**Total No. of Questions : 8]** **SEAT No. :**

**PC1801** **[Total No. of Pages : 2**

# [6353]-120
# 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) Convert the following CFG (Context Free Grammar) to its equivalent CNF (Chomsky Normal Form) **[5]**

$S \rightarrow bA|aB$

$A \rightarrow bAA|aS|a$

$B \rightarrow aBB|bS|b$

b) Explain the following terms **[6]**

i) Ambiguous Grammar

ii) Derivation Tree

c) Simplify the following CFG (Context Free Grammar) **[7]**

$S \rightarrow a|Bb|aDa|B$

$B \rightarrow D|Da|\in$

$D \rightarrow b|aBb$

OR

***Q2)*** a) Distinguish between Regular Grammar (RG) and Context Free Grammar (CFG) with example. **[5]**

b) Convert the following Right Linear Grammar (RLG) to its equivalent Left Linear Grammar (LLG). **[7]**

$S \rightarrow aA|bE$

$A \rightarrow bA|aB$

$B \rightarrow bC|aD$

$C \rightarrow bD|b|aE$

$D \rightarrow bD$

$E \rightarrow a$

c) Construct the DFA for the following Right Linear Grammar (RLG) **[6]**

$S \rightarrow bB$

$B \rightarrow bC|aB|b$

$C \rightarrow a$

***P.T.O.***

***Q3)*** a) Construct the PDA for $L=\{a^n b^{m+n} c^m | n,m>=1\}$ **[6]**

b) Construct a Post Machine to accept a language $L = \{a^n b^{n+1} | n>=0\}$ **[6]**

c) Explain the following. **[6]**

i) Deterministic PDA and Non-Deterministic PDA.

ii) CFL for PDA

OR

***Q4)*** a) Design a Pushdown Automata (PDA) for accepting the set of all strings of well formed parenthesis over inputs (,), [,], {,} **[8]**

b) Differentiate between Finite Automata and Push Down Automata. **[4]**

c) Construct a Post Machine to accept the strings for a language $L = \{a^n b^n c^n | n>=0\}$ **[6]**

***Q5)*** a) Design a Turing Machine for a Language $L = \{a^n bc^n | n>=0\}$ **[7]**

b) Write a short note on **[6]**

i) Recursive Language

ii) Recursively Enumerable Language

c) Write a short note on Multi Tape Turing Machine. **[4]**

OR

***Q6)*** a) Design a Turing Machine to compute proper subtraction of two unary numbers. The proper subtraction function f is defined as follows. **[7]**

$f(x,y) = \{x-y$ if $x>y$

$0$ otherwise

b) Design a Turing Machine (TM) to increment a binary number by 1 **[6]**

c) Write a short note on Church-Turing thesis. **[4]**

***Q7)*** a) Write Short note on **[6]**

i) Un-decidable Problem

ii) Measuring Complexity

b) Let HALT TM = {where M is a TM and M halts on input w}. Prove that HALT TM is undecidable. **[6]**

c) Give difference between P Class and NP class Problem. **[5]**

OR

***Q8)*** a) $A_{DFA}$ is a decidable language. **[6]**

$A_{DFA}$ = {|B is a DFA that accepts input string w}

b) Write a short note on Normal Forms of Boolean Expressions. **[6]**

c) Write a short note on NP Completeness of SAT Problem. **[5]**

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