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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. L2L2R3. L3\*4. L2+5. L336. 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) Alphabet2) Strings1. 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** |
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| **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$w^{R}$ : w ϵ {a, b}\*} (ii) Consider the following grammar,E-> E+T | TT-> T \* F | FF-> ( E ) | idCompute 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 CFGS → ASB | XYA → aAS | a | ε B → SbS | A | bb | CD(ii)Convert the given CFG into GNFS → XA | BBB → b | SBX → bA → 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 \*\*\*\*\***