



Programme of Course "Embedded Systems"

- Code: I0032
- Type of course unit: Compulsory (Laurea Magistrale in Ingegneria Informatica e Automatica curriculum Generale), Compulsory (Laurea Magistrale in Ingegneria Informatica e Automatica curriculum Automatica), Compulsory (Laurea Magistrale in Ingegneria Informatica e Automatica curriculum Informatica), Compulsory (Laurea Magistrale in Ingegneria delle Telecomunicazioni curriculum Comune), Elective (Laurea in Ingegneria dell'Informazione curriculum Automatica), Elective (Laurea in Ingegneria dell'Informazione curriculum Telecomunicazioni), Elective (Laurea in Ingegneria dell'Informazione curriculum Elettronica), Elective (Laurea in Ingegneria dell'Informazione curriculum Comune), Elective (Laurea in Ingegneria dell'Informazione curriculum Informatica)
- Level of course unit: Postgraduate Degrees, Undergraduate Degrees
- Semester: 1

Number of ects credits: (Laurea in Ingegneria dell'Informazione) 9 (workload 225 hours), (Laurea Magistrale in Ingegneria Informatica e Automatica) 9 (workload 225 hours), (Laurea Magistrale in Ingegneria delle Telecomunicazioni) 9 (workload 225 hours)

Teachers: Luigi Pomante

1	Course objectives	The goal of this module is to provide the fundamental set of concepts and techniques that relate to "HW/SW Dedicated Systems Engineering". In fact, it presents the main issues related to the design of dedicated (i.e. application-specific) HW/SW electronic devices that are also typically "embedded" (i.e. integrated into a more complex heterogeneous system) and/or with real-time constraints. In such a context, the course recalls the main HW/SW technologies and the related design methodologies and tools (both academic and commercial), providing also a unified (typically model-based) vision of all the involved concepts.
2	Course content and learning outcomes (dublin descriptors)	<p>Topics of the module include:</p> <ul style="list-style-type: none"> • Introduction: goals and structur of the course, general features of embedded systems, main design issues • Technologies: unified vision of basic HW technologies (ASIC, FPGA), HW components (processors, memories, timers, interfacing, communication) and HW/SW interaction • Architecture: system on-board, systems on-chip, networked/distributed embedded systems (in particular HW and SW technologies for Wireless Sensor Networks) • Methodologies and tools: system-level design flow and tools, HW/SW design flow and tools, RTOS and advanced OS concepts • Case studies <p>On successful completion of this module, the student should :</p> <ul style="list-style-type: none"> • Acquiring knowledge and understanding about the basic hw/sw technologies and design methodologies/techniques normally exploited during embedded systems design process. • Applying knowledge and understanding in order to be able to design an embedded systems by exploiting basic hw/sw technologies and design methodologies/techniques. • Making informed judgments and choices about the hw/sw technologies and methodologies/techniques available to develop an embedded systems starting from given functional and non-functional requirements. • Communicating knowledge and understanding in order to be able to actively work and collaborate in an embedded systems design team. • Capacities to continue learning to be able to understand and evaluate new technologies and design methodologies/techniques in the field of embedded systems design.
3	Course prerequisites	Basic knowledge about computer science, digital electronic, operating systems, computer architecture and sw development.

4	Teaching methods and language	Lectures, case studies, homelabs with tutorials, invited talks by industry speakers, thematic workshops. Language: English Reference textbooks <ul style="list-style-type: none">• F. Vahid, T. Givargis, <i>Embedded System Design: A Unified HW/SW Introduction</i>.• W. Fornaciari, C. Brandolese, <i>Sistemi Embedded - Sviluppo HW/SW per sistemi dedicati</i>.
5	Assessment methods	Homelabs with tutorials, written test, and presentation/discussion of a project work. Students are encouraged to carry out the project work in team and to also take a topic that can be carry out jointly with other courses (e.g. Wirelelss Communication, Digital Electronic 2, etc.).