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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 08 / 01/ 2025 **Time:** 09:30 am –12:30 pm |

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| **School:** SOCSE | **Program:** B.Tech -COM/CAI/CEI/CSE/CCS/CIT/CSG/CST/  CBC/CSD/CBD | |
| **Course Code:** CSE2018 | **Course Name:** Theory of Computation | |
| **Semester**: V | **Max Marks**:100 | **Weightage**:50% |

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| **CO – Levels** | **CO1** | **CO2** | **CO3** | **CO4** |
| **Marks** | **24** | **28** | **24** | **24** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | Differentiate Finite Automata with Pushdown Automata. | **2 Marks** | **L2** | **CO1** |
| **2** | List any 4 applications of Pushdown Automata. | **2 Marks** | **L1** | **CO1** |
| **3** | Define NFA with Tuple representation. | **2 Marks** | **L2** | **CO2** |
| **4** | Compute the ε closure of the states q0, q1, q2, q3 and q4. | **2 Marks** | **L3** | **CO2** |
| **5** | Define Regular Expression? Give any one Example for Regular Language. | **2 Marks** | **L2** | **CO2** |
| **6** | Draw NFA with epsilon for the following Regular Expressionn ( a/ b )\* | **2 Marks** | **L3** | **CO2** |
| **7** | What is Unit Production? Give an example to eliminate Unit production from the grammar. | **2 Marks** | **L2** | **CO3** |
| **8** | Define Derivation. List its types. | **2 Marks** | **L2** | **CO3** |
| **9** | Define Turing Machine. | **2 Marks** | **L2** | **CO4** |
| **10** | Differentiate input tape of Turing Machine with Pushdown Automata. | **2 Marks** | **L2** | **CO4** |

**Part B**

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| **Answer the Questions Total 80 Marks.** | | | | | | | |
| **11.** | **a.** | (i) Let L1= {a, b, ab} L2= {00, 11} and L3= {a, aa, bb}, Compute the following operations.  1. Concatenation of L1L2.  2. L2L2R  3. L3\*  4. L2+  5. L33  6. Prefixes (a a b a b a b b)  7. Sufixes (a a b a b a b b) | | **20 Marks** | **L3** | | **CO1** |
| **or** | | | | | | | |
| **12.** | **a.**  **b.** | Explain about the following with examples.  1) Alphabet  2) Strings   1. Empty Strings 2. Length of the string 3. Concatenation of two strings   Define and Explain any five operations on Languages with Examples. | | **10 Marks**  **10 Marks** | **L2**  **L2** | | **CO1**  **CO1** |
|  |  |  | |  |  | |  |
| **13.** | **a.**  **b.**  **c.**  **d.** | Construct a DFA which accepts set of all binary strings divisible by 3.  Construct NFA to accept the strings with a’s and b’s such that the string has a substring with ‘ab’.  Convert the Regular Expression (b + (ab))\* a into NFA with ε using Thompson’s rule.  Minimize the following DFA using state equivalence method. | | **5 Marks**  **5 Marks**  **5 Marks**  **5 Marks** | **L3**  **L3**  **L3**  **L3** | | **CO2**  **CO2**  **CO2**  **CO2** |
| **or** | | | | | | | |
| **14.** | **a.** | (i) Convert the given NFA into its equivalent DFA.    (ii) Convert the given NFA with epsilon into its equivalent DFA. | **10 Marks**  **10 Marks** | | | **L3**  **L3** | **CO2**  **CO2** |

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| **15.** | **a.**  **b.** | (i) Design a PDA for accepting the language L(G)={w : w ϵ {a, b}\*}  (ii) Consider the following grammar,  E-> E+T | T  T-> T \* F | F  F-> ( E ) | id  Compute the Left most Derivation, Right most Derivation and Parse Tree for the string id \* ( id + id ). | **10 Marks**  **10 Marks** | **L3**  **L3** | **CO3**  **CO3** |
| **Or** | | | | | |
| **16.** | **a.**  **b.** | (i)Remove Unit Productions, Null Productions and Useless production rules for the following CFG  S → ASB | XY  A → aAS | a | ε  B → SbS | A | bb | CD  (ii)Convert the given CFG into GNF  S → XA | BB  B → b | SB  X → b  A → a | **10 Marks**  **10 Marks** | **L3**  **L3** | **CO3**  **CO3** |

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| **17.** | **a.**  **b.** | Design a Turing Machine to reverse a string over the alphabet {a, b}.  Design a Turing Machine to perform the proper Subtraction of two unary numbers. | **10 Marks**  **10 Marks** | **L3**  **L3** | **CO4**  **CO4** |
| **Or** | | | | | |
| **18.** | **a.**  **b.** | Design a Turing Machine which accepts all strings of the form anbncn for n>=1 and rejects all other strings.  Design a Turing Machine to compute the proper addition of two unary numbers. | **10 Marks**  **10 Marks** | **L3**  **L3** | **CO4**    **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***