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Question Paper Code	12384
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023**  
 Third Semester  
**Computer Science and Business Systems**  
**20CBPC301 - FORMAL LANGUAGE AND AUTOMATA THEORY**  
 (Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**  
 Answer ALL Questions

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|  | <i>Marks,</i>      |
|  | <i>K-Level, CO</i> |
| 1. Define Grammars.  | <i>2,K2,CO1</i>    |
| 2. Find and write the regular expression for the production $S \rightarrow aS, S \rightarrow a$ .  | <i>2,K2,CO1</i>    |
| 3. Compare NFA with DFA.   | <i>2,K3,CO2</i>    |
| 4. Construct DFA with the input symbols $\{0, 1\}$ in which it accepts all string ending with 00.  | <i>2,K3,CO2</i>    |
| 5. List out the applications of Context Free Grammar.  | <i>2,K2,CO3</i>    |
| 6. Find the language $L(G)$ of the grammar<br>$S \rightarrow aSb aAb, A \rightarrow bAa ba$ .      | <i>2,K3,CO3</i>    |
| 7. Give the formal definition of Turing Machine.   | <i>2,K2,CO4</i>    |
| 8. Construct a Turing Machine which accepts the string $W = aba$ over the input symbol $\{a,b\}$ . | <i>2,K3,CO4</i>    |
| 9. Define Rice's theorem.  | <i>2,K1,CO5</i>    |
| 10. State Universal Language Lu.   | <i>2,K1,CO5</i>    |

**PART - B (5 × 13 = 65 Marks)**  
 Answer ALL Questions

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|---|------------------|
| 11. a) Explain in detail about Chomsky Hierarchy Model. | <i>13,K2,CO1</i> |
| <b>OR</b>   |                  |
| b) Briefly Discuss about Productions and Derivations.   | <i>13,K2,CO1</i> |

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| 12. a) Construct DFA equivalent to the NFA $M = (\{p, q, r, s\}, \{0,1\}, \delta, p, \{q, s\})$ , where $T$ (transition function) is defined as follows, | <i>13,K3,CO2</i> |
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State/input symbol	0	1
$\rightarrow p$	$\{q, s\}$	$\{q\}$
$*q$	$\{r\}$	$\{q, r\}$
r	$\{s\}$	$\{p\}$
$*s$	-	$\{p\}$

**OR**

- b) (i) Obtain a DFA to accept strings of a's and b's having even number of a's and b's. 7,K2,CO2  
(ii) Distinguish DPDA and NDPDA. 6,K2,CO2
13. a) (i) Reduce the following grammar into Chomsky Normal Form 6,K3,CO3  
 $S \rightarrow aB | ASB$   
 $A \rightarrow B | S$   
 $B \rightarrow b | \epsilon$   
(ii) Consider the following productions 7,K3,CO3  
 $S \rightarrow aB | bA$   
 $A \rightarrow aS | bAA | a$   
 $B \rightarrow bS | aBB | b$   
For the string  $W = aaabbabbba$ , Draw a derivation tree and find Leftmost/Rightmost Derivation.

**OR**

- b) (i) Consider the following grammar 7,K3,CO3  
 $S \rightarrow aAS | a$   
 $A \rightarrow SbA | SS | ba$   
Find leftmost Derivation and draw a derivation tree for the string  $W = aabbaa$ .  
(ii) Find a Greibach normal Form to the following Grammar 6,K3,CO3  
 $S \rightarrow CA$   
 $A \rightarrow a$   
 $C \rightarrow aB | b$
14. a) Prepare a Turing Machine which recognizes the language  $L = 01^*0$ . 13,K3,CO4  
Draw Turing Machine, Transition steps and Tape sequence.

**OR**

- b) Write short notes on 7,K2,CO4  
(i) Two way infinite tape TM. 6,K2,CO4  
(ii) Multiple Tracks Turing Machine.
15. a) Briefly discuss about Universal Turing machine. 13,K2,CO5  
**OR**  
b) Explain about NP complete and NP hard problems. 13,K2,CO5

**PART - C (1 × 15 = 15 Marks)**

16. a) (i) Conversion from Regular expression to finite automata 8,K3,CO1  
 $RE = (a|b)^*abb$ .  
(ii) Minimize the above DFA. 7,K3,CO1  
**OR**  
b) Explain in details about steps to converting NFA into DFA with an example. 15,K2,CO1