Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. .....

Program: B.Tech. (Batch 2018 onward)
Semester: **5th**
Name of Subject: **Theory of Computation**
Subject Code: **PCIT-112**
Paper ID: **16443**

EVENING

04 JAN 2023

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) Differentiate between Pushdown Automata and Turing Machine.
b) Describe the Recursively Enumerable Language with example.
c) Prove that for any transition function δ and for any two input strings x and y, $\delta(q, xy) = \delta(\delta(q, x), y)$
d) Let L be the set of all palindromes over {a,b}. Construct a grammar G generating L.
e) Let G = ({S, A1} , {0,1,2} , P, S) where P consists of
$S \rightarrow 0SA_1 2,\ S \rightarrow 012,\ 2A_1 \rightarrow A_1 2,\ 1A_1 \rightarrow 11$
Find L(G).
f) Prove that following regular expressions are equivalent.
$aa(b^* + a) + a(ab^* + aa) = aa(b^* + a)$

Part – B **[Marks: 04 each]**

Q2. How Noam Chomsky classified the formal languages? Discuss each class with the help of suitable examples. Also name the automata accepting these languages.

Q3. Discuss in detail Linear Bounded Automata.

Q4. State and prove pumping lemma for regular grammars.

EVENING

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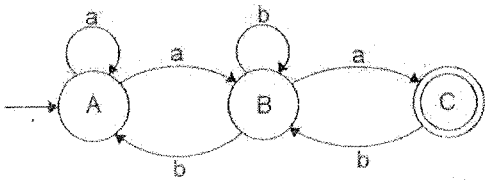
Q5. Given the grammar $S \rightarrow AB, A \rightarrow a$, B $\rightarrow$ C | b, C $\rightarrow$ D, D $\rightarrow$ E, E $\rightarrow$ a, find an equivalent grammar which is reduced and has no unit productions.

Q6. Construct a minimum state automaton equivalent to Finite Automata given below:

STATE	INPUT	
	a	b
$\rightarrow q_0$	q_1	q_2
q_1	q_4	q_3
q_2	q_4	q_3
(q_3)	q_5	q_6
(q_4)	q_7	q_6
q_5	q_3	q_6
q_6	q_6	q_6
q_7	q_4	q_6

Q7. Derive the regular expression of given automaton using Arden's Theorem.



Part – C **[Marks: 12 each]**

Q8. Describe and highlight the points that differentiate a mealy machine from a moore machine.Illustrate using an example, the conversion of moore machine to mealy machine.

OR

Discuss in detail the procedure to convert context free grammar into Greibach Normal Form. Also apply the discussed procedure to convert the following CFG into GNF

$$s \rightarrow AB, \quad A \rightarrow BS|b, \quad B \rightarrow SA|a$$

Q9. What is the difference between PDA acceptance by empty stack and final state? Design a PDA to accept the language $L = \{\omega 2\omega | \omega \varepsilon \{0,1\}^*\}$ by final state.

OR

Design a Turing machine M to recognize the language$\{1^n 2^n 3^n | n \geq 1\}$.Obtain the computation sequence of M for processing the input string 112233.

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