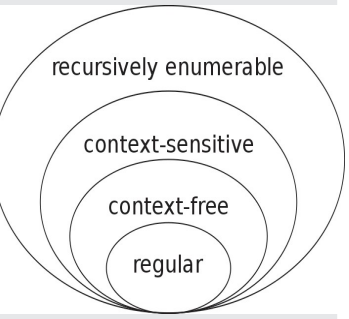

source:
https://en.wikipedia.org/wiki Chomsky_hierarchy

19CS212 FORMAL LANGUAGES AND AUTOMATA THEORY

Hours Per Week :

L	T	P	C
3	-	-	3

Total Hours :

L	T	P
45	-	-

CS	WA/RA	SSH	SA	S	BS
5	5	30	20	5	5

COURSE DESCRIPTION AND OBJECTIVES:

This course aims to teach the student to identify different formal language classes and their relationships, strong theoretical foundation for designing compilers. In addition to this the student will be able to learn the techniques for information processing,design different grammars, automata's and recognizers for different formal languages.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Understand abstract models of computing, including deterministic (DFA), non-deterministic (NFA), Push Down Automata(PDA) and Turing (TM) machine models and their power to recognize the languages.	1
2	Apply different finite state machines for a language.	1
3	Analyze, the given language is regular or not regular, Ambiguous unambiguous, Recursive or not recursive, Decidable or not Decidable and Por NP.	2
4	Evaluate the string is recognized by the finite automata.	4
5	Design different automata's for a language.	3, 5

SKILLS:

- ✓ *Design automata, regular expressions and context free grammars for accepting or generating a certain language.*
- ✓ *Describe the language accepted by an automata or generated by a regular expression or a context free grammar.*
- ✓ *Transform between equivalent deterministic and non-deterministic finite automata, and regular expressions.*
- ✓ *Minimize finite automata and grammars of context free languages.*

UNIT– I **L- 9**

INTRODUCTION: Alphabets; Strings and languages; Automata and grammars; Regular languages; Chomsky hierarchy of languages; Deterministic finite Automata (DFA) - formal definition, simplified notation, state transition graph, transition table, language of DFA; Nondeterministic finite Automata (NFA) - NFA with epsilon transition, language of NFA; Equivalence of NFA and DFA, Minimization of finite automata - Myhill-Nerode Theorem (Table filling algorithm with no proofs); FA with output - Moore and Mealy machine; Equivalence of Moore and Mealy Machine; Applications and limitation of FA.

UNIT – II **L- 9**

REGULAR EXPRESSION (RE): Definition, Operators of regular expression and their precedence; Algebraic laws for Regular expressions; Kleen's theorem; Regular expression to FA; DFA to regular expression; Arden theorem; Non regular languages - pumping lemma for regular languages(proofs not required), application of Pumping lemma; Closure properties of regular languages; Decision properties of regular languages.

UNIT – III **L- 9**

GRAMMAR FORMALISM: Regular grammars - right linear and left linear grammars, equivalence between regular linear grammar and FA; Context free grammar - definition, examples, derivation, derivation trees, ambiguity in grammar, inherent ambiguity, ambiguous to unambiguous CFG, useless symbols, simplification of CFGs; Normal forms for CFGs - CNF and GNF; Closure properties of CFLs; Decision properties of CFLs - emptiness, finiteness and membership; Pumping lemma for CFLs.

UNIT – IV **L- 9**

PUSH DOWN AUTOMATA (PDA): Description and definition, Instantaneous description, Language of PDA, Acceptance by final state, Acceptance by empty stack, Deterministic PDA; Equivalence of PDA and CFG - CFG to PDA and PDA to CFG; Two stack PDA.

UNIT - V **L- 9**

TURING MACHINES (TM) : Basic model, Definition and representation, Instantaneous description, Language acceptance by TM, Types of turing machines, Universal TM, Church's thesis, Recursive and recursively enumerable languages; Halting problem; Introduction to undecidability - undecidable problems about TMs, post-correspondence problem (PCP), modified PCP; Rices theorem.

TEXT BOOK:

1. Hopcroft and Ullman, "Introduction to Automata Theory, Languages and Computation", 2nd edition, Pearson/Prentice Hall India, 2007.

REFERENCE BOOKS:

1. Anand Sharma,"Theory of automata and formal languages",2nd edition, Lakshmi Publications, 2010.
2. Martin J. C., "Introduction to Languages and Theory of Computations", 4th edition, TMH, 2010.
3. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", 2nd edition, Pearson/Prentice Hall India, 2004.