Hall Ticket Number:

Code No. : 31528

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (I.T.) III Year I-Semester Main & Backlog Examinations, December-2017

Theory of Automata

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Design a DFA that accepts strings containing Even no. of zeros and Odd no. of ones.
2. Write the applications of finite automata.
3. Write the closure Properties of Regular Languages.
4. Draw the derivation tree for the string **aabbaa** using the following grammar
   S →aAS | a
   A→SbA | SS | ba
5. Define the languages of PDA accepted by final state and by empty stack.
6. Define Griebach Normal Form and give one example for GNF grammar.
7. What is an Instantaneous Description (ID) in Turing Machine and Give the TM formal definition.
8. Distinguish Multi Tape and Multi Track Turing Machines.
9. State Rice Theorem.
10. When a boolean expression is said to be in Conjunctive normal form?

Part-B (5 × 10 = 50 Marks)

11. a) Convert the following NFA to its equivalent DFA. [6]

δ	a	b
->q_0	{ q_0, q_1}	{ q_0, q_3}
q_1	Ø	{ q_2}
*q_2	Ø	Ø
q_3	{ q_4}	Ø
*q_4	Ø	Ø

b) Obtain a regular expression for the following Finite Automata. [4]

δ	0	1
->q_0	q_1	q_0
*q_1	q_1	q_1

12. a) State the pumping Lemma for Regular Languages and prove that the following Language is not regular. [5]
    L = { a^p / p is prime }

    b) Given the grammar **E -> +EE / *EE / -EE / x / y and** the input string + * - x y x y [5]
    i) Find Left most Derivation
    ii) Find Right most Derivation
    iii) Draw parse tree

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13. a) Convert the following Context free grammar to Pushdown Automata [4]

I -> a / b / Ia / Ib / I0 /I1

E -> I / E*E / E+E / (E)

b) Convert the following grammar into Chomsky Normal Form(CNF) by making necessary elimination of ϵ-Productions, unit productions and useless symbols. [6]

S -> aSB / ϵ

A -> aAS / a

B -> SbS /A /bb

14. a) Design a Turing Machine to accept the language [7]

$L=\{ a^n b^n c^n \mid n \geq 1 \}$

b) Discuss about the extensions to the Turing Machine. [3]

15. a) What is PCP and whether the following PCP instance has a solution or not. [5]

A=(01,001,10) B=(011,01,00).

b) Put the following Boolean expression into 3-CNF. [5]

$x y + \bar{x} z$

16. a) Explain the procedure to convert a ϵ-NFA to a NFA and covert the following ϵ-NFA to NFA without ϵ transitions. [6]

δ	ϵ	a	b	c
->q_0	Ø	{q_0}	{q_1}	{q_3}
q_1	{q_0}	{q_1}	{q_2}	Ø
*q_2	{q_1}	{q_2}	Ø	{q_0}

b) Discuss Chomsky Hierarchy of languages. [4]

17. Answer any *two* of the following:

a) Consider the following CFG and test whether the string **10010** is a member or not in the corresponding language. [5]

$S \rightarrow A_1A_2 / A_2A_3$

$A_1 \rightarrow A_2A_1 / 0$

$A_2 \rightarrow A_3A_3 / 1$

$A_3 \rightarrow A_1A_2 / 0$

b) Write about different Programming Techniques for Turing Machine. [5]

c) Define Recursive and Recursively enumerable languages and write their properties. [5]