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| **Course Code: CSE1008** | | | **Course Title: Theory of Computation** | **TPC** | **4** | | **0** | **4** |
| **Version No.** | | | **2.0** | | | | | |
| **Course Pre-requisites/ Co-requisites** | | | **None** | | | | | |
| **Anti-requisites (if any).** | | | **None** | | | | | |
| **Objectives:** | | | 1. To understand the essential mathematical foundations of automata theory. 2. To design, finite state automata and the equivalent regular expression for any given pattern. 3. To analyze and design Context Free Grammar, Pushdown Automata and Turing Machine. 4. To understand the difference between decidability and undesirability. | | | | | |
| **CO’s Mapping with PO’s and PEO’s**   |  |  |  | | --- | --- | --- | | **Course Outcomes** | **Course Outcome Statement** | **POs/ PEOs/PSOs** | | **CO1** | Understand the abstract machines, computation and basic properties of formal languages, finite automata | PO1, PO3 | | **CO2** | Familiarity with regular language, regular expression, context-free grammars and can make grammars to produce strings from a specific language | PO1, PO2, PO3 | | **CO3** | Can differentiate regular, context-free and recursively enumerable languages and can compare and analyse to different computational models. | PO3,  PO4, PO5 | | **CO4** | Acquire concepts relating to computational models including decidability and intractability and can identify limitations of some computational models and possible methods of proving them | PO3,  PO4, PO5 | | **Total Hours of Instructions: 60** | | |   **a** | | | | | | | | |
| **Module No. 1** | **Finite Automata (FA)** | | | | | **11 Hours** | | |
| Mathematical preliminaries and notations-Finite Automata-Deterministic Finite Automata – Non-Deterministic Finite Automata and equivalence with DFA - Epsilon transitions – Minimization of Finite Automata and its applications. | | | | | | | | |
| **Module No. 2** | **Regular Expressions (RE)** | | | | | **9 Hours** | | |
| Definition, Operators of regular expression and their precedence- Algebraic laws for Regular expressions and Kleene’s Theorem - Regular expression to FA- DFA to Regular expression- Pumping Lemma for regular Languages | | | | | | | | |
| **Module No. 3** | **RE & Context Free Grammar (CFG)** | | | | | **9 Hours** | | |
| Closure properties of Regular Languages- Decision properties of Regular Languages -Context-Free Grammar (CFG) – Derivation Trees – Ambiguity in Grammars and Languages | | | | | | | | |
| **Module No. 4** | **Pushdown Automata (PDA)** | | | | | **11 Hours** | | |
| Definition, Graphical Notation, Instantaneous Descriptions of PDA- Acceptance by Final state, Acceptance by empty stack, Deterministic PDA- CFG to PDA - PDA to CFG | | | | | | | | |
| **Module No. 5** | **Normal forms of CFG** | | | | | **9 Hours** | | |
| Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs | | | | | | | | |
| **Module No. 6** | **Turing Machine** | | | | | **11 Hours** | | |
| Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM- Undecidable problems about TMs-Post correspondence problem (PCP)-Modified PCP- Introduction to recursive function theory -Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines | | | | | | | | |
| **Text Books**   1. J.E.Hopcroft, R.Motwani and J.D Ullman, “Introduction to Automata Theory, Languages and Computations”, Pearson Education, 3rd Edition, 2013. | | | | | | | | |
| **References**   1. Micheal Sipser, “Introduction of the Theory and Computation”, Cengage Learning, 3rd edition, 2014. 2. Martin J. C., “Introduction to Languages and Theory of Computations”, McGraw Higher Ed, 3rd edition, 2009. 3. K.L.P. Mishra and N.Chandrasekaran, “Theory of Computer Science: Automata, Languages and Computation”, PHI, Third edition, 2009. 4. Papadimitriou, C. and Lewis, C. L., “Elements of the Theory of Computation”, Pearson, 2nd edition, 2015. | | | | | | | | |
| **Mode of Evaluation** | | **Continuous Assessment Tests-60%, Practical Assesment-40%**  Continuous Assessment Test-1 20%  Continuous Assessment Test-2 20%  Final Assessment Test 20%  Cumulative class Assessments 20%  Assignment 20% | | | | | | |
| **Recommended by the Board of Studies on** | | **12th BoS 29-04-2023** | | | | | | |
| **Date of Approval by the Academic Council** | | 10th AC 01.06.2023 | | | | | | |