Total No. of Questions : 10]

SEAT No. :

**P3388**

[Total No. of Pages : 3

# [5353] - 591
# T.E. (IT)
# THEORY OF COMPUTATION
# (2015 Pattern)

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

***Q1)*** a) Define pumping lemma. Prove that the language $L=\{a^n b^{n+1} | n>0\}$ is non regular. **[6]**

b) Construct FSM for divisibility by 3 tester for binary number. **[4]**

OR

***Q2)*** a) Construct the Mealy machine to accept strings ending with '00' or '11' over $\sum=\{0,1\}$. Convert Mealy Machine into equivalent Moore machine. **[8]**

b) If $L(r)=\{\in, x, xx, xxx, xxxx, xxxxx\}$ What is *r*? **[2]**

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

$S \rightarrow a|Xb|aYa$

$X \rightarrow Y|\in$

$Y \rightarrow b|X$

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

$S \rightarrow 0A|1B$

$A \rightarrow 0C|1A|0$

$B \rightarrow 1B|1A|1$

$C \rightarrow 0|0A$

***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 $E \rightarrow E+E|E-E|E*E|E|E|(E)|id$ **[6]**

b) Convert the given CFG $G=(\{s\},\{a\},p,s)$ into CNF. **[4]**

$S \rightarrow aaaaaS|aaa$

***Q5)*** a) Construct PDA to accept the strings containing equal no. of *a*'s & *b*'s over $\Sigma=\{a,b\}$ **[8]**

Write ID for

i) *abbaab*.

ii) *aabb*.

b) Design a PM that checks if the given string contains well-formed parenthesis. **[8]**

Simulate for

$(()\ ())$

OR

***Q6)*** a) Construct a PDA that accepts the language $L=\{a^n b^m a^n | m,n \geq 1\}$. **[8]**

Write ID for

i) *aabbaa*.

ii) *abbba*

b) Construct PDA for the following language **[8]**

$L=\{a^{2n} b^n | n \geq 1\}$

***Q7)*** a) Design a TM which compares two positive integers m & n and produces output Gt if $m > n$ ; Lt if $m < n$; and E$q$ if $m = n$ ; **[12]**

Write simulation for the input

i) $m = 1, n = 2$.

ii) $m = n = 2$.

b) Write short note on UTM. **[6]**

OR

***Q8)*** a) Construct TM for the language $L = \{a^n b^n c^n \mid n > 0\}$. **[10]**

b) Design a TM to find the value of $\log_2(n)$ where $n$ is any binary number & a perfect power of 2. **[8]**

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

i) $A_{CFG} = \{\langle G, W\rangle \mid G \text{ is a CFG that generates string } W\}$.

ii) $E_{CFG} = \{\langle G, W\rangle \mid G \text{ is CFG} \& L(G) = \phi\}$.

b) Define the class P & Class NP problems with example. **[6]**

OR

***Q10)*** a) Prove that **[8]**

$PCP = \{\langle P\rangle \mid P$ is an instance of the post correspondence problem with a match$\}$

is undecidable

b) Explain Turing Reduciability with example. **[8]**