

Total No. of Questions :8]

SEAT No. :

P1755

[Total No. of Pages :3

[5058] - 395

T.E. (Computer)

THEORY OF COMPUTATION

(2012 Course) (Semester - I) (310241)

Time : 2½ Hours]

[Max. Marks :70

Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figures to the right side indicate full marks.
- 3) Assume suitable data, if necessary.

- Q1)** a) What is Kleen Closure? What is Positive Closure? For a given language L under what circumstances will  $L^+$  and  $L^*$  be equal? [6]
- b) Construct a DFA over the alphabets  $\{0, 1\}$  for accepting the strings having number of 1's as multiple of 3. [6]
- c) Check whether the given grammar is in CNF. If not then find its equivalent CNF. [8]

$S \rightarrow bA \mid aB, A \rightarrow bAA \mid aS \mid a, B \rightarrow aBB \mid bS \mid b$

OR

- Q2)** a) Define a Language of Polynomials recursively and give derivation for  $7X^4 - 3X^3 + 15X$  [6]
- b) Construct finite automata for the following regular expressions. [6]
- i)  $01 [((10)^* + 111)^* + 0]^* 1$
  - ii)  $1 (1 + 10)^* + 10 (0 + 01)^*$
- c) Simplify the following grammar [8]
- i)  $S \rightarrow Ab, A \rightarrow a, B \rightarrow C \mid b, C \rightarrow D, D \rightarrow E, E \rightarrow a$
  - ii)  $S \rightarrow 0A0 \mid 1B1 \mid BB, A \rightarrow C, B \rightarrow S \mid A, C \rightarrow S \mid \epsilon$

P.T.O.

**Q3) a)** “If  $L_1$  &  $L_2$  are recursive languages, then  $L_1 \cup L_2$  and  $L_1 \cap L_2$  are also recursive.” Justify. [6]

b) What is NDTM? Construct a NDTM to recognize words of the form WW over alphabet  $\{a, b\}$ . [12]

OR

**Q4) a)** What is a post machine? Give formal definition of Post Machine. Construct a Post Machine for Having odd length and a's as center element. [10]

b) Write short note on (Any two): [8]

i) Universal Turing Machine (UTM).

ii) Languages accepted/ decided by TM.

iii) Recursively Enumerable Languages.

**Q5) a)** What is PDA? What are the different types of PDA? Give its applications. [7]

b) Obtain the CFG for the PDA given by  $M = \{\{q_0, q_1\}, \{0, 1\}, \{z_0, X\}, \delta, q_0, z_0, \phi\}$  where  $\delta$  is given as. [9]

$$\delta(q_0, 1, z_0) = \{q_0, xz_0\} \quad \delta(q_0, 1, x) = \{q_0, xx\}$$

$$\delta(q_0, 0, x) = \{q_1, x\} \quad \delta(q_0, \epsilon, z_0) = \{q_0, \epsilon\}$$

$$\delta(q_1, 1, x) = \{q_1, \epsilon\} \quad \delta(q_0, 1, z_0) = \{q_0, z_0\}$$

OR

**Q6) a)** Construct a PDA that accept  $L = \{a^n b^n \mid n \geq 1\}$  through Empty Stack. [6]

b) What is NPDA? Construct a NPDA for  $L = \{a^i b^j c^k \mid i \neq j \text{ or } j \neq k\}$  [10]

**Q7)** a) What do you mean by NP - Complete Problems? List all the problems in this class and Explain any one with suitable example. [8]

b) Why do we need to reduce existing problems to NP-Complete problems? Explain with suitable example. [8]

OR

**Q8)** a) What is SAT problem? Explain in detail. [8]

b) What are Tractable and Intractable problems? Explain. [4]

c) What is Computational Complexity? Explain. [4]

