

E – Charakteristika studijního předmětu/Subject Specification					
Název studijního předmětu / Subject title	Real Time Control Systems				
Typ předmětu / Subject type	Compulsory elective		dopor. ročník / semester/ recommended year / semester	2 nd year 2 nd term	
Rozsah studijního předmětu / Study load in hours and credits		hod. za týden / weekly load	2 + 2	Kreditů / Credits	5
Jiný způsob vyjádření rozsahu / Other expression of study load	10 weeks, each 2 hours of lectures and 2 hours of seminary				
Způsob zakončení / Assessment	Written exam		Forma výuky / Form of teaching	Lectures and labs	
Další požadavky na studenta / Other demands on students					
Vyučující / Lecturer	Doc. Dr. Mgr. Ing. Jaroslav Hlava				
Stručná anotace předmětu / Subject annotation	Short annotation of the course This course is designed to provide the students with a good understanding of the basics of real time systems design. The course includes basic principles of real time programming: processes, synchronisation, communication and scheduling in real time systems and functions of real time operating systems. Since real time control represents one of the most important areas where the real time systems are applied, the course includes also an introduction into digital control, computer implementation of control algorithms and distributed control systems. Topics of the lectures Real-Time Systems, definitions, hard versus soft real time systems, real time control systems, application examples. Commonly used approaches to real-time scheduling, scheduling of periodic tasks, priority driven scheduling, resource access control. Inter-process communication synchronisation, deadlock, semaphores, queues Real Time operating systems. Sampling of continuous systems, discrete models of continuous systems, state space and transfer function models, Z transform. Design of digital controllers, digital approximation of continuous PID controllers, digital controllers with optimised structure.. Implementation of digital control algorithms, selection of sampling period, aliasing, effect of finite word length, fixed point and floating point computation, quantisation effects, effect of the computational time delay. Distributed control systems, communication channel delays and their effect on control performance. Architecture and programming of industrial control systems, connection of logical and digital control in modern PLC systems. Laboratories and seminars The topics covered in lectures are practised in computer laboratory using selected real time operating systems and industrial control systems Rockwell Automation. The basics of digital control are practised using Matlab and relevant toolboxes. .				
Informace ke kombinované nebo distanční formě / Information for students in external form of study					
Rozsah konzultací (soustředění) / Consultations, study meetings		hodin za týden / hours per week			
Rozsah a obsahové zaměření individuálních prací studentů a způsob kontroly / Individual student work – type, load, content and way of checking					
Studijní literatura a studijní pomůcky / Reading list and study utilities					
Liu, J. W. (2000), <i>Real Time Systems</i> , Prentice Hall, Upper Saddle River, N.J. Landau, Ioan D., Zito, Gianluca (2006), <i>Digital Control Systems Design, Identification and Implementation</i> , Springer Verlag Wittenmark, B., Åström, K. J., Årzén K. E. (2002), <i>Computer Control: An Overview</i> , IFAC Professional Briefs, freely available from http://www.ifac-control.org/					