



I Semester M.C.A. (Two Years Course) Examination, May/June 2025
(CBCS) (2020 – 2021 and Onwards)
COMPUTER SCIENCE
1 MCA 4 : Theory of Computation

Time : 3 Hours

Max. Marks : 70

- Instructions :** 1) Part – A : Answer **any five** questions.
2) Part – B : Answer **any four** questions.

PART – A

Answer **any five full** questions.

(5×6=30)

1. What are the central concepts of automata theory ?
2. Obtain a NFA to accept the following language
 $L = \{ w/w \in abab^n \text{ or } aba^n \text{ where } n \geq 0 \}$.
3. State and prove pumping lemma for regular languages and show that
 $L = \{ a^{k^2} \mid K \text{ is an integer, } K \geq 1 \}$ is not regular.
4. What is left recursion ? Eliminate left recursion from the following grammar
 $E \rightarrow E + T \mid T$
 $T \rightarrow T * F \mid F$
 $F \rightarrow (E) \mid \text{id}$.
5. Discuss in detail the types of grammars.
6. Eliminate all unit productions from the grammar.
 $S \rightarrow AB$
 $A \rightarrow a$
 $B \rightarrow C \mid b$
 $C \rightarrow D$
 $D \rightarrow E \mid bc$
 $E \rightarrow d \mid Ab$.
7. Convert the following grammar into GNF
 $S \rightarrow AB$
 $A \rightarrow BSB$
 $A \rightarrow a$
 $B \rightarrow b$.

P.T.O.



8. Write a short note on :

a) Halting problem of Turing machine.

3

b) Post correspondence problem.

3

PART – B

Answer **any four full** questions.

(4×10=40)

9. Consider the following ϵ – NFA

δ	ϵ	a	b
$\rightarrow p$	{r}	{q}	{p, r}
q	ϕ	{p}	ϕ
* r	{p, q}	{r}	{p}

a) Compute the ϵ – closure of each state.

3

b) Convert the automation to a DFA.

7

10. Explain closure properties of regular languages.

11. Check whether the following grammar is ambiguous

$S \rightarrow AB|C$

$A \rightarrow aAb|ab$

$B \rightarrow cBd|cd$

$C \rightarrow aCd|aDd$

$D \rightarrow bDc|bc.$

12. Construct a PDA to accept a string of balanced parentheses. The parentheses to be considered are (,), [,].

13. Construct a Turing machine to accept the language $L = \{ a^n b^n | n \geq 1 \}$.

14. Write a short notes on :

a) Moore and Mealy machine.

6

b) Rice theorem.

4