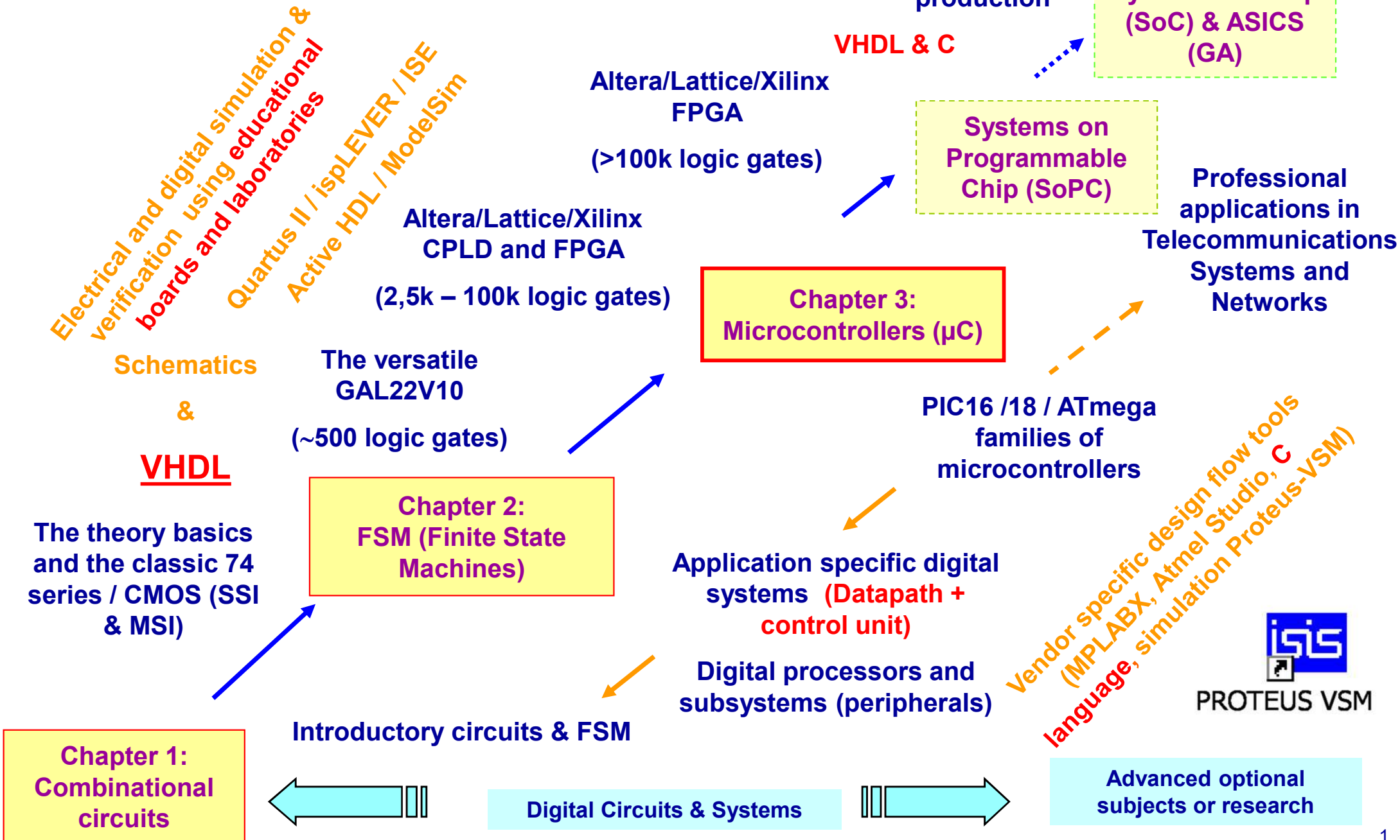


Digital technology roadmap



CSD competencies

**Programmable
logic devices and
VHDL**

**Microcontrollers
and C**

Lab skills

Team work

Project management

**Oral and written
communication**

Self-directed learning

English

Learning goals

Systematically analyse, design, simulate, implement, report, present and reflect about digital circuits and systems using state-of-the-art programmable devices, CAD/EDA software tools and laboratory equipment

CSD specific content



Chapter 1

Combinational Circuits

(50 h) – 2 ECTS

Chapter 2

Finite State Machines

(FSM) (50 h) – 2 ECTS

Chapter 3

Microcontrollers

(μ C) (50h) – 2 ECTS

Laboratory skills: logic analysers, debuggers/programmers, simulators, etc. ...

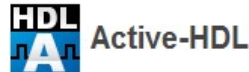
- Proteus-ISIS (virtual lab), WolframAlpha, Minilog - Logic Friday, **VHDL**
- Quartus II (Intel - Altera), ispLEVER Classic – Diamond (Lattice Semiconductor), ISE (Xilinx)
- Synplify Pro synthesis (Synopsys), Intel - Altera Integrated Synthesis, XST (Xilinx synthesis tools)
- ModelSim (Mentor Graphics) Atera Edition, Active HDL (Aldec) Lattice Edition, ISim (Xilinx)

- Proteus-VSM (Labcenter)
- MPLABX (Microchip) / Atmel Studio
- **C** compilers



PROTEUS VSM

ModelSim



ISE WebPACK



- Classic IC's
- SPLD GAL22V10

- Programmable logic devices (CPLD and FPGA) from Intel - Altera, Lattice, Xilinx
- Training boards (UP2, DE2, Spartan 3AN Starter Kit, MachXO USB Starter Kit, NEXYS 2, etc.

- PIC 16F/18F family of microcontrollers, Atmel microcontrollers
- Training boards PICDEM2+, ...

CSD generic tools

Oral and written communication

Team work

Self-directed learning

English language

Project management

• **Microsoft Office / Libreoffice Writer**



• **Visio / Libreoffice Draw**



• **Thunderbird /Firefox**

• **CMapTools**



• **Gantt diagrams**



• **Google drive**



• **Proofing tools**



• **Google translate**



• **Network drive**

• **Sketches, diagrams, schematics and flow charts.**



Planning activities and study time in and out of the classroom (6 ECTS - 150 h)

Activities

Theory and tutorial exercises
(P1 .. P12)

Projects: P_Ch1, P_Ch2, P_Ch3
(including an oral presentation)

Individual test
(Exa_1, Exa_2)



Weekly study plan

Guided learning

- Classroom (2 h)**
General discussion, theory, tutorials and examples
- Laboratory project solving teamwork sessions (2 h)**
- Lab / classroom (1 h)**
Questions and assessment

Self-directed learning

- Student-conducted teamwork sessions**
- Extra individual work**
(> 6 h)

12 weeks



12.5 h per week



6 ECTS

Assessment scheme



Exàmens	40%
Exa_1	20%
Exa_2	20%
Projecte	50%
P_Ch1	15%
P_Ch2	15%
P_Ch3	20%
Actitud i participació	10%
Act_P	10%

Criteris del sistema qualificació

CSD té dos exàmens individuals sobre el 40% de la nota final: l'Exa_1 a mig quadrimestre, i l'Exa_2 al final.

La qualificació dels projectes és el 50% de la nota final. Se'n realitza un en grup cooperatiu per capítol del temari. El P_Ch1 sobre circuits combinacionals en VHDL, el P_Ch2 sobre FSM, i el P_Ch3 sobre programació de microcontroladors en C. S'han de lliurar abans de la data límit segons el procediment establert. El format dels projectes és: 1) especificacions, 2) plantejament, 3) desenvolupament, i 4) simulació i test. Un dels projectes es presenta oralment.

El 10% es subjectiva segons la participació continuada en la matèria i d'actitud activa a les classes i laboratoris.

Activities → Design of real world applications

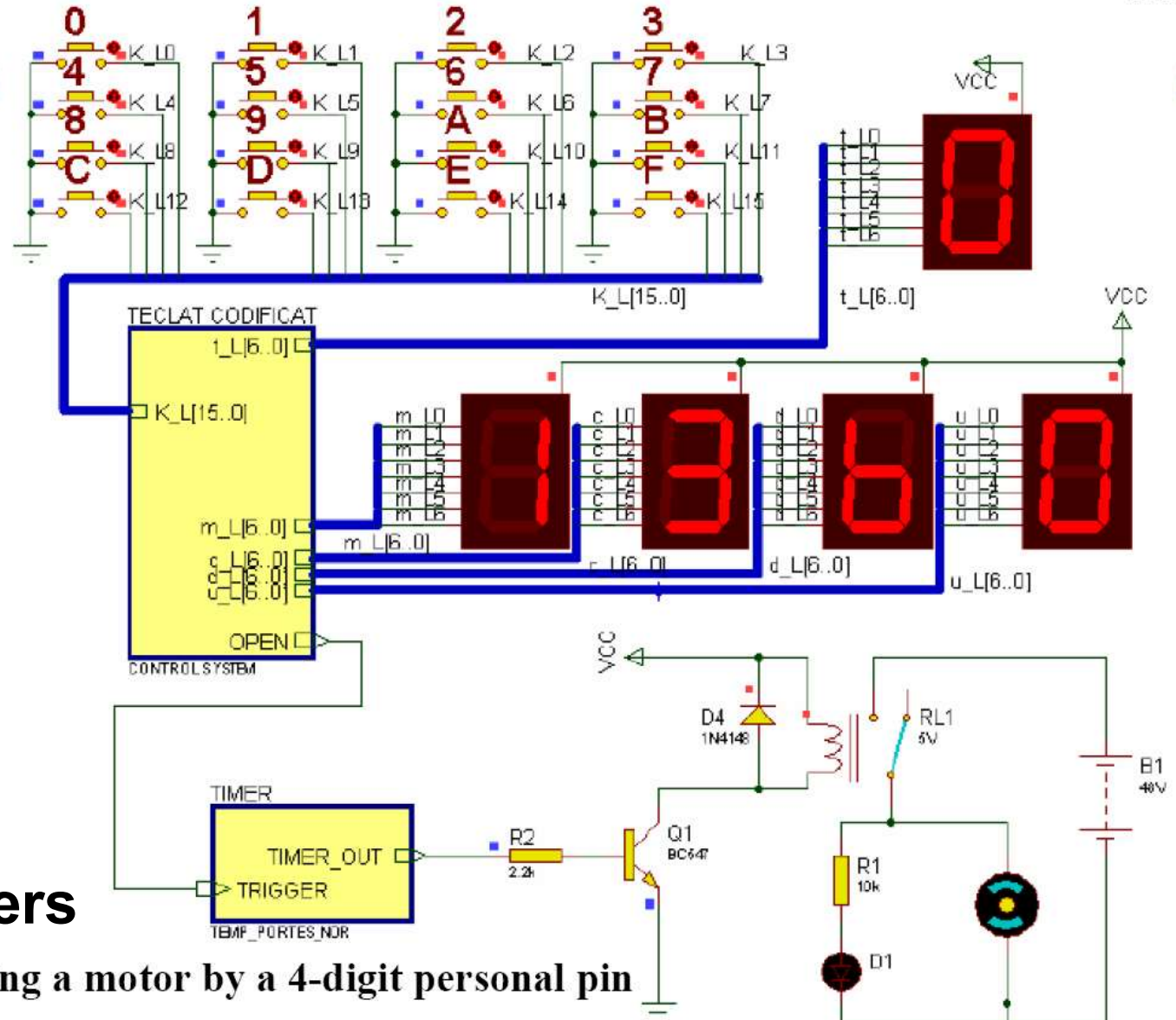
Real world problems instead of pure academic exercises

Motivation

Design using PLD/VHDL

Design using microcontrollers

Activating a motor by a 4-digit personal pin



Cooperative learning as the instructional method

- ***Positive interdependence***

Team members are obliged to rely on one another to achieve their common goal

- ***Individual accountability***

All students in a group are held accountable for doing their share of the work and for mastery of all of the content to be learned

- ***Face-to-face promotive interaction***

Group members providing one another with feedback, challenging one another's conclusions and reasoning, and teaching and encouraging one another

- ***Appropriate use of collaborative skills***

Students are encouraged and helped to develop and practice skills in communication, leadership, decision-making, conflict management, and other aspects of effective teamwork

- ***Regular self-assessment of group functioning***

Team members periodically assess what they are doing well as a team and what they need to work on for functioning more effectively in the future

Content and skills

Chapter 1	Chapter 2	Chapter 3
Combinational Circuits	Sequential Systems	Microcontrollers
VHDL		C language
EDA tools for sPLD/CPLD/FPGA: Lattice ispLEVER Classic or Altera Quartus II or Xilinx ISE		EDA tools for microcontrollers: Microchip or Atmel IDE
		P12: Timers, A/D, I2C, USART, etc.
		P11: Peripherals: LCD display
		P10: FSM style of programming. External Interrupts
		P9: Microcontroller architecture. Basic digital I/O
	P8: CLK generators and complete systems	
	P7: Counters, data and shift registers, and hardware dedicated processors	
	P6: Finite State machines (FSM)	
	P5: Sequential blocks: RS, JK, T, and D-type flip flops	
	P4: Other large combinational circuits (hierarchical structures)	
	P3: Arithmetic circuits: adders, comparators, subtractors, etc.	
	P2: Standard logic circuits: Multiplexers, demultiplexers, decoders, encoders, etc.	
P1: Logic gates and Boolean Algebra (SoP/PoS, maxterms, minterms, schematics, etc)		
Cross-curricular competences (1) (2) (3) (4) (5)		

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General agenda

1516 - Q2 - CSD

CSD – P1: Basic circuits using logic gates

- **The agenda for following the course activities**
- **Exams and discussion from previous semesters**
- **Thread of comments and queries related to each tutorial**
- **Combined with *email* support**



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