Course Title: Computational Complexity	**Number of Units: 1**
SSD : INF/01	**CFU:** 6

Course aims:
This course is the ideal complement of a course in algorithmics. It provides an in-depth knowledge of the inherent complexity of problems and the resources needed to solve them with algorithms. As such, it provides criteria for assessing the optimality of algorithms. The course expands on the relationships between memory and time requirements, and on the role of nondeterminism in assessing the difficulty of problems whose complexity is not exactly known. This part has important links with cryptography, operational research, and combinatorial optimization.

Course Description:
Problems and algorithms: intuitive formulations and their formalizations through multi-string Turing Machines and languages. Appropriate measures of space and time requirements. Speedup theorems. Comparison with other formalizations of computations and Church's thesis. Complexity classes, hierarchy theorems, and Savitch's theorem. Reductions and completeness (respectively) as formalizations of the relative difficulty and characteristic complexity of problems. NP-complete and coNP-complete graph and set problems. Cook's theorems. The polynomial hierarchy and PSPACE. Relationships with modern cryptography. A glimpse beyond PSPACE: problems that need exponential resources and undecidable problems.

Assumed Background: Real and functional analysis, basic logic, basic algorithmics

Assessment methods: Written and oral examination