Formal Language & Automata Theory
Code: PCCCS502
Contacts: 3L

Module-1:

Introduction to concepts of alphabet, language, production rules, grammar and automaton, finite state model, concept of DFA and its problems, concept of NFA and its problems. NFA to DFA conversion, Construction of DFA & NFA for any given string and vice versa, Minimization of FA and equivalence of two FA, Mealy & moore machine and their problems. Limitations of FSM.

Module-2:

Introduction to the concept of Chomosky Classification of Grammar, language generation from production rules and vice- versa. regular language and regular expressions, identity rules. Arden's theorem state and prove, Construction of NFA from regular expression, Conversion of NFA with null moves to without null moves, closure properties, pumping lemma and its applications.

Module-3:

Introduction to Context Free Grammer, Derivation trees, sentential forms. Right most and leftmost derivation of strings, concepts of ambiguity. Minimization of CFG, Chomsky normal form, Greibach normal form, Pumping Lemma for Context Free Languages, Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications, Push Down Automata: Push down automata, definition and description, Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of CFL and PDA, interconversion, DCFL and DPDA.

Module-4:

Turing Machine : Turing Machine, definition, model, Design of TM, Computable functions, Church's hypothesis, counter machine, Types of Turing machines (proofs not required), Universal Turing Machine, Halting problem, P, NP.

Definitions, capability & state equivalent, kth- equivalent concept, Merger graph, Merger table, Compatibility graph, Finite memory definiteness, testing table & testing graph.

Text Books:

1. “Theory of Computer Science “, Automata Languages and computation”, Mishra and Chandrashekaran, 2nd edition, PHI.
2. "An Introduction to Formal Languages and Automata" , Peter Linz.
3. “Formal Languages and Automata Theory”, C.K.Nagpal, Oxford.

References:

1. “Switching & Finite Automata”, ZVI Kohavi, 2nd Edn., Tata McGraw Hill.
2. “Introduction to Automata Theory Language and Computation”, Hopcroft H.E. and Ullman J. D., Pearson Education.

University of Engineering & Management, Kolkata
Even Semester, 2023
Course: B. Tech Semester: 5th
Paper Name: Formal Language and Automata Theory
Paper Code: PCC-CSE502

Paper Name: **Formal Language & Automata Theory**
Paper Code: **PCC-CSE502**
Contact Hours: **3**

Course Educational Objective:		Understanding of theory of computation, grammars and basics of compiler design.
Prerequisites:		Elementary discrete mathematics including the notion of set,function,relation,product,partial order,equivalence relation,graph& tree. They should have a thorough understanding of the principle of mathematical induction.
Course Outcome:	**CO1**	After studying Finite Automata The student will be able to define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems.
	CO2	After studying regular language and grammer Student will convert Finite Automata to regular expression. Students will be able to check equivalence between regular linear grammar and FA.
	CO3	After studying CFG and PDA Students will be able to minimize context free grammar. Student will be able to check equivalence of CFL and PDA. They will be able to design Turing Machine.
	CO4	After studying turing machine Students will be able to design Turing machine.
Module	**Sequence**	**Class Topic**
1	1st Class	Introduction to concepts of alphabet,language,production rules,grammer and automaton.
1	2nd Class	Introduction to finite state model, concept of DFA and its problems.

University of Engineering & Management, Kolkata
Even Semester, 2023
Course: B. Tech Semester: 5th
Paper Name: Formal Language and Automata Theory
Paper Code: PCC-CSE502

1	3rd Class	Revision of DFA and introduction of NFA and its problems. NFA to DFA conversion	
1	4th Class	Construction of DFA & NFA for any given string and vice versa.	
1	5th Class	Minimization of FA and equivalence of two FA.	
1	6th Class	Introduction to mealy & moore machine and their problems.	
2	7th Class	Introduction to the concept of Chomosky Classification of Grammer.	
2	8th Class	Introduction to language generation from production rules and vice versa.	
2	9th Class	Introduction to regular language and regular expressions.	
2	10th Class	Discussion of identity rules and corresponding problems.	CO2
2	11th Class	Discussion of Arden's theorem and proof of arden's theorem and its applications.	CO2
2	12th Class	Construction of NFA from regular expression.	CO2
2	13th Class	Conversion of NFA with null moves to without null moves.	CO2
2	14th Class	Discussion of closure properties.	CO2
2	15th Class	Discussion of pumping lemma and its applications.	CO2
3	16th Class	Introduction to Context Free Grammer, Derivation trees, sentential forms. Right most and leftmost derivation of strings, concepts of ambiguity.	CO3
3	17th Class	Minimization of CFG.	CO3
3	18th Class	Discussion of Chomsky normal form and its problems.	CO3
3	19th Class	Discussion of Greibach normal form and its problems.	CO3

3	20th Class	Pumping Lemma for Context Free Languages.	CO3
3	21st Class	Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications	CO3
3	22nd Class	Push Down Automata: Push down automata, definition and description.	CO3
3	23rd Class	Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence.	CO3
3	24th Class	Equivalence of CFL and PDA, interconversion.	CO3
3	25th Class	Introduction to DCFL and DPDA.	CO3
4	26th Class	Turing Machine : Turing Machine, definition, model, Design of TM, Computable functions.	CO4
4	27th Class	Church's hypothesis, counter machine, Types of Turing machines .	CO4
4	28th Class	Universal Turing Machine, Halting problem. Concept of P, NP class.	CO4

Text Books:

1. "An Introduction to Formal Languages and Automata" , Peter Linz
2. "Formal Languages and Automata Theory", C.K.Nagpal, Oxford
3. "Theory of Computer Science ", Automata Languages and computation", Mishra and Chandrashekaran, 2nd edition, PHI.

Reference Books and Journals:

1. "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
2. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson Education.

University of Engineering & Management, Kolkata
Even Semester, 2023
Course: B. Tech Semester: 5th
Paper Name: Formal Language and Automata Theory
Paper Code: PCC-CSE502