Total	l No.	of Questions : 10] SEAT No. :	
P25	13	[Total No. of Pages: 3	
		[5253]-542	
		T.E. (I.T.)	
THEORY OF COMPUTATION			
(2015 Patern)			
Time	: 21/2	[Max. Marks: 70	
Instr	uctio	ons 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 $L = \{O^{i^2} / i \text{ is an integer, } i \ge 1\}$ is not-regular. [6]	
	b)	Design Finite Automata to accept strings ending with 00 or 11. [4]	
		E. S.	
Q3)	a)	Simplify the following grammar [5]	
		$S \rightarrow a \mid Xb \mid aYa$	
		$X \to Y \in$	
		$Y \rightarrow b X$	
	b)	Write an equivalent left-linear grammar for the right-linear grammar, which	
		is defined as: [5]	
		$S \rightarrow 0A \mid 1B$	
		$A \rightarrow 0C 1A 0$	
		$B \rightarrow 1B 1A 1$	
		$C \rightarrow 0 0A$	

	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.
b)	Write Short Note on Chomsky Hierarchy. [4]
Q5) a)	Construct PDA that accepts language. [8]
	$L = \{ a^n b^m c^n \mid m, n \ge 1 \}$
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] $S \rightarrow 0A1 \mid 0BA$ $A \rightarrow S01 \mid 0$
	$B \rightarrow 1B 1$
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 S

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

[6]

Construct a TM to compute b)

[10]

$$f(a, b) = a - b \text{ where } a > b$$

- 0 where $a \le b$
- Explain Multitape TM c)

[2]

Prove that, following are decidable languages **Q9**) a)

[10]

i)
$$A_{CFG} = \left\{ \left\langle G, w \right\rangle \middle| \begin{array}{l} \text{where G is a CFG that} \\ \text{generates string w} \end{array} \right\}$$
ii)
$$E_{CFG} = \left\{ \left\langle G, w \right\rangle \middle| \begin{array}{l} \text{where G is a CFG and} \\ L(G) = \phi \end{array} \right\}$$

- Write short note on NP completeness with examples. b)

[6]

Prove that, *Q10)*a)

[8]

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

Write short notes on b)

- i) **PCP**
- Measuring complexity ii)