



Section PHELMA “Integrated Electronic Systems”, SEI

Overview

The objective of the training program is to acquire a strongly specialized expertise in design and experimentation of last generation micro and nanoelectronic the most up-to-date embedded chips or optoelectronic circuits and systems. Another complementary objective is to address specification, design and validation of complex systems on chip architectures for a very wide range of applications.

The students are trained in applied research and development of integrated circuits in analog, digital design, system-on-chip, optoelectronics, microwaves, RF.

The two years teaching program concerns students from Grenoble INP, but it welcomes also students following an international exchange curriculum registered at Grenoble INP. The lectures can be taught in English.

Career opportunities

The engineering degree, obtained at the end of the full teaching programme, leads to multiple choices of career in modern, up to date electronic engineering in the following challenging fields:

- **Design of digital, analog and heterogeneous microelectronic circuits and systems**
- **Hardware and Software Architectures of Systems on Chip**
- **Specification and simulation of electronics systems**
- **Optoelectronic systems design and Optronics**
- **Microelectronic and nanotechnology fabrication**

Engineers can also orient to careers covering fabrication, research and development engineering for systems and products, IT project and business management.

These technical fields are nowadays of a great importance in the following application domains:

- **Computers (microprocessors and multiprocessors, hard disk drive, etc)**
- **Wide range of mobile applications (PDA, laptops, GSM, 3G-4G, MP3, GPS, cameras, etc...)**
- **Home entertainment applications (HDTV, Set topbox, video gaming, etc)**
- **Security applications (banking and transactional solutions)**
- **Networking Applications (Bluetooth, Wi-Fi, WLAN, Ethernet, optical high band backbone and urban solutions...)**
- **Automotive and high end applications (cars, trains, airplanes, etc)**
- **Satellite broadcasting**
- **RFID**
- **Integrated solutions for biochips**

Master Thesis : Besides industrial career, the Filière PHELMA “Integrated Electronic Systems”, SEI, can lead to a career in multiple related research domains. Students can obtain one of the two masters dedicated to research: Master “Optique et Radiofréquence, OR” or master “Micro Nano Electronics, MNE”. Phd studies in these domains are open to all students having master curricula.

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Courses Second and third year

SEMESTER 3	Volume Hours	ECTS	SEMESTER 4	Volume Hours	ECTS
Module « Physics and Technology »	44	3	Module « Physics and Technology »	32	2.5
Semiconductor physics	22	1.5	Microelectronics technology	8	1
Microelectronic device physics	22	1.5	Lab works: technology in clean room, characterisation	24	1.5
Module « Microwaves and et Optoelectronics »	60	4.5	Module « Microwaves and Optoelectronics »	12	1
Guided electromagnetism	20	1.5	Optical and microwave lab sessions	12	1
Microwave and optoelectronic passive circuits	16	1	Module « Electronics »	30	2.5
Microwave and optoelectronic active circuits	24	2	Analog to digital converters	14	1
Module « Electronics »	132	9.5	Integrated system architectures	16	1.5
Analogue integrated circuit design	24	2	Module « Communication systems for electronics »	58	6
Electronic systems	22	1.5	Digital signal processing	18	1.5
Analog design lab works	24	1.5	Automatics	14	1
VLSI digital design	22	2	Communications and digital modulation systems	24	2
Microelectronic design flow	16	1	Lab sessions on communication systems for electronics	20	1.5
Digital design lab works	24	1.5	Module « Informatics and networks »	58	7
Module « Informatics and networks »	20	4	Operating systems	24	3
Informatics project in C language	20	4	Networking	12	1
Module “Languages”	50	4	Object Oriented Programming	22	3
English	30	2	Module “Projects”	56	5
Foreign language 2	30	2	Option 1		
Module “Professional education”	52	4.5	Analog design project	28	2.5
Sport	28	1.5	Microwave design project	28	2.5
Feedback on the 1 st year internship	4	1	Option 2		
Law and financial management	20	2	Digital design project	56	5
OR, Business and activity development	30	2	Module “Languages”	26	2
Total	368	30	English	26	2
			Module “Professional education”	60	4
			Sport	24	1.5
			Personal project and professional insertion	16	0.5
			Strategy, global vision, marketing	20	2
			OR Business and activity development	30	2
			Total	350	30

SEMESTER 5	Volume hours	ECTS
Option 1 : Design of integrated RF and optoelectronic systems	268	23.5
Module “Electronic design”	120	10
RF integrated front-end	28	2
Analog systems for signal processing	20	2
Signal integrity and packaging	12	1
Antennas	26	2
New standards for RF transmission	16	1.5
Lab sessions : Microwaves (PHOG)	16	1
Module “RF circuits and systems”	92	8,5
Lab sessions: Transmitter design project for Wifi network	76	7,5
HLS synthesis	8	0,5
Wireless system design synthesis	8	0,5
Module “Optoelectronic Systems”	64	5.5
High data rate fiber systems	16	1.5
Optoelectronic and opto-microwave functions, optoelectronic transceivers	24	2
Lab sessions : Optics (PHOG)	16	1.5
Option 2 : Systems on chip	264	23.5
Module “Software Architectures”	24	2
Real time operating systems	8	1
Lab sessions on operating systems	16	1
Modules “Hardware Architectures”	110	9,5
Robust and low power design	28	2.5
SoC Architectures	36	3
From algorithm to architecture	26	2,5
Lab sessions on CAD	20	1,5
Modules “Methodology and realisation of a SoC”	130	12
SoC Design Methodology	10	1
Lab sessions on SystemC	28	2
Formal verification methodology	12	1
SoC architecture project	40	4
SoC design Methodology project	40	4
Module « Languages »	24	2
English	24	2
Foreign language 2- optional	20	1.5
Module « Professional education »	68	4.5
Sport	24	1,5
Management and leadership	16	1,5
Complementary course or Management, on choice	16	1,5
Personal project and last year’s project investigation	4	
Professional Integration Preparation	4	
Total	350	30