Total No. of Questions : 8]

**PA-1499**

SEAT No. :

[Total No. of Pages : 3

**[5926]-119**

# T.E. (Information Technology)

## THEORY OF COMPUTATION

## (2019 Pattern) (Semester - I) (314441)

*Time : 2½ Hours]* *[Max. Marks : 70*

*Instructions to the candidates:*

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

*Q1)* a) What is a Regular Grammar? Explain types of regular grammar. [5]

b) Simplify the following CFG. [6]

$S \rightarrow ABA$

$A \rightarrow aA \mid \varepsilon$

$B \rightarrow bB \mid \varepsilon$

c) What is ambiguous grammar? Show that the following grammar is ambiguous and find the equivalent unambiguous grammar. [7]

$E \rightarrow E + E \mid E * E \mid (E) \mid I$

$I \rightarrow a \mid b$

OR

*Q2)* a) Write CFG for the language $L = \{a^i b^j c^k \mid i = j + k \ \& \ j, k >= 1\}$. [6]

b) Check whether the given language is CFL or not $L = \{a^n b^n c^n \mid n >= 0\}$. [6]

c) Covert the following RLG to FA. [6]

$S \rightarrow 0A \mid 1B \mid 0 \mid 1$

$A \rightarrow 0S \mid 1B \mid 1$

$B \rightarrow 0A \mid 1S$

*Q3)* a) Define Post machine. [3]

b) Design a PDA for accepting language L= { w c $w^R$ | w ∈ (a, b)*}. [6]

c) Define Push down Automata. Explain different types of PDA. Explain any two applications of PDA. [8]

OR

*Q4)* a) Design a Pushdown Automata for the following language [7]

L = {$a^n$ c $b^n$ | n ≥ 1}

b) Convert the grammar [6]

S → 0S1 | A

A → 1A0 | S | ε

to PDA that accepts the same language by empty stack.

c) Compare Finite Automata and Pushdown Automata. [4]

*Q5)* a) Write a note on Universal turing Machine. [5]

b) Explain post correspondance problem with a suitable example. [6]

c) Construct a Turing machine to find 2's complement of a binary number. [7]

OR

*Q6)* a) Design a Turing Machine to increment value of binary number by one. [8]

b) Write short notes on [6]

i) Unsolvable problems

ii) Applications of Turing Machine

c) What are recursive and recursively enumerable languages? [4]

*Q7)* a) What is a Traveling Salesman Problem? Justify that it is a NP-class problem. [8]

b) Write short notes on [9]

i) A Simple Un-decidable problem

ii) Measuring Complexity

OR

*Q8)* a) Explain Cook's theorem in detail. [8]

b) Explain in detail the Node-Cover Problem. [9]

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