CE349: THEORY OF COMPUTATION

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	0	-	3	3
Marks	100	0	-	100	

A. Objective of the Course:

The main objectives for offering the course Theory of Computation are:

- To have a knowledge of regular languages and context free languages.
- To have an understanding of finite state and pushdown automata.
- To know the relation between regular language, context free language and corresponding recognizers.
- To study the Turing machine and classes of problems

B. Outline of the Course:

Sr. No.	Title of the unit	Minimum Number of Hours
1	Introduction	03
2	Mathematical Terms and Theory	05
3	Regular Grammar & Languages, Regular Expression, Finite Automata	14
4	Context Free Grammar & Languages, Push down Automata	13
5	Turing Machine, Recursively Enumerable Languages	08
6	Decidable & Undecidable Problems	02

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. Detailed Syllabus:

1.	**Introduction**	03 Hours	06 %
	Alphabet, String, Language, Formal Grammar, Chomsky Hierarchy, Introduction to Automata		
2.	**Mathematical Terms and Theory**	05 Hours	10 %
	Basic Mathematical Notations, Set Theory, Logical Statement, Function, Proof, Relation, Clouse of Relation, Mathematical Inductions, Recursive Definitions,		
3.	**Regular Grammar & Languages, Regular Expression, Finite Automata**	14 Hours	32 %
	Regular Language, Regular Expressions, Applications, Chomsky Hierarchy, Finite Automata, Nondeterministic Finite Automata, Kleen's Theorem, Automata with Output (Moore Machine, Mealy Machine), Properties of Regular Languages (Pumping Lemma, Closure Property, Decision Algorithm)		
4.	**Context Free Grammar & Languages, Push down Automata**	13 Hours	30 %
	The Chomsky, Notion of Grammars and Languages Generated by Grammars, CFG, CFL, Regular Language and Regular Grammar, Derivation Tree and Ambiguity, BNF, CNF, GNF, CFL properties (Pumping Lemma, Closure Property, Decision Algorithm), Intersections and Complements of CFL, Non-CFL, Definition, DPDA, NPDA, Equivalence of CFG and PDA		
5.	**Turing Machine, Recursively Enumerable Languages**	08 Hours	18 %
	Definition, Model of Computation, Combining TM, Variations of TM, Non Deterministic TM, Universal TM, Recursively Enumerable and Recursive, Enumerable Languages, Context sensitive languages		
6.	**Decidable & Undecidable Problems**	02 Hours	04 %
	Tractable and Intractable Problems, Complexity Classes, Tractable and Possibly Intractable Problems, P and NP Completeness, Countability		

D. 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.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments/Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.

E. Student Learning Outcome:

After completion of the course students will be able to

- Understand the basic concepts and application of Theory of Computation.
- Apply knowledge in the computer field to solve computational problems and in the field of Natural Language Processing.

F. Recommended Study Material:

- ❖ **Text Books:**
    1. Introduction to Languages and Theory of Computation, John C. Martin, TMH
- ❖ **Reference Books:**
    1. An introduction to automata theory and formal languages, Adesh K. Pandey, S. K. Kataria & Sons
    2. Introduction to computer theory, Deniel I. Cohen, John Wiley & Sons Inc
    3. Computation: Finite and Infinite, Marvin L. Minsky, Prentice-Hall
    4. "An introduction to Formal Languages and Automata", Peter Linz, 6th edition, Jones & Bartlett Learning
    5. "Introduction to the Theory of Computation", Michael Sipser, 3rd edition, Cengage Learning.
- ❖ **Web Materials:**
    1. http://en.wikipedia.org/wiki/Theory_of_computation
    2. https://www.youtube.com/playlist?list=PLEbnTDJUr_IdM__FmDFBJBz0zCsOFxfK
    3. http://nptel.ac.in/courses/106103070/

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4. http://nptel.ac.in/courses/106104028/
5. http://nptel.ac.in/courses/106106049/
6. https://www.youtube.com/watch?v=4GLC-s0PQLY