

Faculty of Engineering

End Semester Examination May 2025

CA5EL49 Theory of Computation

Programme	:	MCA / BCA-MCA (Integrated)	Branch/Specialisation	:	-
Duration	:	3 hours	Maximum Marks	:	60

Note: All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary.
 Notations and symbols have their usual meaning.

Section 1 (Answer all question(s))				Marks CO BL
Q1. Transition function for finite Automata is-				1 1 2
<input type="radio"/> $\Sigma^* Q \rightarrow \Sigma$		<input type="radio"/> $Q^* Q \rightarrow \Sigma$		
<input type="radio"/> $\Sigma^* \Sigma \rightarrow Q$		<input checked="" type="radio"/> $Q^* \Sigma \rightarrow Q$		
Q2. There are _____ tuples in a finite state machine.				1 1 1
<input type="radio"/> 4		<input checked="" type="radio"/> 5		
<input type="radio"/> 6		<input type="radio"/> 7		
Q3. Every grammar in Chomsky Normal Form is-				1 1 2
<input type="radio"/> Regular		<input type="radio"/> Context sensitive		
<input checked="" type="radio"/> Context free		<input type="radio"/> All of the above		
Q4. Which of the following statements are true?				1 2 4
<input type="radio"/> Every left-recursive grammar can be converted to a left-recursive grammar and vice-versa		<input type="radio"/> Not all epsilon productions can be removed from any context-free grammar by suitable transformations		
<input type="radio"/> The language generated by a context-free grammar, all of whose productions are of the form $X \rightarrow w$ or $X \rightarrow wY$ (where, w is a string of terminals and Y is a non-terminal), is always regular		<input checked="" type="radio"/> The derivation trees of strings generated by a context-free grammar in Chomsky Normal Form are always binary trees		
Q5. The transition in a Push Down Automaton makes is additionally dependent upon the-				1 1 2
<input checked="" type="radio"/> Stack		<input type="radio"/> Input tape		
<input type="radio"/> Terminals		<input type="radio"/> None of the mentioned		
Q6. Which one of the following is FALSE?				1 2 4
<input type="radio"/> There is a unique minimal DFA for every regular language		<input type="radio"/> Every NFA can be converted to an equivalent PDA		
<input type="radio"/> Complement of every context-free language is recursive		<input checked="" type="radio"/> Every nondeterministic PDA can be converted to an equivalent deterministic PDA		
Q7. There are _____ tuples in Turing machine.				1 1 2
<input type="radio"/> 9		<input type="radio"/> 6		
<input type="radio"/> 8		<input checked="" type="radio"/> 7		
Q8. What language will be there in between Recursive set and Context sensitive language?				1 2 4
<input checked="" type="radio"/> Recursive Enumerable Language		<input type="radio"/> Regular Language		
<input type="radio"/> Recursive set		<input type="radio"/> Context Free		

Q9. _____ is the class of decision problems that can be solved by non-deterministic polynomial algorithms. 1 2 3

- NP
- NP Hard

- P
- NP complete

Q10. Problems that cannot be solved by any algorithm are called- 1 2 3

- Tractable problems
- Undecidable problems
- Intractable problems
- Decidable problems

Section 2 (Answer all question(s))

Q11. Define Star Closure. Marks CO BL 2 1 1

Rubric	Marks
Defination = 2 Marks	2

Q12. Design a Finite Automata that end with 1010 where $\Sigma = \{0,1\}$. 3 2 3

Rubric	Marks
every state should be correct = 2 marks and Notation is 1 Marks	3

Q13. (a) Design a Deterministic Finite Automaton which accept substring abab. where $\Sigma = \{a,b\}$. 5 2 3

Rubric	Marks
machine , notation = 4+1	5

(OR)

(b) Convert following Moore machine to Melay machine where transaction table is-

	a	b	Output
q_0	q_1	q_2	0
q_1	q_3	q_0	1
q_2	q_0	q_1	1
q_3	q_2	q_3	0

Rubric	Marks
Conversion plus representation =4+1	5

Section 3 (Answer all question(s))

Q14. Define grammar and its tuple. Marks CO BL 2 2 1

Rubric	Marks
Define =1 marks, and tuples =1 marks	2

Q15. (a) Explain all types of grammar of Chomsky hierarchy with examples.

8 2 1

Rubric	Marks
Each types is of 2 Marks	8

(OR)

(b) Convert following CFG to Chomsky Normal Form, where S is start symbol:

$$\begin{aligned} S &\rightarrow ASB \\ A &\rightarrow aAS|a|\epsilon \\ B &\rightarrow SbS|A|bb \end{aligned}$$

Rubric	Marks
Introduce a start variable is 2 Marks unit conversion is of 2 Marks Remove null symbol is of 2 Marks convert into CNF is 2 Marks	8

Section 4 (Answer all question(s))

Marks CO BL
3 2 2

Q16. Write down all the tuples of Push Down Automata.

Rubric	Marks
Total tuples have 3 marks	3

Q17. (a) Design a PDA where $L=\{WCW^R : W \text{ is } (a,b)^*\}$ and C is a separator.

7 3 3

Rubric	Marks
All transection must be satisfy	7

(OR)

(b) Design a PDA with the empty stack method. where $L=\{a^n b^{2n} \text{ where } n \geq 1\}$.

Rubric	Marks
All transection must be satisfy	7

Section 5 (Answer all question(s))

Marks CO BL
4 2 2

Q18. Explain all the tuples of Turing Machine.

Rubric	Marks
All tuples with explaination is of 4 marks	4

Q19. (a) Design a Turing machine for $L=\{a^n b^n \text{ where } n \geq 1\}$.

6 4 3

Rubric	Marks
5 marks to machine trasition and 1 Marks for Final notation	6

(OR)

(b) Design a Turing machine for parenthesis checker (00).

Rubric	Marks
5 marks to machine trasition and 1 Marks for Final notation	6

Section 6 (Answer all question(s))

Marks CO BL

Q20. Explain in detail P and NP problems.

4 5 4

Rubric	Marks
each of 2 Marks	4

Q21. (a) Elaborate Recursive Set and Recursive Enumerable Set.

6 5 1

Rubric	Marks
3 marks each.	6

(OR)

(b) Define Post Correspondence Problem. Explain it with an example.

Rubric	Marks
Define is of 2 marks and Example is of 4 Marks	6
