

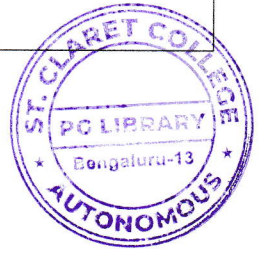
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St. Clare College

Autonomous, Bengaluru

ROLL NO:

DATE:



MCA END SEMESTER EXAMINATION-SEPTEMBER 2026
MCA: SECOND SEMESTER
MCA 2225: THEORY OF COMPUTATION

TIME: 3 hours.

MAX. MARKS: 70

This paper contains TWO printed pages and FOUR parts

Instructions:

1. Verify and ensure that the question paper is completely printed.
2. Any discrepancies or questions about the exam paper must be reported to the COE within 1 hour after the examination.
3. Students must check the course title and course code before answering the questions.

PART-A

Answer any EIGHT questions out of TEN. Each answer carries TWO marks. [2X8=16]

1. Define finite automata and write the tuples of a DFA.
2. What is a trap state? Give an example.
3. Define E-closure with an example.
4. Define a regular expression with an example.
5. Define a parse tree with types.
6. What is the Pumping Lemma?
7. Define PDA (Pushdown Automata).
8. Explain ID (Instantaneous Description) of a Turing Machine.
9. Define the post correspondence problem.
10. Define Rice's Theorem.

PART-B

Answer any FOUR questions out of SIX. Each answer carries FIVE marks. [5X4=20]

11. Differentiate among DFA, NFA, ϵ -NFA.
12. Design a DFA that accepts strings of a's and b's ending with ab or ba.
13. Convert the following grammar into CNF.
$$S \rightarrow 0A \mid 1B$$
$$A \rightarrow 00A \mid 1S \mid 1$$
$$B \rightarrow 1BB \mid 0S \mid 0$$
14. Construct an ϵ -NFA for the regular expression $(0^*+1^*)^* 2^* 3^*$.
15. Obtain a PDA to accept the language $L(M) = \{a^n b^n \mid n \geq 1\}$.
16. Define a Turing machine. Illustrate different types of Turing machines.

PART-C

Answer any TWO questions out of FOUR. Each answer carries TEN marks. [10X2=20]

17. Convert the following NFA to DFA.

Process	0	1
$\rightarrow P$	{Q, S}	{Q}
*Q	{R}	{Q, R}
R	{S}	{P}
*S	-	{P}

18. Minimize the following DFA

Process	a	b
$\rightarrow A$	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

19. Obtain a PDA to accept the language $L(M) = \{wCw^R \mid w \in (a,b)^*\}$ where w^R is the reverse of w by final state. Prove that, the PDA is deterministic.

20. Obtain a Turing machine to accept the language

$$L(M) = \{0^n 1^n 2^n \mid n \geq 1\}$$

PART-D

Answer the following question. Answer carries FOURTEEN marks.

[14X1=14]

21. i) Obtain the corresponding PDA from the following CFG

$$S \rightarrow aABB \mid aAA$$

$$A \rightarrow aBB \mid a$$

$$B \rightarrow bBB \mid A$$

$$C \rightarrow a$$

ii) Construct a regular expression from the given DFA.

State	0	1
$\rightarrow q_0$	q_0	q_1
q_1	q_2	q_1
q_2	q_0	q_3^*
q_3^*	q_0	q_1