



**2020/TDC (CBCS)/ODD/SEM/
CSCHCC-501T/090**

**TDC (CBCS) Odd Semester Exam., 2020
held in March, 2021**

COMPUTER SCIENCE

(5th Semester)

Course No. : CSCHCC-501T

(Theory of Computation)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

SECTION—A

1. Answer any *ten* of the following questions :

2×10=20

(a) Define grammar.

(b) What is the difference between Σ^* and Σ^+ ? What is null string?

(c) Define reverse of a string with example.



(2)

- (d) Write a regular language over the alphabet $\Sigma = \{a, b\}$ that does not accept the string aa .
- (e) Give the formal definition of DFA.
- (f) Write the regular expression over the alphabet $\Sigma = \{a, b\}$ that accepts all strings starts with a and ends with b .
- (g) State pumping lemma for regular languages.
- (h) Differentiate between TG and FA.
- (i) Define CFG.
- (j) What do you mean by ambiguity in grammar?
- (k) Draw the parse tree for the following CFG :
 $S \rightarrow aA, A \rightarrow aB, B \rightarrow bB, B \rightarrow a$
- (l) Write the CFG for palindrome.
- (m) What is PDA?
- (n) What is context-free language? Give example.
- (o) State Chomsky normal form.

(3)

- (p) How is CFG related to PDA?
- (q) Why do we need Turing machine?
- (r) Define recursive language.
- (s) Differentiate between PDA and TM.
- (t) Write two properties of recursive enumerable language.

SECTION—B

Answer any **five** questions

- 2. (a) Discuss the basic operation on language.
- (b) Define the following :
 - (i) Alphabet
 - (ii) Symbol
 - (iii) String
 - (iv) Complementation
 - (v) Cardinality 5+5=10
- 3. (a) Write short notes on the following :
 - (i) Kleene star
 - (ii) Concatenation
- (b) Explain the different areas of TOC.

(3+2)+5=10



4. (a) Discuss the closure properties of regular language.
- (b) What is automata? Differentiate between DFA and NFA. 5+5=10
5. (a) Design DFA for the following languages :
- (i) $L = \{a^n b : n \geq 0\}$
- (ii) $L = \{w \in \{a, b\}^* : w \text{ contains even number of } a\text{'s and } b\text{'s}\}$
- (b) Draw an FA that contains aa and bb . 10
6. (a) Given a CFG with the following production rules :
- $$S \rightarrow aA$$
- $$A \rightarrow bS$$
- $$A \rightarrow b$$
- Obtain the derivation tree and language accepted by the grammar.
- (b) Explain leftmost derivation and rightmost derivation with examples. 10
7. Draw a PDA for—
- (i) $a^n b^n, n \geq 1;$
- (ii) $a^n b^m a^n \mid m, n \geq 1.$ 4+6=10

8. (a) Discuss the properties of context-free language.
- (b) Why is PDA more powerful than FA?
- (c) Write down the application of pumping lemma. 5+2+3=10
9. (a) Construct TM for the language $L = \{a^n b^n c^n : n \geq 1\}$
- (b) Discuss unsolvability problem. 6+4=10
10. (a) Write the formal definition of TM.
- (b) Write short notes on the following :
- (i) Universal TM
- (ii) Halting problem 3+(3½+3½)=10
11. (a) Show that the grammar $S \rightarrow S|S, S \rightarrow a$ is ambiguous.
- (b) Construct CFG for the language :
- (i) $L = \{WWR \mid W \in \{a, b\}^*\}$
- (ii) $L = \{a^n b^{2n} \mid n \geq 1\}$ 4+(3+3)=10
