Module Description

Advanced Electronic Design

General Information

Number of ECTS Credits

3

Abbreviation

TSM_AdvElDes

Version

27.03.2017

Responsible of module

Christophe Bianchi, HES-SO

Language

	Lausanne	Bern	Zürich
Instruction	☐ E ☑ F	☐ D ☐ E ☐ F	☐ D ☑ E
Documentation	☑ E ☐ F	☐ D ☐ E ☐ F	☐ D ☑ E
Examination	☐ E ☑ F	☐ D ☐ E ☐ F	☐ D ☑ E

Module category

☐ Fundamental theoretical principles

☑ Technical/scientific specialization module

☐ Context module

Lessons

☑ 2 lecture periods and 1 tutorial period per week

☐ 2 lecture periods per week

Brief course description of module objectives and content

This Advanced Electronic Design module gives to the students the key elements for the development of high performance electronic systems. These systems are characterized by:

- a mixed-signal PCB (Printed Circuit Board)
- the presence of sensitive analogue circuits and signals
- the presence of complex and high-speed digital ICs (Integrated Circuits)

Aims, content, methods

Learning objectives and acquired competencies

- The student masters the technologies used in the development of high-performance printed circuit boards.
- The student is able to design a high-performance electronic board composed of sensitive analogue circuits and high speed digital signals.
- The student is able to implement high-speed and high-resolution signal processing chains based on A/D and D/A converters, analogue functions blocs and complex digital ICs.

Contents of module with emphasis on teaching content

The topics of this module can be grouped into three different subject areas. Therefore three courses are proposed. Each course is taught by a different person.

Course	Title	Weeks	Emphasis
1	High-performance PCB development : • PCB technologies: materials, multi-layers, buried vias • PCB design: EMC, signal integrity, grounding and power supply routing, decoupling, transmission lines, simulation tools • Board assembly: IC package, chip-on-board, soldering, heat transfer, testability	1 – 4	~30%
2	High-speed digital electronic design : • high-speed signaling, clock distribution, skew, jitter, latch-based design, low-power	5 – 8	~30%
3	Advanced analogue electronic design : • Advanced operational amplifier applications: low level and sensor signal conditioning, electronic noise, leakages, high-speed and low-power amplifiers, simulation tools • Advanced ADC and DAC implementations: high-speed, high-resolution, sigma-delta converter, low-power, anti-aliasing and post-filter	9 – 14	~40%

Teaching and learning methods

- Lecture
- Exercises
- Presentation and discussion of case studies
- Self-study of the presented cases and exercises

Prerequisites, previous knowledge, entrance competencies

The student must have knowledge and experience in the following areas.:

- Electrical field et Magnetic field
- Active and passive electronic components, operational amplifier
- AD and DA conversion principle
- Digital circuit

Literature

The Data Conversion Handbook, Walt Kester, Analog devices, March 2004.
High Speed Signal Propagation: Advanced Black Magic, Howard Johnson – Martin Graham, Prentice Hall, 2003.
Op Amps for everyone, Ron Mancini, Texas Instruments, 2002.

Assessment

Certification requirements for final examinations (conditions for attestation)

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Written module examination

Duration of exam : 120 minutes
Permissible aids: Course material, pocket calculator except PC – PDA – Mobile phone