Course title: Theory of Algorithms	**Neptun code: GEMAK416-a**
Course coordinator: Dr. Attila Házy, PhD, associate professor	
type of lesson and number of lessons: **lecture (2)**	
method of evaluation: colloquium	
curriculum location of the subject: (autumn/spring semester): autumn and spring	
pre-study conditions *(if any)*: -	
The task and purpose of the subject:	
The need to be able to measure the complexity of a problem, algorithm or structure, and to obtain bounds and quantitative relations for complexity arises in more and more sciences: besides computer science, the traditional branches of mathematics, statistical physics, biology, medicine, social sciences and engineering are also confronted more and more frequently with this problem. In the approach taken by computer science, complexity is measured by the quantity of computational resources (time, storage, program, communication) used up by a particular task. These notes deal with the foundations of this theory.	
Course description:	
Models of Computation. Finite automata, The Turing machine, Universal Turing machines, The Random Access Machine, Boolean functions and Boolean circuits. Algorithmic decidability. Recursive and recursively enumerable languages, Computability in logic, Gödel's incompleteness theorem, Church's Theorem. Computation with resource bounds (Time and space), Polynomial time: Algorithms in arithmetic, Gaussian elimination, Graph algorithms, Maximum bipartite matching and alternating paths, Polynomial space. General theorems on space and time complexity. Non-deterministic algorithms, Non-deterministic Turing machines, Witnesses and the complexity of non-deterministic algorithms, Examples of languages in NP. NP-completeness, NP-complete problems for graphs, arithmetic and algebra. Randomized algorithms (Verifying a polynomial identity, Prime testing). Randomized complexity classes. Measuring information complexity. Kolmogorov complexity and data compression. An application of complexity: cryptography (The Rivest-Shamir-Adleman code)	
Required literature:	
1. Lovász László: Complexity of Algorithms	
Recommended literature:	
1. Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullmann. Design and Analysis of Computer Algorithms. Addison-Wesley, New York, 1974. 2. Thomas H. Cormen, Charles E. Leiserson, and Ronald L. Rivest. Algorithms. Mc Graw-Hill, New York, 1990.	