

Real-time systems			
Credits: 5 Semester 1 Compulsory: No			
Format	Lectures 25 h	Guided project 15 h	Private study 85 h
Lecturer: B.J.Kubica (WUT), M.Chetto (ECN), F. Pla (UJI), A. Sgorbissa (UNIGE)			
<p>Objectives: By attending the course, the student will learn how to deal with issues concerning real-time applications and real-time operative systems, real-time design and programming, embedded systems.</p> <p>Contents:</p> <p>Real-time operating systems</p> <ul style="list-style-type: none"> • Basic principles; • Real-time scheduling algorithms for periodic tasks: Rate Monotonic, Earliest Deadline First, Deadline Monotonic; • Real-time scheduling algorithms for aperiodic tasks: scheduling in background, Polling Server, Deferrable Server; • Protocols for accessing shared resources: Priority Inheritance, Priority Ceiling. <p>Soft real-time systems</p> <ul style="list-style-type: none"> • Real-time programming in Posix; • Thread, mutex and conditional variables; • Rate Monotonic on Posix Linux; • Periodic servers; • Interprocess communication for real-time systems. <p>Hard real-time systems</p> <ul style="list-style-type: none"> • QnX, VxWorks, Windows CE • RTAI: periodic and aperiodic tasks; communication mechanisms. <p>Fundamentals of real-time programming for embedded systems.</p> <ul style="list-style-type: none"> • General overview of existing families of micro-controllers, DSPs, FPGAs, ASICs. • Basics of development for embedded systems: coding, compiling, linking, downloading, executing. • Different kinds of memory devices and memory organization; basic I/O operations; Buses and communication channels. • Interrupt-driven programming. 			
<p>Abilities: At the end of the course the student will be able to</p> <ul style="list-style-type: none"> • Correctly state and solve problems concerning the design of real-time applications, • Implement real-time applications in Linux Posix and RTAI; <ul style="list-style-type: none"> • Design event-driven, embedded real-time applications for micro-controllers. 			
Assessment: 30% laboratory work, 70% end of semester examination.			
<p>Recommended texts:</p> <ul style="list-style-type: none"> • Giorgio C. Buttazzo, Hard Real-time Computing Systems, Kluwer Academic publishers, 1997. • Q. Li, C. Yao. Real-Time Concepts for Embedded Systems. CMP Books, 2003. <p>Further readings:</p> <ul style="list-style-type: none"> • will be provided by lecturer. 			