COURSE TITLE	**THEORY OF COMPUTATION**
COURSE CODE	**01CE1608**
COURSE CREDITS	**4**

Objective:

1 This subject will introduce students to the algorithms, formal languages and grammars, automata theory, decidability, complexity, and computability. It helps students to understand and conduct mathematical proofs for computation and algorithms.

Course Outcomes: After completion of this course, student will be able to:

1 Apply mathematical concepts and analyse regular languages using regular expressions and the pumping lemma.

2 Construct and convert between different types of finite automata and minimize them.

3 Analyse context free grammars and convert between context-free grammars and pushdown automata.

4 Analyse pushdown automata and prove the equivalence between pushdown automata and context free grammars.

5 Analyse Turing machines and their variations.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	1	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	**Mathematical Theory and Regular Languages** Set Theory, Predicate Logic, Relations, Functions, Principal of Mathematical Induction, Regular Expression, Regular Languages, Regular Languages – Pumping Lemma	5
2	**Finite State Machine** Basics of Automata theory, Finite automata, Deterministic andNonDeterministic Automata,, Transition Finite automata, Conversion NFA - ^ to NFA, Conversion NFA to DFA, Conversion RE (Regular Expression) to Non-Deterministic Finite Automata, Subset Algorithm to convert Non DFA to DFA, Finite automata minimization, Moore and Mealey machine and their Conversion	10
3	**Context Free Grammar (CFG)** Context free language, Chomsky normal forms, Derivation - Derivation tree with their relation, Ambiguous and unambiguous CFG, Closure properties of Context Free Language	10

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Contents : Unit	Topics	Contact Hours
4	**Push Down Automata (PDA)** Introduction about PDA, Equivalence between CFG and PDA, Deterministic PDA- Acceptance of Empty and Final state, Pumping Lemma for Context Free Language	9
5	**Turing machine and REL** Basics of Turing machine, Language acceptor, Turing machine variations, Church Turing thesis, Universal Turing machine, Recursively and Enumerable Languages	8
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Tutorial 1** Problem solving for Set Operation, Cartesian Product and Classification of Functions.	2
2	**Tutorial 2** Principle of Mathematical Induction and its application, Regular Grammar and Construction of Regular Language	2
3	**Tutorial 3** Construction and representation of Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA) & e-NFA	2
4	**Tutorial 4** Conversion techniques including NFA to DFA(Subset Construction), e-NFA to NFA and Minimization of DFA	2
5	**Tutorial 5** Design and Analysis of Moore and Mealy Machine along with methods of conversion between them.	2
6	**Tutorial 6** Introduction to context-free grammar, derivation and construction of parse (derivation) trees	2
7	**Tutorial 7** Conversion of CFGs to Chomsky Normal Form(CNF) & Identification of ambiguous grammar	2
8	**Tutorial 8** Design PDA for given languages, solve problems on stack operations and language recognition.	2
9	**Tutorial 9** Conversion of CFG to PDA and Acceptance by final state & empty stack	2
10	**Tutorial 10** Solve TM construction problems and trace execution.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
11	**Tutorial 11** Design TM for operations (increment, palindrome, etc.), study variants	2
Total Hours		**22**

Textbook :

1 Introduction to Languages and the Theory of Computation, Martin, John C, Tata Mcgraw Hill Education Private Limited, 2010

References:

1 Automata Theory, Languages, and Computation, Automata Theory, Languages, and Computation, , Motwani, and Ullman , Hopcroft, 2008

2 Theory of Computation, Theory of Computation, Moret, Bernard M, Pearson Education, 2018

3 Elements of The Theory of Computation, Elements of The Theory of Computation, Lewis, Harry R, PHI Learning PVT. Ltd, 2013

4 Fundamentals of the Theory of Computation: Principles and Practice, Fundamentals of the Theory of Computation: Principles and Practice, Greenlaw, Raymond Hoover, H. James,, Morgan Kaufmann Publishers, 2011

5 Theory of Computation, Theory of Computation, Sipser, Michael, n, Cenagage Learning India Private Limited, 2013

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
15.00	35.00	33.00	12.00	5.00	0.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as role play, Quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the class-room.

3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses.

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Supplementary Resources:

1 http://nptel.ac.in

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