

Total No. of Questions : 8]

PB-3858

SEAT No. :

[Total No. of Pages : 2

[6262]-121

T.E.(Information Technology Engineering)

Theory of Computation

(2019 Pattern) (Semester-I) (314441)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1) a) What is an ambiguous grammar? Explain with a suitable example. [4]  
b) What is Regular Grammar? Explain types of regular grammar. [5]  
c) Convert the following grammar to GNF. [9]

$$S \rightarrow AB$$

$$A \rightarrow BSB \mid BB \mid b$$

$$B \rightarrow aAb \mid a$$

OR

- Q2) a) Write CFG for the language  $L = \{ a^i b^j c^k \mid i = j + k \ \& \ j, k \geq 1 \}$  [6]  
b) Convert the following RLG to FA. [6]

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

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

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

- c) Explain any three closure properties of Context Free language. [6]

- Q3) a) Define Push down Automata. Explain different types of PDA. Explain any two applications of PDA. [6]  
b) Write a note on Instantaneous Description of PDA with an example [5]

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- c) Convert the following CFG to PDA that accepts the same language by empty stack. [6]

$$S \rightarrow 0S1 \mid A$$

$$A \rightarrow 1A0 \mid S \mid \varepsilon$$

OR

- Q4) a) Compare Finite Automata and Pushdown Automata. [4]

- b) Design a Pushdown Automata for the following language. [7]

$$L = \{0^a 1^b 2^c \mid a+c=b\}$$

- c) Design Post Machine for  $L = \{0^n 1^n \mid n \geq 0\}$  [6]

- Q5) a) Write a note on Universal Turing Machine [6]

- b) Explain Church Turing hypothesis. [3]

- c) Define Turing machine and design a right shifting TM over alphabet  $\{0,1\}$  with an example. [9]

OR

- Q6) a) Construct a Turing Machine to replace string '110' by '101' in a binary input string. Write down transition table along with diagram. [10]

- b) Discuss the following terms [8]

i) Post Correspondence Problem

ii) Halting Problem of Turing Machine

- Q7) a) What do you mean by NP problems? Justify why the Travelling Salesman problem is a NP problem. [8]

- b) Define decidability of problem with suitable example. Describe un-decidable problems for context-free Grammar. [9]

OR

- Q8) a) Write short note on : [9]

i) A Simple Un-decidable problem

ii) Measuring Complexity

- b) Explain in detail Cook's theorem. [8]

