

**Module Description, available in: EN**

## Advanced Electronic Design

**General Information****Number of ECTS Credits**

3

**Module code**

TSM\_AdvEIDes

**Valid for academic year**

2023-24

**Last modification**

2021-05-12

**Coordinator of the module**

Hanspeter Schmid (FHNW, hanspeter.schmid@fhnw.ch)

**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.

	Lausanne			Lugano	Zurich		
<b>Instruction</b>					X E 100%		
<b>Documentation</b>					X E 100%		
<b>Examination</b>					X E 100%		

**Module Category**

TSM Technical scientific module

**Lessons**

2 lecture periods and 1 tutorial period per week

**Entry level competences****Prerequisites, previous knowledge**

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

- Circuit analysis, Laplace / Bode
- 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:

- 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 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

Course	Title	Weeks	Emphasis
1	High-speed digital electronic design : <ul style="list-style-type: none"><li>• high-speed signaling and timing, clock distribution, skew, jitter, latch-based design, low-power</li></ul>	1 – 5	~35%
2	Advanced analogue electronic design : <ul style="list-style-type: none"><li>• Advanced operational amplifier applications: low level and sensor signal conditioning, electronic noise, high-speed and low-power amplifiers, frequency response analysis</li><li>• Advanced ADC and DAC implementations: high-speed, high-resolution, sigma-delta converter, low-power, anti-aliasing and post-filter</li></ul>	6 – 14	~65%

### Teaching and learning methods

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

### Literature

#### Recommended:

*Design with Operational Amplifiers and Analog Integrated Circuits*, Sergio Franco, 4th ed., McGraw-Hill 2016.

#### Additional reading:

*The Op Amp Applications Handbook*, Walt Jung, Analog Devices, 2005.

<https://www.analog.com/en/education/education-library/op-amp-applications-handbook.html>

*The Data Conversion Handbook*, Walt Kester, Analog Devices, 2005.

<https://www.analog.com/en/education/education-library/data-conversion-handbook.html>

*High Speed Signal Propagation: Advanced Black Magic*, Howard Johnson – Martin Graham, Prentice Hall, 2003.

## Assessment

### Certification requirements

Module does not use certification requirements

### Basic principle for exams

**As a rule, all the standard final exams for modules and also all resit exams are to be in written form**

### Standard final exam for a module and written resit exam

**Kind of exam**

written

**Duration of exam**

120 minutes

**Permissible aids**

*Aids permitted as specified below:*

**Permissible electronic aids**

Course material either on paper or on computer; pocket calculator; tools on computer; computer and phones must be offline (WiFi, Bluetooth, ..., switched off)

**Other permissible aids**

Course material

**Special case: Resit exam as oral exam**

**Kind of exam**

oral

**Duration of exam**

30 minutes

**Permissible aids**

No aids permitted