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**Examination: Odd Semester Examination 2024**

**Paper Name: Formal Languages and Automata Theory**

**Paper Code: BTCSE 503/ BTCSE503(Lateral)/ BTCSEAI 503**

**Time: 2.5 Hours**

**Maximum Marks: 60**

**Note: This question paper has two sections : Section A and Section B. Assume missing data, if any.**

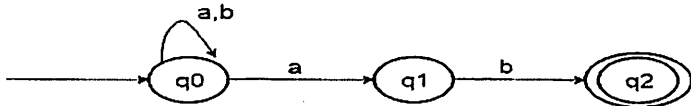
**Attempt (i) Section-A: All questions are compulsory.**

**(ii) Section-B: Attempt any FOUR QUESTIONS.**

**Section –A (All questions are compulsory) 4×5=20 Marks**

| <p><b>Q1</b> Consider the below finite automata and check the strings are accepted or not. Q0 is initial and Q3 is final state.</p> <table><tr><th rowspan="2">States, Q</th><th colspan="2">Input Symbols</th></tr><tr><th>0</th><th>1</th></tr><tr><td>Q0</td><td>Q1</td><td>Q2</td></tr><tr><td>Q1</td><td>Q0</td><td>Q1</td></tr><tr><td>Q2</td><td>Q1</td><td>Q3</td></tr><tr><td>Q3</td><td>Q3</td><td>Q0</td></tr></table> <p>(i) 1110                      (ii) 0001</p> | States, Q | Input Symbols |  | 0 | 1 | Q0 | Q1 | Q2 | Q1 | Q0 | Q1 | Q2 | Q1 | Q3 | Q3 | Q3 | Q0 | CO3 | BL 3 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------|--|---|---|----|----|----|----|----|----|----|----|----|----|----|----|-----|------|
| States, Q                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | Input Symbols |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0         | 1             |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
| Q0                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Q1        | Q2            |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
| Q1                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Q0        | Q1            |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
| Q2                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Q1        | Q3            |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
| Q3                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Q3        | Q0            |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
| <p><b>Q2</b> Check if the given grammar is ambiguous or not for the string aabbccdd:</p> <p>S → AB / C<br/>A → aAb / ab<br/>B → cBd / cd<br/>C → aCd / aDd<br/>D → bDc / bc</p>                                                                                                                                                                                                                                                                                                  | CO2       | BL 3          |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
| <p><b>Q3</b> For the given Context Free Grammar, convert into CNF?</p> <p>S → aSb<br/>S → ab</p>                                                                                                                                                                                                                                                                                                                                                                                 | CO2       | BL2           |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |
| <p><b>Q4</b> Explain difference between recursive and recursive enumerable language?</p>                                                                                                                                                                                                                                                                                                                                                                                         | CO1       | BL1           |  |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |      |

**Section –B (Attempt any Four questions) 4×10=40 Marks**

|                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----|------|
| Q1 Design Turing machine that accepts even number of 0's and any number of 1's.                                                                                                                                                                                                                                                                                                                       | CO4 | BL 5 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| Q2 For given Regular expression, design Finite automata-<br>11(010)*.01+10*10                                                                                                                                                                                                                                                                                                                         | CO3 | BL4  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| Q3 Write short note on Linear Bound Automata ?                                                                                                                                                                                                                                                                                                                                                        | CO1 | BL2  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| <p>Q4 For the given NFA, design DFA . Show all steps.</p>  <p align="center">Figure 1</p>                                                                                                                                                                                                                            | CO2 | BL 3 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| <p>Q5 Construct minimum DFA equivalent to</p> <table border="1"> <tr> <td></td><td>0</td><td>1</td></tr> <tr> <td>A</td><td>B</td><td>C</td></tr> <tr> <td>B</td><td>B</td><td>D</td></tr> <tr> <td>C</td><td>B</td><td>C</td></tr> <tr> <td>D</td><td>B</td><td>E</td></tr> <tr> <td>E</td><td>B</td><td>C</td></tr> </table> <p>A is initial and E is final state.</p> |     | 0    | 1 | A | B | C | B | B | D | C | B | C | D | B | E | E | B | C | CO4 | BL 4 |
|                                                                                                                                                                                                                                                                                                                                                                                                       | 0   | 1    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                     | B   | C    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| B                                                                                                                                                                                                                                                                                                                                                                                                     | B   | D    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| C                                                                                                                                                                                                                                                                                                                                                                                                     | B   | C    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| D                                                                                                                                                                                                                                                                                                                                                                                                     | B   | E    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| E                                                                                                                                                                                                                                                                                                                                                                                                     | B   | C    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |
| <p>Q6 Construct the string aabaa from the Leftmost and Rightmost derivation.</p> <p>S-&gt; aAS / aSS / \$</p> <p>A-&gt; SbA /ba</p>                                                                                                                                                                                                                                                                   | CO3 | BL5  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |      |