SEAT No. :

[**Total No. of Pages : 2**

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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= { $a^i b^j c^k$ | i = j + k & j, k >=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]**

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