

GANDAKI COLLEGE OF ENGINEERING AND SCIENCE

Level: Bachelor
Programme: BE
Course: Theory of Computation

Semester: Spring

Year : 2024
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Give the formal definition of DFA. Design a DFA that accepts a set of string such that string contains neither aa or bb as substring over alphabet {a,b}. 8
b) Define regular expression. Construct a finite automata equivalent to the following regular expression.
 $(a + a(b+aa)^*b)^*a(b+aa)^*a$ 7
2. a) State the pumping lemma for regular set. Show that $L = \{0^i1^i \mid i > 0\}$ is not regular. 7
b) Convert the following CFG into Chomsky Normal Form. 8
$$S \rightarrow Sbb|aabb|Aa|Bb$$
$$A \rightarrow Aa|a$$
$$B \rightarrow Bb|b|\epsilon$$
3. a) Define Context Free Grammar. Check whether the given grammar $S \rightarrow aB|ab, A \rightarrow aAB|a, B \rightarrow AB|b$ is ambiguous or not. 7
b) Design a PDA for the language $L = \{a^n b^n, \text{ where } n \geq 1\}$. 8
4. a) "TM is stronger than PDA and FA". Explain this statement with their suitable block diagram. 8
b) State the pumping lemma for context free language. Prove that $L = \{a^n b^n c^n, n \geq 1\}$ is not context free language. 7
5. a) Construct a Turing Machine that recognizes the language $L = \{a^n b^n \mid n \geq 0\}$. Check the acceptance of string aaabbb. 8
b) Convert the following CFG to equivalent PDA. 7
 $S \rightarrow 0S1 \mid 00 \mid 11$

- a) Write about Church Turing thesis and universal Turing machine. 5
 - b) Differentiate between Recursive and Recursively enumerable languages. 5
 - c) Define computational complexity theory. Define class P and class NP. 5
7. Write short notes on: (**Any two**) 2×5
- a) Halting problem
 - b) Arden's theorem
 - c) ID of PDA