CS6202 THEORY OF COMPUTATION	L	T	P	EL	CREDITS
	3	1	0	3	5

OBJECTIVES:

- To understand the Chomsky language hierarchy
- To construct automata for any given pattern and find its equivalent regular expressions
- To design CFG for any given language and prove its equivalence
- To understand the need for Turing machines and their capability
- To understand undecidable problems

MODULE I :	L	T	P	EL
	3	1	0	3

Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon Transitions – NFA to DFA conversion – Epsilon NFA to DFA conversion

SUGGESTED ACTIVITIES :

- Defining automata for different types of patterns
- EL – Epsilon NFA to DFA direct conversion

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE II :	L	T	P	EL
	3	1	0	3

Regular Expression – FA and Regular Expressions – Pumping Lemma for Regular Languages

SUGGESTED ACTIVITIES :

- Proofs in class
- EL – Regular expression for practical patterns

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE III :	L	T	P	EL
	3	1	0	3

Properties of Regular languages - Equivalence and Minimization of Automata

SUGGESTED ACTIVITIES :

- Flipped Class room – Moore and Mealy machines
- Problems based on properties – in-class and EL

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE IV :	L	T	P	EL
	2	1	0	3
Context-Free Grammar (CFG) – Derivation Trees – Ambiguity in Grammars and Languages – Equivalence of Parse Trees and Derivation				
SUGGESTED ACTIVITIES : • EL - CFG for practical programming constructs • EL – Alternate theorems and proofs				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				

MODULE V :	L	T	P	EL
	4	1	0	3
Simplification of Context-free Grammar – Chomsky Normal Form – Greibach Normal Form				
SUGGESTED ACTIVITIES : • EL – Problems based on context-free grammar • Proofs of all the grammar equivalence – in-class				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				

MODULE VI:	L	T	P	EL
	6	2	0	6
Definition of the Pushdown Automata – Language of a Pushdown Automata – Equivalence of Acceptance by Empty-stack and final state - Equivalence of Pushdown Automata and CFG – Pumping Lemma for CFL – Ogden's lemma for CFL - Closure Properties - Deterministic Pushdown Automata.				
SUGGESTED ACTIVITIES : • Proofs – in-class • EL – String acceptance using the converted PDA from CFG and CFG from PDA • EL - Problems based on properties of CFL				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				

MODULE VII:	L	T	P	EL
	3	1	0	3
Turing Machines – Language of a Turing Machine – Turing Machine as a Computing Device				
SUGGESTED ACTIVITIES : • EL – problems on Turing machines as language acceptors, computing device • In-class and EL – Turing machines as computing functions in both unary and binary representation				

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE VIII:	**L**	**T**	**P**	**EL**
	3	**1**	**0**	**3**

Techniques for TM – Modifications of Turing Machines – Two-way Infinite Tape, Equivalence of One Way Infinite Tape and Two-way Infinite Tape Turing Machines – Multi Tape Turing Machines

SUGGESTED ACTIVITIES :

- Flipped Class room – Non-deterministic Turing machines, multi-dimensional Turing machine

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE IX:	**L**	**T**	**P**	**EL**
	6	**1**	**0**	**6**

Chomsky hierarchy - A Language that is not Recursively Enumerable (RE) – An Undecidable Problem that is RE – Undecidable Problems about Turing Machine – Universal language – L_r, L_{nr}, L_e, L_{ne}, - Rice Theorem for Recursive and Recursively Enumerable Languages

SUGGESTED ACTIVITIES :

- EL – Halting problem and other undecidable problems and their proofs

SUGGESTED EVALUATION METHODS:

- Assignment problems
- Quizzes

MODULE X:	**L**	**T**	**P**	**EL**
	3	**1**	**0**	**3**

Undecidable nature of Post Correspondence Problem and Modified Post Correspondence problem

SUGGESTED ACTIVITIES :

- EL – Problems based on PCP, MPCP and conversions
-

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

OUTCOMES:

Upon completion of the course, the students will be able to:

- Classify languages based on Chomsky hierarchy
- Identify the class of language and design automata or Type x grammar
- Prove equivalence of the different language representations within a class of the Chomsky hierarchy
- Identify the undecidable problems and their class of languages
- Apply and prove a given language is decidable or undecidable

TEXT BOOK:

1. John E Hopcroft and Jeffery D Ullman, “Introduction to Automata Theory, Languages and Computations”, Narosa Publishing House, 2002.

REFERENCES:

1. J. Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, Tata McGraw Hill, 2003.
2. Micheal Sipser, “Introduction of the Theory and Computation”, Thomson Brokecole, 1997.
3. H.R. Lewis and C.H. Papadimitriou, “Elements of the Theory of Computation”, Second Edition, Pearson Education, 2003.

EVALUATION PATTERN:

Category of Course	Continuous Assessment	Mid – Semester Assessment	End Semester
Theory	**40**	**20**	**40**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓									✓		
CO2		✓	✓								✓	
CO3											✓	✓
CO4					✓				✓	✓		
CO5	✓									✓		✓

CS 6301 **MACHINE LEARNING**

OBJECTIVES:

- To understand the need for machine learning for various types of problem solving
- To know the mathematics involved in various machine learning algorithms
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To learn about probabilistic models in machine learning
- To have a glimpse of the latest developments in machine learning