Total No. of Questions : 8]

SEAT No. :

**P806**

[Total No. of Pages : 2

# [5870]-1126
## T.E. (Computer Engineering)
## THEORY OF COMPUTATIONS
## (2019 Pattern) (Semester-I) (310242)

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***

***Q1)*** a) Write a grammar G for generating the language **[9]**
i) L={w belongs to {a,b}* | w is an even length palindrome with |w|>0}
ii) Set of odd length strings in {0,1}* with middle symbol '1'

b) Simplify the following grammar **[9]**
S→ 0A0|1B1|BB
A→ C
B→ S|A
C→ S|€

OR

***Q2)*** a) Reduce the following grammar to Greibach Normal form. **[9]**
S→ AA | 0
A→ SS | 1

b) Construct a DFA for the following left linear grammar. **[9]**
S→ B1/A0/C0
B→ B1/1
A→ A1/B1/C0
C→ A0

***Q3)*** a) Construct a context free grammar which accepts N(A), where **[9]**
A = ({q0,q1}, {0,1}, {Z0,Z}, δ, q0, Z0, $\varphi$}-where δ is given by
δ (q0, 1, Z0) = {(q0, ZZ0)}
δ (q0, ε, Z0) = {(q0,ε)}
δ (q0, 1, Z) = {(q0, Z Z)}
δ (q0, 0, Z) = {(q1, Z)}
δ (q1, 1, Z) = {(q1, ε)}
δ (q1, 0, Z0) = {(q0, Z0)}

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

b) Construct a PDA that accept the language generated by grammar **[8]**

i) $S \rightarrow 0S1|A, A \rightarrow 1A0|S|€$

ii) $S \rightarrow aABB|aAA, A \rightarrow aBB|a, B \rightarrow bAA|A$

OR

***Q4)*** a) What is NPDA? Construct a NPDA for the set of all strings over {a,b} with odd length palindrome. **[9]**

b) Design a push down automaton to recognize the language generated by the following grammar: **[8]**

$S \rightarrow S + S \mid S \square S \mid 4 \mid 2$

Show the acceptance of the input string 2 + 2*4 by this PDA.

***Q5)*** a) What is a Turing Machine? Give the formal definition of TM. **[9]**
Design a TM that replaces every occurrence of abb by baa.

b) What are the different ways for extension of TM? Explain. **[9]**
Design TM for language L = {a^i b^j | i<j}

OR

***Q6)*** a) What is TM? Design TM to check well formedness of Parenthesis. Expand the transition for (())() **[9]**

b) Elaborate the following terms **[9]**

i) Universal Turing Machine (UTM)

ii) Recursively Enumerable Languages

iii) Halting Problem of Turing Machine

***Q7)*** a) Justify "Halting Problem of Turing machine is undecidable". **[9]**

b) Define the Class P and Class NP and Problem with their example in detail. **[8]**

OR

***Q8)*** a) Explain Satisfiability Problem and SAT Problem and comment on NP Completeness of the SAT Problem. **[9]**

b) What do you mean by polynomial time reduction? Explain with suitable example. **[8]**