

BACHELOR OF TECHNOLOGY (CBCS) (2021-COURSE)
B. Tech. Sem - III Computer Science & Business Systems : WINTER: 2025
SUBJECT: FORMAL LANGUAGE & AUTOMATA THEORY

Day : Tuesday
Date : 09/12/2025

W-24142-2025

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the **RIGHT** indicate **FULL** marks.
- 3) Assume suitable data **WHEREVER** necessary.
- 4) Draw neat diagrams **WHEREVER** necessary.

Q.1 Define and explain Alphabet, Strings and Languages with suitable examples. (10)
Differentiate between Graphs, Directed Graphs and Trees with examples.

OR

Q.1 Explain the concept of Finite State Machine (FSM). Draw an FSM for detecting (10)
substring '110' in a binary string.

Q.2 Construct a DFA to accept strings containing an even number of 1's and an odd (10)
number of 0's over $\{0,1\}$. Explain the minimization process of this DFA.

OR

Q.2 Explain Regular Expressions. Convert the Regular Expression $(a+b)^*abb$ into DFA. (10)

Q.3 Explain Context-Free Grammar. Derive parse tree for the string 'aab' for grammar: (10)

$S \rightarrow aS \mid b$

Explain ambiguity in CFG with example.

OR

Q.3 Design PDA for $L = \{a^n b^m \mid n, m \geq 1\}$. Explain the working for string 'aaabb'. (10)

Q.4 Design a Turing Machine to multiply a binary number by 2. Explain its working (10)
with a suitable example.

OR

Q.4 Design a Turing Machine to test whether a string has equal number of 0's and 1's. (10)
Explain its working in detail.

Q.5 Explain Church-Turing Thesis. Prove that the Halting Problem is undecidable. (10)

OR

Q.5 Design a Turing Machine for $L = \{wwR \mid w \in \{0,1\}^*\}$ where wR is the reverse of (10)
 w . Explain the working with an example.

Q.6 Write short notes on: (10)

- a) P and NP classes
- b) Time Complexity for Non-Deterministic Turing Machines

OR

Q.6 Write short notes on: (10)

- a) NP-Complete problems
- b) Complexity classes with diagram:
