**17CS2202 - FORMAL LANGUAGES AND AUTOMATA THEORY**

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| **Course Category:** | Core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-2-0 |
| **Prerequisite:** | Knowledge in Discrete Mathematics and logical reasoning | **Sessional Evaluation:**  **Univ. Exam Evaluation:**  **Total Marks:** | 40  60  100 |
| **Objectives** | * Basic mathematical foundations of computation and various other notions. * Understand and conduct mathematical proofs for computation and algorithms. * Familiarity with thinking intuitively for problem solving in related areas of theory in computer science * Develop a view on the importance of computational theory concepts. | | |

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| **Course Outcomes** | Upon successful completion of the course, the students will be able to: | |
| CO1 | Demonstrate abstract models of computing like DFA and NFA. |
| CO2 | Learn regular languages and are exposed to a overview of the theoretical foundations of computer science. |
| CO3 | Design grammars and recognizers for different formal languages and to prove or disprove theorems in automata theory using its properties. |
| CO4 | Apply Mathematical and formal techniques for solving real time applications using PDA. |
| CO5 | Perceive the power and limitations of a Turing machine. |
| CO6 | Determine the decidability and intractability of computational problems. |
| **Course Content** | UNIT-I  **Automata:** Introduction to Finite Automata, Structural Representations, Automata and Complexity, The Central concepts of Automata Theory-Alphabets, Strings and Languages, Deterministic Finite Automata, Nondeterministic Finite Automata, Finite Automata with Epsilon-Transitions.  **Mealy and Moore Models:** Finite Automata With outputs, Procedure for Transforming a Mealy Machine into Moore Machine and Moore Machine to Corresponding Mealy Machine.  UNIT-II  **Regular Expressions and Languages**: Regular expressions, Finite Automata and Regular Expressions, Algebraic Laws for Regular Expressions.  **Properties of Regular Languages**: Proving languages not to be regular, closure properties of regular languages, Decision properties of Regular Languages, Equivalence and Minimization of Automata.  UNIT-III  **Context Free Grammars And Languages**: Context free grammars, Parse trees, Ambiguity in Grammars and languages.  **Properties of Context Free Languages**: Normal Forms for context free grammars, Pumping lemma for context free languages, Closure properties of context free languages.  UNIT-IV  **Push Down Automata**: Definition of Push down automaton, The languages of PDA-Acceptance by final state, Acceptance by empty stack, from empty stack to final state, from final state to empty stack, Equivalence of PDA’s and CFG's, Deterministic PDA.  UNIT-V  **Introduction to Turing Machine**: Problems that Computers cannot solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Restricted Turing machines  **UNIT-VI**  **Undecidability**: A Language that is not Recursively Enumerable, an Undecidable problem that is RE, Undecidable problems about Turing Machine, Post’s Correspondence problem.  **Intractable Problems:** The classes of P and NP. | |
| **Text Books and References:** | **Text Books:**   1. Hopcroft J E, Motwani R And Ullman J D An Introduction To Automata Theory, Languages And Computation , pearson education 2. Theory of Computer Science By K.L.P.Mishra,N.Chandrasekaran (2.8 for Mealy and Moore Models).   **Reference Books:**   1. Azad S K, Theory of Computation – An Introduction To Automata, Formal Languages And Computability, Dhanpat Rai & co. 2. Cohen D I, An Introduction To Computer Theory, 2nd edition, John Wiley 3. LINZ P, An Introduction to Formal Languages and Automata 2nd edition. 4. Martin J C Introduction to languages and the theory of computation 3rd edition, Tata Mcgraw Hill | |
| **E-Resources** | 1. [**https://nptel.ac.in/courses**](https://nptel.ac.in/courses) 2. [**https://freevideolectures.com/university/iitm**](https://freevideolectures.com/university/iitm) | |