Computer Science Paper VI
Theoretical Computer Science
[DESC-III]

Semester: V	Credits: 2	Subject Code: BS52206	Lectures: 36

Course Outcomes:

At the end of this course, the learner will be able to:
- Explain the use of automata during language design.
- Demonstrate Chomsky hierarchy.
- Classify the Regular Language, Context Free Language, Context Sensitive Language and Unrestricted Language.
- Construct the Finite Automata, Pushdown Automata and Turing Machine.

Unit 1: Finite Automation	10

- Introduction: Symbol, Alphabet, String, Prefix & Suffix of Strings, Formal Language, Operations on Languages.
- Grammar - Definition and Examples.
- Derivation-Reduction - Definition and Examples.
- Chomsky Hierarchy.
- Deterministic finite Automaton – Definition, DFA as language recognizer, DFA as pattern recognizer.
- No- Deterministic finite automaton – Definition and Examples.
- NFA with ε- transitions Definition and Examples. NFA to DFA conversion & Examples
- Finite automaton with output – Mealy and Moore machine, Definition and Examples.
- Minimization of DFA (My hill Nerode Method), Algorithm & Problem using Table Method.

Unit 2: Regular Expressions and Languages	8

- Regular Grammar: Definition.
- Left linear and Right Linear Grammar-Definition and Example.
- Regular language-Definition and Examples.
- Regular Expressions (RE): Definition & Example
- Regular Expressions Identities.
- Conversion of RE to FA-Examples.
- Pumping lemma for regular languages and applications.
- Equivalence of FA & Regular Grammar
- Construction of regular grammar equivalent to a given DFA.
- Construction of a FA from the given right linear grammar

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• Closure Properties of regular Languages	

Unit 3: Context-Free Grammars and Languages	8
• CFG: Definition & Examples. LMD, RMD, Parse Tree • Ambiguous Grammar: Concept & Examples. • Simplification of CFG: Removing Useless Symbols, Unit Production, ϵ-production and Nullable Symbol. • Normal Forms: Greibach Normal Form (GNF) and Chomsky Normal Form (CNF)	

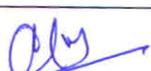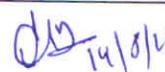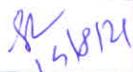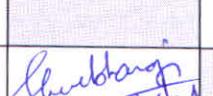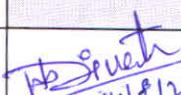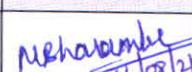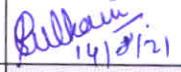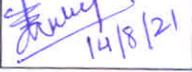| Unit 4: Push Down Automata	5
• Definition of PDA and examples. • Construction of PDA using empty stack and final State method: Examples using stack method. • Definition DPDA & NPDA, their correlation and Examples of NPDA • CFG (in GNF) to PDA: Method and examples	

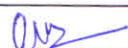| Unit 5: Turing Machine	5
• The Turing Machine Model, Definition and Design of TM • Problems on language recognizers. • Language accepted by TM. • Types of Turing Machines (Multitrack TM, Two-way TM, Multitape TM, Non- deterministic TM) • Introduction to LBA (Basic Model) & CSG. (Without Problems)	
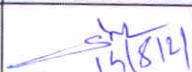
Recommended Reference Books:
• Daniel I. A. Cohen, *Introduction to Computer Theory* 2nd edition. John Wiley & Sons; 1996. • John C. Martin *Introduction to Languages and The Theory of Computation*, Fourth Edition. The McGraw- Hill; 2011. • John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman *Introduction to Automata Theory, Languages and Computation*, Third Edition. Pearson Education Publication; 2008. • John E. Hopcroft and JeffreyUllman *Introduction to Automata theory, Languages and computation*. Narosa Publishing House; 1995. • K.L.P. Mishra, N. Chandrasekaran *Theory of Computer Science Automata, Languages and Computation*. Publication: Prentice Hall of India; 2008.

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