Name: **Kinematics and Dynamics of Industrial Robots**		*NEPTUN-code:* *NBXIK1SMNE*	*Number of periods/week:* full-time: 2 lec + 0 sem + 2 lab
Credit: 4 *Requirement:* exam		*Prerequisite:* *NIXMI1EMNE* High Availability Embedded Systems	
Responsible: József TAR, Ph.D.	*Position:* professor, habil.	*Faculty and Institute name:* John von Neumann Faculty of Informatics Institute of Applied Mathematics	
Way of assessment: – either oral exam or solving a numerical task			
Competences			
Course description:			
The goal is to provide the Students with the mathematical foundations that are needed for the efficient description of open kinematic chains and tackling forward and inverse kinematic problems. Kinematics: The Special Euclidean group: translations and rotations, the fundamental operations that can be done with rigid bodies. Definition of the open kinematic chain. Denavit – Hartenberg conventions, rotation around a given axis, roration around rotating axles. Definition of the invesrse kinematic task. Special structures having closed-form analytical solution. Differential inverse kinematics: singularities and redundancies; Moore-Penrose Pseudo-inverse, SVD, SVD-based pseudo-inverse, Gram-Schmidt Algorithm; Application of Fixed Point transformations in solving inverse kinematic tasks; Dynamics: Expression of the kinetic energy by the use of the homogeneous matrices. Variational Principle, Euler-Lagrange equations of motion; Generalized forces and their measuring possibilities, physical possibilities for motion control; the robot-environment dynamic interaction, contact forces, friction models (static and dynamic ones) and their effects.			
Literature			
Richard M. Murray, Zexiang Li, S. Shankar Sastry: A Mathematical Introduction to Robotic Manipulation, CRC Press, 1994 (electronic notes) Herman Bruyninckx: Robot Kinematics and Dynamics, 2010 (electronic notes)			