**Lecture Plan**

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| **Faculty Name** | Shreya Agarwal |
| **Course** | B.Tech |
| **Session** | 2024-2025 |
| **Year** | 2nd  |
| **Branch** | Computer Science and Engineering |
| **Section**  | A |
| **Semester** | 4th  |
| **Subject Name** | Theory of Automata and Formal Languages |
| **Subject Code** | BCS402 |
| **Total Number of Students** | 73 |
| **Number of Lecture Proposed** | 40 |

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| **S.No** | **Unit No** | **Topic** | **CO** | **No of Lectures Required** | **Actual Date of Completion** | **Suggested Reference** |
|  | **1** |  Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages |  | **1** |  |  |
|  | Deterministic Finite Automaton (DFA) - Definition, Representation, Acceptability of a String and Language. | **2** |  |  |
|  | Non Deterministic Finite Automaton (NFA). | **1** |  |  |
|  | Equivalence of DFA and NFA, NFA with ε-Transition.  | **1** |  |  |
|  | Equivalence of NFA’s with and without ε-Transition. | **1** |  |  |
|  | Finite Automata with output- Moore Machine, Mealy Machine. | **1** |  |  |
|  | Equivalence of Moore and Mealy Machine, Minimization of Finite Automata. | **1** |  |  |
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| **No of Lectures Required to complete Unit 1** | **8** |
|  | **2** | Regular Expressions, Transition Graph, Kleen’s Theorem.  |  | **1** |  |  |
|  | Finite Automata and Regular Expression- Arden’s theorem. |  |  |  |
|  | Algebraic Method Using Arden’s Theorem, Regular and Non-Regular Languages. | **2** |  |  |
|  | Closure properties of Regular Languages. | **1** |  |  |
|  | Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma.  | **2** |  |  |
|  | Decidability- Decision properties, Finite Automata and Regular Language | **2** |  |  |
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| **No of Lectures Required to complete Unit 2** | **8** |
|  | **3** | Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity |  | **1** |  |  |
|  | Regular Grammars-Right Linear and Left Linear grammars | **1** |  |  |
|  | Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG | **1** |  |  |
|  | Normal Forms- Chomsky Normal Form (CNF). | **1** |  |  |
|  | Normal Forms- Greibach Normal Form (GNF)  | **2** |  |  |
|  | Chomsky Hierarchy, Programming problems based on the properties of CFGs. | **2** |  |  |
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| **No of Lectures Required to complete Unit 3** | **8** |
|  | **4** | Nondeterministic Pushdown Automata (NPDA) - Definition, Moves, A Language Accepted by NPDA |  | **2** |  |  |
|  | Deterministic Pushdown Automata(DPDA) and Deterministic Context free Languages(DCFL) | **1** |  |  |
|  | Pushdown Automata for Context Free Languages,  | **1** |  |  |
|  | Context Free grammars for Pushdown Automata. |  | **1** |  |  |
|  | Two stack Pushdown Automata |  | **1** |  |  |
|  | Pumping Lemma for CFL, Closure properties of CFL.  |  | **1** |  |  |
|  | Decision Problems of CFL, Programming problems based on the properties of CFLs. |  | **1** |  |  |
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| **No of Lectures Required to complete Unit 4** | **8** |
|  | **5** | Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines,  |  | **2** |  |  |
|  | Techniques for Turing Machine Construction, Modifications of Turing Machine. | **2** |  |  |
|  | Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, |  | **2** |  |  |
|  | Church’s Thesis, Recursive and Recursively Enumerable language, Halting Problem. |  | **1** |  |  |
|  | Post’s Correspondence Problem, Introduction to Recursive Function Theory. |  | **1** |  |  |
| **No of Lectures Required to complete Unit 5** | **8** |

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| **Text Books & References** |
| 1 | Theory of Computer Science, Automata, Languages and Computation |
| 2 | Introduction to Automata theory, Languages and Computation, J.E.Hopcraft, R.Motwani, and Ullman. 2nd edition, Pearson Education Asia. |

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| **Course Outcomes (COs)** |
| **At the end of this course students will demonstrate the ability to:**  |
| **CO 1** | Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars |  |
| **CO 2**  | Analyze and design, Turing machines, formal languages, and grammars |  |
| **CO 3**  | Demonstrate the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving |  |
| **CO 4** | Prove the basic results of the Theory of Computation. |  |
| **CO 5** | State and explain the relevance of the Church-Turing thesis. |  |

**Name of Faculty with Signature: Shreya Agarwal**

**Head of Department Dean Academics**