

BACHELOR OF TECHNOLOGY (CBCS) (2021-COURSE)
B. Tech. Sem - IV Computer Science & Engineering-AI & ML : WINTER : 2024
SUBJECT: THEORY OF COMPUTATION

Day : Saturday
Date : 30/11/2024

W-23946-2024

Time : 02:30 PM-05:30 PM
Max. Marks : 60

- N.B.** 1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat diagrams wherever necessary.

- Q. 1** Design a DFA – (10)
i) $L = \{x \in \{a, b, c, \}^* : |X| \equiv 0 \pmod{3}\}$
ii) $L = \{x \in \{0, 1\}^* : \text{second symbol of } x \text{ is } 0 \text{ and fourth symbol of } x \text{ is } 1\}$

OR

- Q.1** If language L is accepted by NFA then there exists an equivalent DFA that accepts the same language. Explain with example (10)

- Q. 2** Construct NFA for following RE (10)
a) $01^* + 1$
b) $ab^* + b$
c) $((a+bb)^*aa)^*$
d) $(0(00)^*1+01^*0)^*$
e) $10+(0+11)0^*1$
f) $ab^*aa+bba^*ab$

OR

- Q.2** Find finite Automata without epsilon transition for given regular expression (10)
a) $r = 10 + (0+11)0^*1$
b) $r = (0+1)^*(00+11)(0+1)^*$
c) $r = (ab)^*ba^*(bb+ab)^*$

- Q.3** What is ambiguity in grammar show the following grammar is ambiguous or not, justify your answer (10)
 $S \rightarrow S+S | S^*S | a | b | c$

OR

- Q.3** Convert the following grammar into Greibach normal form (GNF) (10)
 $S \rightarrow AB$
 $A \rightarrow BSB | BB | b$
 $B \rightarrow aAb | a$

- Q. 4** Design a PDA to accept each of the following languages by final state (10)
a) $\{0^n 1^n | n \geq 1\}$
b) The set of all strings of 0's and 1's with an equal number of 0's and 1's

OR

- Q.4** Demonstrate the languages defined by PDA's are exactly the context-free languages. (10)
Q. 5 Explain a Turing machine with two way infinite tape and write a relation with one way infinite tape (10)

OR

- Q.5** Design a Turing machine that accepts (10)
 $L = \{a^n b^n | n \geq 1\}$

- Q. 6** Prove the following (10)
a) the complement of a recursive language is recursive
b) the union of two recursive language is recursive

OR

- Q.6** Explain the Halting problem with suitable example (10)

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