



Sardar Patel Institute of Technology

Bhavan's Campus, Murshi Nagar, Andheri (W), Mumbai: 400058, India
(Autonomous College of Affiliated to University of Mumbai)

Re-Examination

August 2023

Maxi Marks: 100

Class: T.E

Course code: CS301/IT301

Name of the course: Theory of Computation

Duration: 3 hours

Semester: V

Branch: COMP/IT

Instructions:

- (1) All questions are compulsory
- (2) Draw neat diagrams
- (3) Assume suitable data if necessary

Q No		Max Marks	CO	BL
Q1	Attempt all the questions			
a	Which two of the following four regular expressions are equivalent? Justify your answer. (i) $(00)^*(\epsilon + 0)$ (ii) $(00)^*$ (iii) 0^* (iv) $0(00)^*$ (i) and (ii) B) (ii) and (iii) C) (i) and (iii) D) (iii) and (iv)	2	2	3
b	How many states the smallest finite automation will have one that accepts the language $L = \{x \mid \text{length of } x \text{ is divisible by } 3\}$. Justify your answer.	2	1	3
c	Let ω be any string of length n in $\{0, 1\}^*$. Let L be the set of all substrings of ω . What is the minimum number of states in a non-deterministic finite automaton that accepts L ? (A) $n-1$ (B) n (C) $n+1$ (D) 2^{n+1}	1	1	3
d	Design FSM which contains NO occurrence of aa over $\Sigma(a, b)$. OR Construct the NFA to recognize the string ending with abb .	5	1	3
Q2 a	State and prove Arden's theorem with example.	10	2	3
Q2 b	Design Mealy m/c for 2's complement of a given binary number.	10	1	3
Q3 a	Construct a DFA with reduced states equivalent to the regular expression: $10+(0+11)0^*1$	10	1	3
Q3 b	Give and explain formal definition of Pumping Lemma for Regular Language and prove that the following language is not regular. $L = \{WW \mid W \in \{a, b\}^*\}$.	10	2	3
Q4 a	Design a Turing Machine to recognise all strings consisting of even number of 1's. Assume the string is made up of only 1's, i.e. the input is a unary number.	10	4	3

Q4 b	Construct a PDA for the language $\{a^n b^{2n} \mid n \geq 1\}$ OR Prove that NPDA \neq DPDA	10	4	3
Q5 a	Convert the following CFG into CNF $S \rightarrow aSa \mid bSb \mid a \mid b \mid aa \mid bb$	10	3	3
Q5 b	Convert the following CFG into GNF $S \rightarrow AB$ $A \rightarrow BS \mid b$ $B \rightarrow SA \mid a$	10	3	3
Q6 a	Construct a grammar for $L = \{a^j b^n c^n \mid n \geq 1, j \geq 0\}$	05	3	3
Q6 b	Describe Type 2 and Type 3 grammar with example.	05	3	3