Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Third Year Bachelor of Engineering (Information Technology)

(In Effect From Academic Year 2019-20)

Subject Code: IT 503-N	**Subject Title:** Formal Language & Automata Theory
Pre-requisite	

Teaching Scheme (Credits and Hours)

Teaching scheme				**Total Credit**	**Evaluation Scheme**					
L	**T**	**P**	**Total**		**Theory**		**Mid Sem Exam**	**CIA**	**Pract.**	**Total**
Hrs	**Hrs**	**Hrs**	**Hrs**		**Hrs**	**Marks**	**Marks**	**Marks**	**Marks**	**Marks**
03	00	00	03	03	03	70	30	20	-	120

Course Objective:

- The purpose of this course is to acquaint the student with an overview of the theoretical foundations of computer science from the perspective of formal languages.
- Classify machines by their power to recognize languages.
- Employ Finite state machines to solve problems in computing.
- To understand deterministic and non-deterministic machines.
- To understand the differences between decidability and undecidability.
- To identify proper machine to implement any problem.
- To understand Chomsky Hierarchies

Outline of the Course:

Sr. No	**Title of the Unit**	**Minimum Hours**
1	Introduction	6
2	Regular Languages	4
3	Finite Automata	11
4	Context-Free Languages	8
5	Pushdown Automata	8
6	CSL and Pumping Lemma	4
7	Turing Machines	7

Total hours (Theory): 48
Total hours (Lab): NA
Total hours: 48

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Detailed Syllabus

Sr. No	Topic	Lecture Hours	Weightage (%)
1	**Introduction:** Set Theory, Logic, PMI, Proof methods, Strings, Alphabet, Languages, Production, derivation and Chomsky hierarchy of Languages.	6	12
2	**Regular Languages:** Regular Languages and Regular Expressions, Distinguishable and Indistinguishable Strings.	4	8
3	**Finite Automata:** Deterministic finite automata (DFA), Finding Regular Expression of a FA, Constructing Finite Automata for a given regular expressions, Union, Intersection, Difference and Complements of a FA, Nondeterministic finite automata (NFA), NFA-^, Theorem and example of NFA-^ to NFA and NFA to DFA conversion, Kleene's Theorem Part 1, Minimization of DFA, Moore and Melay machines.	11	23
4	**Context Free Languages:** Context Free Grammar and Context Free Languages with example, Regular Grammars, Derivation Tree and Ambiguity, Unambiguous CFG, Chomsky Normal Form.	8	17
5	**Pushdown Automata:** Definition of PDA, CFG to PDA conversion, Deterministic PDA and Non Deterministic PDA, Parsing.	8	17
6	**CSL and Pumping Lemma:** Definition of Context Sensitive languages and Linear Bounded Automata, Non Regular Languages and Non Context Free Languages, Pumping Lemma for Regular Languages.	4	8
7	**Turing Machines:** Definition and Examples of TM, Variation of Turing Machines, Variation of TM, Nondeterministic Turing Machines, Universal Turing Machines, Recursive Enumerable and Recursive Languages, Undecidability.	7	15
	Total	48	100

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course needs more focus on numerical examples based on exercises at the end of each chapter to aware of algorithm and theorem more precisely.

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Learning Outcome:

On successful completion of this course, the student should be able to:

- Graduate should be able to understand the concept of abstract machines and their power to recognize the languages.
- Attains the knowledge of language classes & grammars relationship among them with the help of Chomsky hierarchy.
- Graduate will be able to understanding the pre-requisites to the course compiler or advanced compiler design.
- Able to employ finite state machines for modeling and solving computing problems.
- Able to design context free grammars for formal languages.
- Able to understand the concepts of Turing machine.
- Able to distinguish between decidability and undecidability.
- Able to gain proficiency with mathematical tools and formal methods.

e-Resources:

- https://nptel.ac.in/courses/106106049/
- https://nptel.ac.in/courses/106103070/
- https://nptel.ac.in/courses/111103016/
- https://nptel.ac.in/courses/106104148/

Reference Books:

1. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.
2. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
3. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
4. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
5. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
6. Mishra and Chandrashekaran, Theory of Computer Science – Automata languages and computation, PHI.
7. Daniel I.A. Cohen, Introduction to Computer Theory, John Wiley.
8. P. K. Srimani, Nasir S. F. B, A Text book on Automata Theory, Cambridge University Press.
9. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan Rama R.
10. Theory of Computation: A Problem - Solving Approach, Kavi Mahesh, Wiley India Pvt. Ltd.