Total No. of Questions : 10]

SEAT No. :

**P2999**

[Total No. of Pages : 3

# [5669]-591

## T.E. (Information Technology)

## THEORY OF COMPUTATION

## (2015 Pattern) (Semester - I)

*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 and 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 the following terms with an example. **[4]**

i) Alphabet.

ii) Regular Language.

b) Define formal definition of RE, also give the Regular expression for the following languages : **[6]**

i) The Set a strings over the alphabet {a, b} starting with b and ending with odd number of a's or even numbers of b's.

ii) The Set {10, 1010}

iii) If L (r) = {€, x,xx, xxx, xxxx, xxxxx) what is r?

OR

***Q2)*** a) Simplified the following grammar : **[4]**

$S \rightarrow Ab, A \rightarrow a, B \rightarrow C|b, C \rightarrow D, D \rightarrow E, E \rightarrow a$

b) Discuss application of RE and FA. **[3]**

c) Compare Moore machine and Mealy Machine. **[3]**

***Q3)*** a) Construct the FA from given RE 1* 00 (01)* **[4]**

b) Give CFG for following languages: **[6]**

i) Matching parenthesis

ii) All string without substring 'aaa'

iii) R = bba * bb + bb

***P.T.O.***

OR

***Q4)*** a) Convent following left linear grammar to right linear grammar stepwise. **[6]**

$S \rightarrow A0 \mid B1$

$A \rightarrow C0 \mid A1 \mid 0$

$B \rightarrow B1 \mid A1 \mid 1$

$C \rightarrow 0 \mid A0$

b) State and prove that Pumping Lemma with an application. **[4]**

***Q5)*** a) Design PDA to accept the language containing all odd length palindromes over $\Sigma = \{0,1\}$ by empty stack and final state. **[8]**

b) Design Post Machine that accept the following languages. **[8]**

$L = \{a^n b^m c^n \mid n >= 0\}$

OR

***Q6)*** a) Construct a PDA that accepts the language defined by the following grammar : **[8]**

S --> 0A | 1B | 0

A --> 0A | B

B –> c | d

Here N = {S, A, B}, T = {0, 1, c, d} and S is start symbol.

b) Construct PDA by final state that accepts the following language. **[8]**

Simulate for "aaaaa" $L = \{a^{2n} \mid n>0\}$

***Q7)*** a) Design TM which compares two positive integers m & n and produces output **[12]**

**Gt**, if m > n; **Lt**, if m < n; and **Eq**, if m = n;

Simulate the working of the TM for the input i) m = 1, n = 2. ii) m = n = 2.

b) Write a note on each of the following : **[6]**

i) Recursively enumerable language.

ii) Recursive language

iii) Recursive function.

OR

*Q8)* a) Construct a TM to compute the following function. **[12]**

f (a, b) = a – b where a > b

= 0 where a < b

Simulate the working of the TM for the input i) x = 2, y = 2. ii) x = 4, y = 2

b) Define TM. Explain its working. Give the types of TM & applications of the same. **[6]**

*Q9)* a) Suppose that there is an NP-complete problem P that has a deterministic solution taking $O(n^{\log 2^n})$ time (here log n denotes log $2^n$). What can you say about the running time of any other NP-complete problem Q? **[9]**

b) Prove that PCP with two lists x= (b, $bab^3$, ba) and y= ($b^3$, ba, a) have a solution? **[7]**

OR

*Q10)* a) Show that PCP over $|\Sigma| \geq 2$ is unsolvable. **[9]**

b) Find the running time for the Euclidean algorithm for evaluating GCD (a, b) where a, b are positive integers expressed in binary representation. **[7]**

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