

# GANDAKI COLLEGE OF ENGINEERING AND SCINECE

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Theory of Computation

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 string not ending with aba over alphabet  $\{a,b\}$ . 8  
b) Convert the following R.E. to equivalent E-NFA 7
  1.  $a^*(a+b)^*bb$
  2.  $(0+1)^*(00+11)^*(0+1)^*$
2. a) State the pumping lemma for regular set. Show that  $L = \{a^n b^n \mid n > 0\}$  is not regular. 7  
b) Convert the following CFG into Chomsky Normal Form. 8
$$S \rightarrow Sbb \mid aabb \mid Aa \mid Bb$$
$$A \rightarrow Aa \mid a$$
$$B \rightarrow Bb \mid b \mid \epsilon$$
3. a) Define Context Free Grammar. Check whether the given grammar 7
$$S \rightarrow aB \mid ab$$
$$A \rightarrow aAB \mid a$$
$$B \rightarrow AB \mid b$$
 is ambiguous or not. 8  
b) Design a PDA for the language  $L = \{a^n b^{2n} \mid n \geq 1\}$ .
4. a) "TM is functionally stronger than PDA and FA". Explain this statement with their suitable block diagram. 8  
b) State the pumping lemma for context free language. 7  
Prove that  $L = \{a^n b^n c^n \mid n \geq 1\}$ , not context free language.

5. a) Construct a Turing Machine that recognizes the language  $L = \{ a^n b^n c^n \mid n \geq 0 \}$ . Check the acceptance of string aaabbbccc. 8
- b) Convert the following CFG to equivalent PDA 7
- $S \rightarrow 0S1 \mid 0AA \mid 1BB$   
 $A \rightarrow 1A \mid 0$   
 $B \rightarrow 0B \mid 1$
6. a) Write Turing machine used for computing of a function with example. 5
- b) Differentiate between Recursive and Recursively enumerable languages. 5
- c) Define computational complexity theory. Define class P and class NP.
7. Write short notes on: (**Any two**) 2×5
- d) Halting problem is undecidable
- e) Write about Church Turing thesis and universal Turing machine.
- f) Chomsky hierarchy.