National Institute of Technology Meghalaya

An Institute of National Importance

CURRICULUM

Programme	**Master of Computer Applications**	Year of Regulation	**2024-25**
Department	**Computer Science and Engineering**	Semester	**II**

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
CA408	**Automata and Formal Languages**		**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives

To introduce students to theory of computation: automata, computability, and complexity with application of mathematical techniques and logical reasoning to important problems,
To develop a strong background in reasoning about finite state automata and formal languages.
To introduce students to different ways of parsing a formal language.
To introduce students to theory of computability and complexity.

Course Outcomes

	CO's	Statement	Bloom's Taxonomy
	CA408.1	Able to acquire knowledge about fundamental understanding of the core concepts in automata theory and formal languages.	Understand
	CA408.2	Able to design grammars and automata for different language classes.	Create
	CA408.3	Able to acquire knowledge to identify formal language classes and prove language membership properties.	Understand
	CA408.4	Able to acquire knowledge to prove and disprove theorems establishing key properties of formal languages and automata.	Understand
	CA408.5	Able to acquire knowledge to demonstrate a fundamental understanding of computation and computational models including decidability and intractability.	Create

COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CA408.1	**3**	**1**	**1**	**1**								**1**	**2**	**3**	**1**
CA408.2	**2**	**2**	**3**	**1**									**2**	**2**	**1**
CA408.3	**2**	**2**	**2**	**1**									**2**	**2**	**1**
CA408.4	**1**	**2**	**3**	**1**									**2**	**2**	**1**
CA408.5	**3**	**3**	**1**	**3**								**1**	**3**	**3**	**1**
CA408	**2.2**	**2**	**2**	**1.4**								**2**	**2.2**	**2.4**	**1**

SYLLABUS

No.	Content	Hours	COs
I	Basic Mathematical Objects: Sets Logic, Functions, Relations, Strings, Alphabets, Languages, Mathematical Induction: Inductive proofs, Principles; Recursive definitions.	**02**	**CA408.1**
II	Regular Languages and Finite Automata (FA), Deterministic and Nondeterministic Finite Automata, Equivalence and minimization of Automata, Finite Automata with output- Mealy and Moore Machines, Properties of Regular Sets: The Pumping Lemma for Regular sets, Closure properties and Decision properties of regular languages, Regular Expressions (RE), Relation Between RE and FA.	**14**	**CA408.1, CA408.2**
III	Grammar , Types of Grammar and Languages- Chomsky Hierarchy, Context Free Grammar (CFG), Derivation trees & Ambiguity, Inherent ambiguity, Parse tree, Application of CFG, Simplification of CFG, Normal form of CFG, Relations between classes of languages and Automata, Closure properties and Decision properties of CFG, Properties of Context Free Languages: The Pumping Lemma,	**14**	**CA408.1, CA408.2, CA408.3**
IV	Push Down Automata(PDA), Languages of PDA, Equivalence of PDA and CFG, Deterministic PDA	**06**	**CA408.1, CA408.2,CA408.4**
V	Turing Machine(TM) - Standard Model, Variations of TM (Multi-Track TM, Multi-Tape TM, Multi-Dimensional TM, Universal TM), Deterministic and Non deterministic TM, Turing Thesis, Halting Problem, Language of a Turing Machine-Recursively Enumerable Language, Unrestricted Grammar, Linear Bounded Automata(LBA), Computability and Decidability. Time and Space Complexity, Growth Rate, Complexity classes, Tractable and Non tractable Problems: P and NP, Cooks's theorem.	**6**	**CA408.1, CA408.4,CA408.5**
	Total Hours	**42**	

Essential Readings

1. Peter Linz, "An Introduction To Formal Languages And Automata", 3rd ed., 2001, Narosa Publication.
2. K.L.P.Mishra, N. Chandrasekaran," Theory Of Computer Science: Automata, Languages and Computation", 3rd ed., 2016, PHI.
3. S. Kandar, "Introduction to Automata Theory, Formal Languages and Computation", 1st ed., 2013, Pearson.

Supplementary Readings

1. John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, "Introduction to Automata theory, languages computation ", 2nd ed., 2005, Pearson India, Indian Reprint.
2. Michael Sipser, "Introduction to the Theory of. Computation", 3rd ed., 2013, Cengage Learning.

3. H. R. Lewis, C. H. Papadimitriou, “Elements of the Theory of Computation”, 2nd ed., 1998, Prentice-Hall.