
- (iii) Applications and Limitations of FA

OR

- (b) Discuss the finite state machine with the help of an appropriate example.

10 Marks (CO1)

3. (a) Explain CHOMSKY classification of languages with example. 10 Marks (CO1)

OR

- (b) Design DFA for a Language of string 0 and 1 that :

10 Marks (CO1)

(i) ending with 10

(ii) ending with 11

(iii) ending with 1

4. (a) State Arden's theorem. Consider a DFA machine,  $M = (\{q_1, q_2, q_3\}, \{0, 1\}, \delta, q_1, \{q_1\})$ , where the transition function is defined as following :

$$\delta(q_1, 0) = q_1, \quad \delta(q_1, 1) = q_2,$$

$$\delta(q_2, 0) = q_3, \quad \delta(q_2, 1) = q_2,$$

$$\delta(q_3, 0) = q_1, \quad \delta(q_3, 1) = q_2$$

Find a regular expression 'r' such that

$$L(r) = L(M).$$

10 Marks (CO2)

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OR

- (b) Write the statement of Pumping Lemma for regular languages. Show that  $L = \{ a^n : n \geq 2, \text{ is a prime number} \}$  is not a regular language over  $\Sigma = \{a\}$ .

10 Marks (CO2)

5. (a) Consider the Mealy machine described by the transition table given in table. Construct a Moore machine which is equivalent to the Mealy machine. 10 Marks (CO2)

P. State	Input a = 0		Input a = 1
	State	Output	State
q1	q3	0	q2
q2	q1	1	q4
q3	q2	1	q1
q4	q4	1	q3

OR

- (b) Draw the NFA for the regular expression  $(a|b)^* a b$  with  $\epsilon$  move. Convert this NFA to DFA using  $\epsilon$  closure method.

10 Marks (CO2)