



PRACTICE SET
End Sem Examination- Fall 2025

Program: B. Tech

Semester: V

Course: Formal Language & Automata Theory

Course Code: 3PCCCS302

Course Outcomes	After the successful completion of the course, the students will be able to:
CO1	Relate formal languages and mathematical models of computation.
CO2	Analyse different types of languages and the corresponding machines.
CO3	Analyse the Pushdown machine and its role in compiler construction.
CO4	Find the capability of real computers and learn examples of unsolvable problems.
CO5	Analyse classes of P, NP, NP-C and NP-Hard problems.

Unit -1

Section A:

1. Define DFA. Explain all the tuples of DFA with an example. [CO1] [Unit-1]
[Understand, LOT]
2. Design a DFA with $\Sigma = \{0, 1\}$ accepts all strings starting with 1. [CO1] [Unit-1]
[Apply, LOT]
3. Elaborate on the formal definition of a Finite Automaton (FA). Write the applications of Automata theory. [CO1] [Unit-1] [Understand, LOT]
4. Describe the basic terminologies used in Automata. [CO1] [Unit-1] [Understand, LOT]
5. Design a DFA with $\Sigma = \{0, 1\}$ accepts all strings starting with 1 and ended with 0 or starting with 0 and ended with 1. [CO1] [Unit-1] [Apply, LOT]

6. Construct an NFA for the language $L = \{w \mid w \text{ ends with } 01\}$ over $\Sigma = \{0,1\}$. [CO1] [Unit-1] [Understand, Apply, LOT]

Section B:

7. Compare NFA and DFA? Also mention the application of FA. [CO1] [Unit-1] [Analyze, HOT]
8. Explain with example the different graphical notation of Transition Diagram/ State Transition Diagram. [CO1] [Unit-1] [Understand, LOT]
9. Explain Nondeterministic Finite Automaton (NFA) with its formal definition and suitable example. [CO1] [Unit-1] [Understand, LOT]
10. Design a DFA which accept a language of all strings ending with 'a' over the input alphabet $\Sigma = (a, b)$. [CO1] [Unit-1] [Apply, LOT]
11. Explain following term in context of FA. [CO1] [Unit-1] [Understand, LOT]
- (a) Union (b) Complement (c) Intersection

Section C:

12. Design following DFA: [CO1] [Unit-1] [Apply, LOT]
- (a) that will accepts set of all string over $\{0, 1\}$ of length 3.
- (b) that will accepts set of all string over $\{0,1\}$ with three consecutives '0'.
- (c) that will accepts set of all string over $\{0,1\}$ which ends with 1.
- (d) that will accepts set of all string over $\{0,1\}$ which contains 0.
- (e) that will accepts set of all string over $\{a,b\}$ which ends with bb.
13. Convert the following NFA to DFA. [CO1] [Unit-1] [Analyze, HOT]

(i)

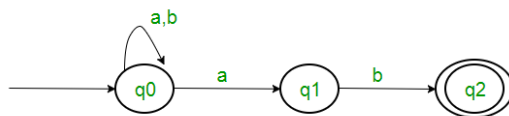
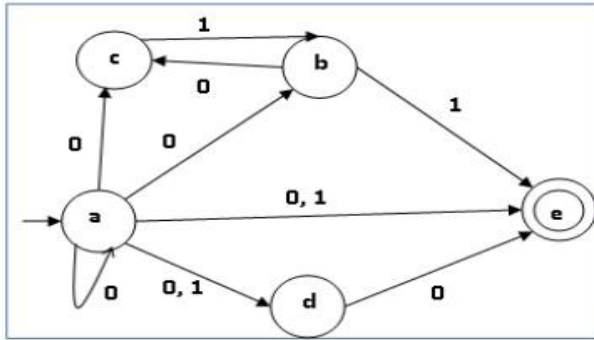


Figure 1

(ii)



Unit - 2

Section A:

14. Convert the following regular expression into a DFA: $(0+1)^*01$. [CO2] [Unit-2]
[Apply, LOT]
15. Write down different operation of regular operation. [CO2] [Unit-2] [Understand, LOT]
16. Explain finite and infinite language with proper example. [CO2] [Unit-2]
[Understand, LOT]

Section B:

17. Write the regular expression for the language. [CO2] [Unit-2] [Apply, LOT]
 - (a) Accept all the string which start with 1 and end with 0, over $\Sigma = \{0, 1\}$.
 - (b) Start and end with 'a' and having any combination of b's in between,
Over $\Sigma = \{a, b\}$.
18. Define Arden's Theorem. Prove the Arden's theorem? [CO2] [Unit-2] [Understand, LOT]
19. Design a FA from given regular expression $10 + (0 + 11)0^* 1$. [CO2] [Unit-2] [Apply, HOT]
20. Construct the FA for regular expression $0^*1 + 10$. [CO2] [Unit-2] [Apply, HOT]

Section C:

21. Provide a detailed explanation of the Pumping Lemma for regular languages. Discuss its significance in proving that certain languages are not regular. Include the main components of the Pumping Lemma and how it relates to the properties of regular languages. [CO2] [Unit-2] [Apply, HOT]

Unit-3

Section A:

22. Define formal definition of grammar with suitable example. [CO3] [Unit-3]
[Understand, LOT]
23. Describe Type-0, Type-1, Type-2, Type-3 grammar. [CO3] [Unit-3] [Understand, LOT]
24. Explain Chomsky's Normal Form with suitable example. [CO3] [Unit-3]
[Understand, LOT]
25. Explain Greibach's Normal Form with suitable example. [CO3] [Unit-3] [Understand, LOT]

Section B:

26. Describe the different types of grammar with suitable example. [CO3] [Unit-3]
[Remember, LOT]
27. Explain Grammar. What are the two basic element of grammar? [CO3] [Unit-3]
[Remember, LOT]
28. Write down the closure properties of Context Free Languages. [CO3] [Unit-3]
[Understand, LOT]
29. Explain Chomsky Hierarchy of Grammar. [CO3] [Unit-3] [Understand, LOT]
30. With a proper example convert CFG to GNF. [CO3] [Unit-3] [Apply, LOT]
31. Convert the following CFG to CNF. [CO3] [Unit-3] [Apply, LOT]
S \rightarrow Aba
A \rightarrow aab
B \rightarrow Ac
32. Differentiate between CNF and GNF. [CO3] [Unit-3] [Analyse, HOT]
33. With a proper example design a regular grammar from FA. [CO3] [Unit-3] [Apply, LOT]
34. With a proper example design a FA from regular grammar. [CO3] [Unit-3] [Apply, LOT]

Section C:

35. (i) What is Pumping Lemma? Explain it with proper example for context free language. [CO3] [Unit-3] [Apply, LOT]
(ii) Design the Grammar for the language $L = \{a^n b^n c^n \mid n \geq 1\}$. [CO3][Unit-3] [Apply, LOT]

Unit-4

Section A:

36. Provide a concise yet comprehensive explanation of the formal definition of a Pushdown Automaton (PDA). Discuss how a PDA operates on input strings and its computational capabilities? [CO4] [Unit-4] [Understand, LOT]
37. Differentiate between DPDA and NPDA. [CO4] [Unit-4] [Analyze, LOT]

Section B:

38. Design the PDA that accept the language $L = \{ a^n b^n \mid n > 0 \}$
39. Design a PDA for the following grammar:
 $wc w^R \mid w \in (a,b,c)^+$. [CO4] [Unit-4] [Analyse, HOT]
40. Explain ambiguous grammar with suitable example. Test whether the grammar is ambiguous or not. $S \rightarrow A \mid B$
 $A \rightarrow aAb \mid ab$
 $B \rightarrow abB \mid \epsilon$. [CO4] [Unit-4] [Understand, LOT]
41. Explain parsing technique with proper example. [CO4] [Unit-4] [Understand, LOT]

Section C:

42. (i) Design a PDA for the following language and also show its state diagram and transition diagram $L = \{ 0^n 1^n \mid n \geq 1 \}$ [CO4] [Unit-4] [Understand, LOT]
- (ii) Design a PDA for the following language and also show its state diagram and transition diagram $L = \{ a^n b^m c^n \mid n \geq 1, m \geq 1 \}$. [CO4] [Unit-4] [Understand, LOT]
- (iii) Construct a parse tree for the following grammar
 $S \rightarrow aB \mid bA$
 $A \rightarrow aS \mid bAA \mid a$
 $B \rightarrow bS \mid aBB \mid b$
which accepts the string “aaabbabbba”?
- (iv) Construct the left-most and right-most derivations and parse trees for the following grammar
 $S \rightarrow (L)/a$
 $L \rightarrow (L, S)/S$
which accepts the string (a , a).
[CO4] [Unit-4] [Understand, LOT]

Unit-5

Section A:

43. What is the primary purpose of a Turing Machine in computer science? [CO5] [Unit-5] [Understand, LOT]
44. Explain one advantage of using a multi-tape Turing Machine over a single-tape Turing Machine. [CO5] [Unit-5] [Understand, LOT]
45. Briefly describe why the Halting Problem is considered a challenge for computers. [CO5] [Unit-5] [Understand, LOT]

Section B:

46. Explain the concept of a single-tape Turing Machine. What are the main components a Turing Machine, and how does it operate on an input tape? [CO5] [Unit-5] [Understand, Apply, LOT]
47. Compare and contrast single-tape and multi-tape Turing Machines. Highlight the advantages of using multi-tape machines in terms of computational efficiency. [CO5] [Unit-5] [Analyze, LOT]
48. Design a Turing Machine to accept the strings having equal number of 0's and 1's. [CO5] [Unit-5] [Analyse, HOT]
49. Define the complexity classes P, NP, NP-C, and NP-Hard. Explain the basic characteristics that distinguish each class from the others. [CO5] [Unit-5] [Understand, LOT]

Section C:

50. Describe the basic components and operation of a Turing Machine. Explain how Turing Machines are used to recognize languages. Provide a simple example of a language and demonstrate how a Turing Machine can accept or reject strings from that language. [CO5] [Unit-5] [Understand, LOT]
51. Design a Turing Machine that accept the Language $L_1 = \{a^n b^n c^n\}$ and $L_2 = \{a^n b^n\}$? Also define all tuples of Turing Machine. [CO5] [Unit-5] [Create, HOT]

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**Summary Sheet: FLAT (B. Tech-V) 2025 Fall
CO Wise**

CO	Q. No	Marks
CO1	1,2,4,5,6,7,8,9,10,11,12,13	120
CO2	14,15,16,17,18,19,20,21	75
CO3	22,23,24,25,26,27,28,29,30,31,32,33,34,35	130
CO4	36,37,38,39,40,41,42	70
CO5	43,44,45,46,47,48,49,50,51	95
Total		490

Unit Wise

Unit	Q. No	Marks
Unit 1	1,2,4,5,6,7,8,9,10,11,12,13	120
Unit 2	14,15,16,17,18,19,20,21	75
Unit 3	22,23,24,25,26,27,28,29,30,31,32,33,34,35	130
Unit 4	36,37,38,39,40,41,42	70
Unit 5	43,44,45,46,47,48,49,50,51	95
Total		490

Blooms Taxonomy Level (BTL) Wise

BTL	Q. No	Marks
LOT	1,2,3,4,5,6,8,9,10,11,12,14,15,16,17,18,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38,40,41,42,43,44,45,46,47,49,50	370
HOT	7,13,19,20,21,32,39,48,51	120
Total		490

Prepared by:

Disclaimer: -This is a Practice Set. The Question in End term examination will differ from the Practice Set. This Practice Set is meant for practice only.