

Total No. of Questions : 8]

SEAT No. :

P806

[5870]-1126

[Total No. of Pages : 2

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) $L = \{w \text{ belongs to } \{a,b\}^* \mid w \text{ is an even length palindrome with } |w| > 0\}$
ii) Set of odd length strings in $\{0,1\}^*$ with middle symbol '1'

- b)** Simplify the following grammar **[9]**
 $S \rightarrow 0A0 \mid 1B1 \mid BB$
 $A \rightarrow C$
 $B \rightarrow S \mid A$
 $C \rightarrow S \mid \epsilon$

OR

- Q2) a)** Reduce the following grammar to Greibach Normal form. **[9]**
 $S \rightarrow AA \mid 0$
 $A \rightarrow SS \mid 1$
b) Construct a DFA for the following left linear grammar. **[9]**
 $S \rightarrow B1/A0/C0$
 $B \rightarrow B1/1$
 $A \rightarrow A1/B1/C0$
 $C \rightarrow A0$

- Q3) a)** Construct a context free grammar which accepts $N(A)$, where **[9]**
 $A = (\{q_0, q_1\}, \{0, 1\}, \{Z_0, Z\}, \delta, q_0, Z_0, \phi)$ where δ is given by
 $\delta(q_0, 1, Z_0) = \{(q_0, ZZ_0)\}$
 $\delta(q_0, \epsilon, Z_0) = \{(q_0, \epsilon)\}$
 $\delta(q_0, 1, Z) = \{(q_0, Z Z)\}$
 $\delta(q_0, 0, Z) = \{(q_1, Z)\}$
 $\delta(q_1, 1, Z) = \{(q_1, \epsilon)\}$
 $\delta(q_1, 0, Z_0) = \{(q_0, Z_0)\}$

P.T.O.

- b) Construct a PDA that accept the language generated by grammar [8]
 i) $S \rightarrow 0S1 \mid A, A \rightarrow 1A0 \mid S \mid \epsilon$
 ii) $S \rightarrow aABB \mid aAA, A \rightarrow aBB \mid a, B \rightarrow bAA \mid A$

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 $L = \{a^i b^j \mid i < j\}$

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]

