CS-21003: Automata Theory and Formal Languages(AT&FL)
School of Computer Engineering,
KIIT Deemed to be University, Bhubaneswar
Session: Jul-Dec, 2024
Credit: 4

Instructor:

Mr. Nayan Kumar Subhashis Behera
Email: nayan.beherafcs@kiit.ac.in
Phone: +91-7978943719

Class Timings:

CSE-39	9-10	10-11	11-12	12-1	1-2	2-3	3-4
MON			----		C-LH-408,2nd	----	----
TUE			----	----	----	----	C-LH-305,2nd
FRI	----	----	C-LH-002,2nd	----	----	----	----
SAT	----		----	----	----	----	C-LH-203,2nd

Course Objective:

- To introduce the concepts of string, languages and automata.
- To enable the students to understand Language Acceptors and Generators for different Formal Languages.
- To classify machines by their power to recognize languages.
- To prove or disprove theorems in automata theory using closure and decision properties.
- To identify different formal language classes and their relationships.

Course Outcome: At the end of the course, the students will be able to:

CO1:	Develop and implement mathematical models for regular languages with finite automata for real life applications.
CO2:	Design regular expressions for acceptance of regular languages.
CO3:	Prove irregularity of languages using Pumping Lemma
CO4:	Design pushdown automata (PDA) for context free languages and demonstrate their properties.
CO5:	Design grammars of languages and identify the limitations of automata and language classes
CO6:	Develop computational models using Turing machine

Day Wise Lesson Plan:

Topics	Lecture Serial No
MODULE 1:	
Preliminaries: Set, Symbol, Alphabet, String, Functions and Relations on Strings, Language, Formal Languages	1.
Introduction to Automata, Classification of Automata and languages, Overview of Syllabus	2.
Description and definition of Deterministic Finite Automata(DFA)	3.
DFA with examples (Lect-1)	4.
DFA with examples (Lect-2)	5.
DFA with examples lec-3	6.
DFA with examples lec-4	7.
Design of Compound DFAs	8.
Description and definition of Non- Deterministic Finite Automata(NFA) , DFA vs. NFA Design of NFA Examples (Lect-1)	9.
Design of NFA Examples (Lect-2), Language accepted by DFA, NFA(without λ-transitions)	10.
Languages accepted by NFAs (with λ-transitions)	11.
Conversion from NFA without λ -transitions to DFA	12.
Conversion from NFA with λ -transitions i.e. λ - NFA to DFA	13.
Minimization of DFA	14.
MODULE 2	
Description of Regular Expression (RE), Identities of RE	15.
Write Regular Expression from Regular Languages-(Lect-1)	16
Write Regular Expression from Regular Languages-(Lect-2)	17
Conversion from Regular expression to NFA	18.
Conversion from DFA to RE using State Elimination Method	19.
Closure properties of Regular language (Lect-1)	20.
Closure properties of Regular language (Lect-2)	21.
Pumping lemma for Regular Language (Lect-1)	22.
Proof a language is regular or not by Pumping Lemma (Lect-1)	23
Proof a language is regular or not by Pumping Lemma (Lect-2)	24.

MID SEMESTER

MODULE-3	
Description of Regular grammar with examples (Lect-1)	25.
Regular grammar with examples (Lect-2)	26.
Conversion between Right Linear Grammar(RLG), Left Linear Grammar(LLG) and FA	27.
Context Free Grammar(CFG) and Context Free Languages(CFL)	28.
Find Leftmost Derivation(LMD), Rightmost Derivation(RMD), Derivation Tree of String from a given Grammar	29.
Ambiguous Grammar and Check whether the grammar is ambiguous or not. Inherently Ambiguous Grammar and Example	30.
Conversion from Ambiguous to Unambiguous Grammar	31.
Conversion from Context free languages (CFL) to Context free Grammar(CFG) and Find Languages generated by CFG	32.
Simplification of CFG i.e. Simplified Grammar a) Removal of λ- production b) Removal of Unit production c) Removal of Useless symbol	33.
More examples of Simplification of CFG	34.
Description of Chomsky Normal Form(CNF) Conversion from CFG to CNF examples	35.
Description of Greibach Normal Form(GNF) Conversion from CFG to GNF examples	36.
MODULE-4	
Introduction to PDA	37.
PDA Example (Lect-1)	38.
PDA Example (Lect-2)	39.
Instantaneous Description (ID) of PDA	40.
Conversion from CFG to PDA	41.
Pumping lemma theorem for CFL	42.
Closure Properties of CFL (Lect-1)	43.
Closure Properties of CFL (Lect-2)	44.

MODULE-5	
Introduction to Turing Machine(TM)	45.
Turing Machine Examples	46.
Instantaneous Description(ID) of TM	47.
Recursive Languages(REC) vs. Recursively Enumerable Languages(REL) Chomsky classification of Grammar & Languages.	48.
END SEMESTER	

Text books:

1. Introduction to automata theory, languages and computations, John E.Hopcroft, Jeffery D.Ullman and Rajeev Motwani, Pearson Education, 3rd Edition. (PDF)

Reference Books:

1. An Introduction to Formal Language and Automata, Peter Linz, Jones & Bartlett Publishers, 6th Edition. (PDF)
2. Elements of the theory of computation, Lewis, Harry R. and Christos H. Papadimitriou Prentice- Hall Englewood, 2nd Edition. (PDF)
3. Introduction to the Theory of Computation, Michel Sipser, Thomson Brooks/Cole, 2nd Edition. (PDF)
4. Theory of computer science by KLP Mishra & N. Chandra Sekharan ,PHI, 3rd edition. (PDF)

Online Resources:

1. https://nptel.ac.in/courses/111/103/111103016/:by Dr.K.V.Krishnaand, Dr.D.Goswami, IIT Guwahati
2. https://nptel.ac.in/courses/106/106/106106049/:by Prof.K.Krithivasan, IIT Madras
3. https://nptel.ac.in/courses/106/105/106105196/:by Prof.S.Mukhopadhyay, IIT Kharagpur
4. https://www.ics.uci.edu/~goodrich/teach/cs162/notes/:by Prof.M.T.Goodrich, University of California, Irvine, USA

Grading Policy:

- Assignments/quizzes/activities: **30 Marks**
- Mid-semester exam: **20 Marks**
- End-semester exam: **50 Marks**

.