

Course number: **MTH401**

Course title: **Theory of Computation**

Credits: 3L-0T-0P-0A [9 credits]

Objective of the course

The course introduces the student to automata theory and Turing machines.

Course contents, with lecture-wise break up of topics (Total: 40 lectures)

Regular languages (14) – Regular expressions and regular languages, Deterministic and non-deterministic finite automata. Finite automata and regular languages, Closure properties, Languages that are and are not regular, State minimization in deterministic finite automata, Algorithmic aspects of finite automata

Context-free languages (10) – Context-free grammars, Closure properties, Parse trees, Algorithms for context-free grammars, Languages that are and are not context-free, Push-down automata and context-free languages

Turing machines (6) – Basic Turing machine model and Turing computability, Variants of Turing machines, Church-Turing thesis and Universal Turing machines, Halting problem, Some undecidable problems, Rice's theorem

Other topics (as time permits) and *Student presentations* (10) – Unsatisfiability problem in first order logic, Grammars, Recursive functions, Computational complexity: Classes P and NP, NP-completeness, Examples of NP-complete problems

Lecture videos will be uploaded on mooKit.

Discussion hour: Usually on Mondays, 12.00-1.15pm, FB557.

If held on Tuesdays, time, venue: 9.00-10.15am, T111

Contact me by mail (mohua@iitk.ac.in).

Evaluation Components & Policies: Timed written/oral examinations.

Mid-semester examination: 30% weightage

Presentation: 20% weightage

End-semester examination: 50% weightage

Recommended Textbooks:

1. H.R. Lewis and C.H. Papadimitriou: Elements of the Theory of Computation, Prentice Hall, 1998.
2. J.E. Hopcroft, R. Motwani, J.D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education, 2001.

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