

**CAS 705**  
**COMPUTABILITY AND COMPLEXITY**

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**Course Outline (Tentative):**

Languages and Machines: sets of sequences/languages (finite/infinite sequences, closure properties, Nerode equivalence, regular languages, automata, transition systems), defining sets by expressions and equations (regular expressions, fix-point theory), machines, computational models and structures (Turing machines, RAM, PRAM, non-standard automata, etc.).

Rewriting Systems: Grammars, Post systems, Chomsky hierarchy.

Computability: Functions and sets, Primitive recursive functions and sets, recursive functions and sets, recursively enumerable sets, what does computable and decidable mean (Halting problem), limitation of formal systems (Gödel's theorem), Church thesis.

Complexity: definition, independence from a computing platform, time/space hierarchy, P vs NP, NP-completeness, reduction problem.

**Text:** none

**Reference Books:**

1. D.C. Kozen, Automata and Computability, Springer 1997.
2. J.E. Hopcroft, R. Motwani, J.D. Ullman, *Introduction to Automata Theory, Languages and Computation*, Addison-Wesley, 2001.
3. M. Sipser, Introduction to the Theory of Computation, 3<sup>rd</sup> Edition, Cengage Learning, 2012.

**Lecture Notes:** They will be available on the website, usually before an appropriate class.

**Evaluation:** 4, rather heavy and labour consuming, assignments.

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3. Copying and using unauthorized aids in tests and examinations.