

Module Description

Advanced Electronic Design

General Information

Number of ECTS Credits

3

Module code

TSM_AdvEIDes

Responsible of module

Christophe Bianchi, HES-SO

Language

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Berne	Lausanne		Lugano	Zurich	
Instruction	<input type="checkbox"/> E 100%	<input type="checkbox"/> E 100%	<input checked="" type="checkbox"/> F 100%	<input type="checkbox"/> E 100%	<input checked="" type="checkbox"/> E 100%	<input type="checkbox"/> D 100%
Documentation	<input type="checkbox"/> E 100%	<input type="checkbox"/> E 100%	<input checked="" type="checkbox"/> E 100% <input type="checkbox"/> F %	<input type="checkbox"/> E 100%	<input checked="" type="checkbox"/> E 100%	<input type="checkbox"/> E % <input type="checkbox"/> D %
Examination	<input type="checkbox"/> E 100%	<input type="checkbox"/> E 100%	<input type="checkbox"/> E 100% <input checked="" type="checkbox"/> F 100%	<input type="checkbox"/> E 100%	<input checked="" type="checkbox"/> E 100%	<input type="checkbox"/> E 100% <input type="checkbox"/> D 100%

Module category

- FTP Fundamental theoretical principles
- TSM Technical/scientific specialization module
- CM Context module

Lessons

2 lecture periods and 1 tutorial period per week

Entry-level competencies

Prerequisites, previous knowledge

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

- Circuit analysis
- Electrical and magnetic fields
- Active and passive electronic components, operational amplifiers
- AD and DA conversion principle
- Digital circuits

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, mixed signal and high speed digital circuits.
- 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 : <ul style="list-style-type: none"> • PCB technologies: materials, multi-layers, micro vias • PCB design: EMC, signal integrity, grounding and power supply routing, decoupling, transmission lines and effects, simulation tools • Board assembly: IC package, chip-on-board, soldering, heat transfer, testability 	1 – 4	~30%
2	High-speed digital electronic design : <ul style="list-style-type: none"> • high-speed signaling and timing, clock distribution, skew, jitter, latch-based design, low-power 	5 – 8	~30%
3	Advanced analogue electronic design : <ul style="list-style-type: none"> • Advanced operational amplifier applications: low level and sensor signal conditioning, electronic noise, high-speed and low-power amplifiers, simulation tools, frequency response analysis • 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

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)

None

Basic principle for exams:

**All the standard final exams for modules are written exams.
The repetition exams can be either written or oral.**

Standard final exam for a module and written repetition exam

Kind of Exam	written
Duration of exam	120 minutes
Permissible aids	<input type="checkbox"/> no aids <input checked="" type="checkbox"/> permissible aids: <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Electronical aids: pocket calculator <input checked="" type="checkbox"/> Hardcopy form: Course material <input type="checkbox"/>

Special case: Repetition exam as an oral exam

If an oral exam is set (only possible for ≤ 4 students), the following applies:

Kind of Exam	oral
Duration of exam	30 minutes
Permissible aids	no aids