



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.

($5 \times 6 = 30$)

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
$$\begin{aligned} E &\rightarrow E + T | T \\ T &\rightarrow T * F | F \\ F &\rightarrow (E) | \text{id.} \end{aligned}$$
5. Discuss in detail the types of grammars.
6. Eliminate all unit productions from the grammar.
$$\begin{aligned} S &\rightarrow AB \\ A &\rightarrow a \\ B &\rightarrow C | b \\ C &\rightarrow D \\ D &\rightarrow E | bc \\ E &\rightarrow d | Ab. \end{aligned}$$
7. Convert the following grammar into GNF
$$\begin{aligned} S &\rightarrow AB \\ A &\rightarrow BSB \\ A &\rightarrow a \\ B &\rightarrow b. \end{aligned}$$

P.T.O.



8. Write a short note on :

- a) Halting problem of Turing machine.
- b) Post correspondence problem.

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PART – B

Answer any four full questions.

(4×10=40)

9. Consider the following \in – NFA

δ	\in	a	b
$\rightarrow p$	{ r }	{ q }	{ p, r }
q	\emptyset	{ p }	\emptyset
* r	{ p, q }	{ r }	{ p }

- a) Compute the \in – closure of each state.

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- b) Convert the automation to a DFA.

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10. Explain closure properties of regular languages.

11. Check whether the following grammar is ambiguous

$$\begin{aligned} S &\rightarrow AB|C \\ A &\rightarrow aAb|ab \\ B &\rightarrow cBd|cd \\ C &\rightarrow aCd|aDd \\ D &\rightarrow bDc|bc. \end{aligned}$$

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.
- b) Rice theorem.

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