Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Winter Examination-2019

Subject Name : Theory of Computation

Subject Code : 4TE06TOC1 **Branch: B.Tech (CE)**

Semester: 6 **Date: 20/09/2019** **Time: 10:30 To 01:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) Explain one to one function with example.
b) What is a universal language?
c) When is a string accepted by PDA?
d) Give an example of deterministic CFL.
e) Explain types of relations.
f) What is Finite Automata?
g) List out applications of Regular Expression
h) List out special features of Turing machines.
i) Which of the following CFG's can't be simulated by an FSM?
A. S --> Sa | b
B. S --> aSb | ab
C. S --> abX, X --> cY, Y --> d | aX
D. None of these
j) Consider a grammar with the following productions
S--> aab | bac | aB
S --> α S | b
S --> α b b | ab
Sα --> bdb | b
The above grammar is
A. Context free
B. regular
C. context sensitive
D. LR (k)
k) Define: Context Sensitive Grammar
l) What is parse tree?
m) Differentiate push down stack and push down store ?
n) Which of the following is true?
A. Power of deterministic automata is equivalent to power of non-deterministic automata.

B. Power of deterministic pushdown automata is equivalent to power of non-deterministic pushdown automata.

C. Power of deterministic Turing machine is equivalent to power of non-deterministic Turing machine.

D. All the above

Attempt any four questions from Q-2 to Q-8

Q-2		**Attempt all questions**	**(14)**
	a)	Prove that square root of 2 is Irrational by method of Contradiction.	**(5)**
	b)	Suppose that Languages L1 and L2 are the subsets given below. Where Σ = { 0 , 1 } L1 = { x | 00 is not a substring of x } L2 = { x | x ends with 01 } Draw FAs recognizing the following languages (1) L1 - L2 (2) L1∩L2	**(5)**
	c)	Using Mathematical induction prove that 3^n is true for all natural numbers.	**(4)**
Q-3		**Attempt all questions**	**(14)**
	a)	Find a regular expression corresponding to each of the following subsets of {0, 1}*. i. The language of all strings that do not contain the substring 110. ii. The language of all strings containing both 101 and 010 as substrings. iii. The language of all strings in which both the number of 0's and the number of l's are odd.	**(5)**
	b)	Prove Kleene's Theorem (Part I): Any Regular Language can be accepted by a Finite Automata (FA)	**(5)**
	c)	Show using pumping lemma that the given language is not a CFL. L = { $a^n b^{2n} a^n$ | n ≥ 0}	**(4)**
Q-4		**Attempt all questions**	**(14)**
	a)	Prove that the following CFG is Ambiguous. S →S + S | S * S | (S) | a Write the unambiguous CFG for the above grammar. Draw Parse tree for the string **a + a * a.**	**(7)**
	b)	Eliminate useless symbols, ∈-productions and unit productions for the following grammar: S→0A0|1B1|BB, A→C, B→S|A, C→S|∈	**(7)**
Q-5		**Attempt all questions**	**(14)**
	a)	State and prove Arden's theorem.	**(5)**
	b)	Design a push down automata to check well-formed parenthesis.	**(5)**
	c)	Define Context-Sensitive Grammar. What is the language of following context-sensitive grammar? S→aTb | ab aT→aaTb | ac.	**(4)**
Q-6		**Attempt all questions**	**(14)**

	a)	Write a Turing Machine to copy strings.	**(7)**
	b)	Convert following CFG to equivalent Chomsky Normal Form(CNF). S→AACD | ACD | AAC | CD | AC | C A→aAb | ab C→aC | a D→aDa | bDb | aa | bb	**(7)**
Q-7		**Attempt all questions**	**(14)**
	a)	Draw a Turing Machine(TM) to accept Even and odd Palindromes over {a,b}.	**(7)**
	b)	Write short note on NP- Hard and NP – Complete Problems.	**(7)**
Q-8		**Attempt all questions**	**(14)**
	a)	Explain Universal Turing Machine and Halting Problem.	**(7)**
	b)	What is decidability? How to prove that the given language is un decidable? List some un decidable problems.	**(7)**