Total No. of Questions : 8]

SEAT No. :

**PA-1442**

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**[5926]-58**

# T.E. (Computer Engg.)

## THEORY OF COMPUTATION

## (2019 Pattern) (Semester-I) (310242)

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) ***Answer Q1 or Q2, Q3. orQ4, Q5 or Q6, and Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figure to the right indicate full marks.***
4) ***Assume suiable data if necessary.***

***Q1)*** a) Convert the following grammar to Chomsky Normal form (CNF) **[9]**

$S \rightarrow a \mid aA \mid B$

$A \rightarrow aBB \mid \varepsilon$

$B \rightarrow Aa \mid b$

b) Convert the following grammar to GNF. **[9]**

$S \rightarrow XB \mid AA$

$A \rightarrow a \mid SA$

$B \rightarrow b$

$X \rightarrow a$

OR

***Q2)*** a) Show that the following grammar is ambiguous. **[6]**

S-> iCtS

S-> iCtSes

S-> a

C-> b

b) Convert the following grammar to chomsky normal form (CNF) **[6]**

G=({S}, {a, b}, P, S)

P = {S → aSa | bSb | a | b | aa | bb}



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

c) Consider the following grammar. **[6]**

E-> E + E | E–E | id

Derive the string id-id*id using

i) Leftmost derivation

ii) Rightmost derivation.

***Q3)*** a) Find the transition rules of PDA for accepting a language

$L=\{w \in \{a,b\}^* \mid w \text{ is of the } a^n b^n \text{ with } n \geq 1\}$ through both empty stack and final state and demonstrates the stack operation for the string aaabbb. **[9]**

b) Design a PDA for accepting a language $\{a^n b^{2n} \mid n>=1\}$ **[9]**

Simulate this PDA for the input string "aaabbbbbb".

OR

***Q4)*** a) Design a PDA for accepting a language $\{0^n 1^m 0^n \mid m, n>=1\}$.

Simulate this PDA for the input string "0011100". **[9]**

b) Construct a PDA for $L=\{0^n 1^m 2^m 3^n \mid m,n \geq 0\}$ **[6]**

c) Compare FA and PDA. **[3]**

***Q5)*** a) Write a short note on Halting problem of Turing machine. **[4]**

b) Design a Turing Machine for the following language by Considering transition table and diagram. **[9]**

i) TM That erases all non blank symbols on the tape where the sequence of non blank symbols does not contain any blank symbol B in between.

ii) TM that find 2's complement of a binary machine.

c) Design a Turing Machine that reads a string representing a binary number and erases all leading 0's in the string. However, if the string comprises of only 0's it keeps one 0. **[5]**

OR

*Q6)* a) Write short notes on: **[4]**

i) Reducibility

ii) Multi-tape Turing Machine

b) Construct a Turing Machine for R=aba*b **[6]**

c) Design a TM that multiplies two unary numbers over Σ={1}. Write simulation for the string 11*111. **[8]**

*Q7)* a) Justify "Halting problem of Turing machine is undecidable" **[8]**

b) Define and compare class P and class NP problem with suitable diagram **[8]**

OR

*Q8)* a) Explain in brief the term "recursively enumerable". **[6]**

b) Explain examples of problems in NP. **[6]**

c) Differentiate between P Class and NP class. **[4]**