

Total No. of Questions : 10]

SEAT No. :

P2513

[Total No. of Pages : 3

[5253]-542

T.E. (I.T.)

THEORY OF COMPUTATION

(2015 Patern)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Design Moore machine for divisibility by 3 tester for binary number. [6]
b) Discuss Applications of FA & regular expressions. [4]

OR

- Q2)** a) Using Pumping lemma, Prove that $L = \{0^i / i \text{ is an integer, } i \geq 1\}$ is not-regular. [6]
b) Design Finite Automata to accept strings ending with 00 or 11. [4]

- Q3)** a) Simplify the following grammar [5]

$$S \rightarrow a \mid Xb \mid aYa$$

$$X \rightarrow Y \mid \epsilon$$

$$Y \rightarrow b \mid X$$

- b) Write an equivalent left-linear grammar for the right-linear grammar, which is defined as : [5]

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

$$A \rightarrow 0C \mid 1A \mid 0$$

$$B \rightarrow 1B \mid 1A \mid 1$$

$$C \rightarrow 0 \mid 0A$$

P.T.O.

OR

- Q4)** a) Check whether or not the following grammar is ambiguous; if it is ambiguous, remove the ambiguity and write an equivalent unambiguous grammar. [6]

$$S \rightarrow aS \mid aSbS \mid \epsilon$$

- b) Write Short Note on Chomsky Hierarchy. [4]

- Q5)** a) Construct PDA that accepts language. [8]

$$L = \{ a^n b^m c^n \mid m, n \geq 1 \}$$

- b) Construct PDA to check for well formedness of paranthesis. Write ID for i) (() ()) ii) (()) [8]

OR

- Q6)** a) Construct Post Machine which accepts the string over $\Sigma = \{a, b\}$ containing odd length & the element at the centre as 'a'. [8]

Write simulation for the string abbabba

- b) Convert the following CFG into CNF & construct PDA for the same. [8]

$$S \rightarrow 0A1 \mid 0BA$$

$$A \rightarrow S01 \mid 0$$

$$B \rightarrow 1B \mid 1$$

- Q7)** a) Design a TM that multiplies two unary numbers. [10]

Write simulation for the strings.

11 & 111

- b) Compare FA and TM. [4]
c) Define Recursive languages & Recursively enumerable languages with example [4]

OR

Q8) a) Design TM to find 2's complement. [6]

b) Construct a TM to compute [10]

$$\begin{aligned} f(a, b) &= a - b \text{ where } a > b \\ &= 0 \text{ where } a \leq b \end{aligned}$$

c) Explain Multitape TM [2]

Q9) a) Prove that, following are decidable languages [10]

i) $A_{CFG} = \left\{ \langle G, w \rangle \mid \begin{array}{l} \text{where } G \text{ is a CFG that} \\ \text{generates string } w \end{array} \right\}$

ii) $E_{CFG} = \left\{ \langle G, w \rangle \mid \begin{array}{l} \text{where } G \text{ is a CFG and} \\ L(G) = \phi \end{array} \right\}$

b) Write short note on NP completeness with examples. [6]

OR

Q10)a) Prove that, [8]

$$HALT_M = \left\{ \langle M, w \rangle \mid \begin{array}{l} M \text{ is TM \& } M \text{ halts} \\ \text{on input } w \end{array} \right\} \text{ is undecidable.}$$

b) Write short notes on : [8]

i) PCP

ii) Measuring complexity

