THEORY OF COMPUTATION

IV Semester: CSE / IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AITB03	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Comprehend abstract, mathematical models of computation and use them to solve computational problems.
II. Interpret the relationship between formal languages in Chomsky's hierarchy and different machines.
III. Analyze and explain the behavior of push-down automata.
IV. Understand the limits and capacities of Turing machines to recognize languages.

COURSE OUTCOMES(COs):

CO 1. Understand the functionality of deterministic finite automata and Non-deterministic finite automata
CO 2. Apply the regular languages , regular expressions to construct finite automata
CO 3. Apply the context free grammars to construct derivation trees and the accept various strings
CO 4. Compare the functionality of push down automata with deterministic finite automata
CO 5. Apply the concept of Turing machines to solve the complex functions

COURSE LEARNING OUTCOMES (CLOs):

1. Able to show the importance of alphabets, strings and languages to construct finite automata
2. Demonstrate the behavior of deterministic finite automata
3. Able to understand the functionality of non- deterministic finite automata
4. Show the differences between the deterministic finite automata and non- deterministic finite automata
5. Able to understand the Regular sets, regular expressions, identity rules
6. Analyze the construction of finite automata for a given regular expressions
7. Able to understand the conversion of finite automata to regular expressions
8. Able to understand the pumping lemma of regular sets, regular grammars, right linear and left linear grammars
9. Able to create right most and leftmost derivation trees for given strings
10. Analyze the Ambiguity in context free grammars
11. Able to understand the minimization process of context free grammars
12. Apply the Chomsky normal form and Greibach normal forms to eliminate the Ambiguity in context free grammars
13. Apply the push down automata for acceptance of context free languages
14. Able to construct the push down automata for given context free languages
15. Able to construct the deterministic push down automata to accept the context free languages
16. Show the difference between deterministic push down automata and non- deterministic push down automata
17. Able to understand the functionality of Turing machine
18. Able to understand the recursively enumerable languages and Church's hypothesis
19. Analyze the functionality of different types of Turing machines
20. Apply the linear bounded automata and context sensitive language

Module -I	**Finite Automata**	**Classes: 10**
Fundamentals: Alphabet, strings, language, operations; Introduction to finite automata: The central concepts of automata theory, deterministic finite automata, nondeterministic finite automata, an application of finite automata finite automata with epsilon transitions.		
Module -II	**Regular Languages**	**Classes: 9**
Regular sets, regular expressions, identity rules, constructing finite automata for a given regular expressions, conversion of finite automata to regular expressions, pumping lemma of regular sets, closure properties of regular sets (proofs not required), regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and finite automata, inter conversion.		
Module -III	**Context Free Grammars**	**Classes: 8**
Context free grammars and languages: Context free grammar, derivation trees, sentential forms, right most and leftmost derivation of strings, applications. Ambiguity in context free grammars, minimization of context free grammars, Chomsky normal form, Greibach normal form, pumping lemma for context free languages, enumeration of properties of context free language (proofs omitted).		
Module -IV	**Pushdown Automata**	**Classes: 9**
Pushdown automata, definition, model, acceptance of context free language, acceptance by final state and acceptance by empty stack and its equivalence, equivalence of context free language and pushdown automata, inter conversion;(Proofs not required); Introduction to deterministic context free languages and deterministic pushdown automata.		
Module -V	**Turing Machine**	**Classes: 10**
Turing machine: Turing machine, definition, model, design of Turing machine, computable functions, recursivey enumerable languages, Church's hypothesis, counter machine, types of Turing machines (proofs not required), linear bounded automata and context sensitive language, Chomsky hierarchy of languages.		

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, –Introduction to Automata, Theory, Languages and Computation‖, Pearson Education, 3rd Edition, 2007.

Reference Books:

1. John C Martin, –Introduction to Languages and Automata Theory, Tata McGraw-Hill, 3rd Edition, 2017.
2. Daniel I.A. Cohen, –Introduction to Computer Theory, John Wiley & Sons, 2nd Edition, 2004.

Web References:

1. https://www.tutorialspoint.com/automata_theory/index.htm
2. https://www.iitg.ernet.in/dgoswami/Flat-Notes.pdf

E-Text Books:

1. https://freefundkenotes.files.wordpress.com/2014/02/toc-klp-mishra.pdf

MOOC Course

1. http://nptel.ac.in/courses/111103016/
2. http://nptel.ac.in/courses/106106049/
3. http://onlinevideolecture.com/?course_id=1312
4. http://www.nptelvideos.in/2012/11/theory-of-computation.html