Teaching program

Systèmes réseaux et télécommunications

Academic year 2023-2024

Ecole polytechnique de Nantes Université

November 13, 2023

Contents

Part I

Tables of teaching units

Semester 5 - unit *SRT 3*

Mathematics

ECTS : 2

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Analysis	8	7					*0.4*
• Basics of mathematics	10	10					*0.6*
TOTAL	18	17	0	0	0	0	

Electronics and physics

ECTS : 6

Manager : EL ZOGHBI Mohamad

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Electromagnetism	4	3					*0.1*
• Basics in electronic	5	5	15				*0.35*
• Digital electronics	5	5	15				*0.35*
• Guided wave propagation	6	6					*0.2*
TOTAL	20	19	30	0	0	0	

Programming

ECTS : 4

Manager : NACEUR Maha

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Algorithms and C language	5	5	20				*0.6*
• Web programming	3	3	16				*0.4*
TOTAL	8	8	36	0	0	0	

Systems and networks

ECTS : 4

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Network administration	2	2	12				*0.4*
• Operating systems	6	6	16				*0.6*
TOTAL	8	8	28	0	0	0	

Humanities

ECTS : 4

Manager : KINGSTON John

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• AP - S5 - ITII		2					*0*
• Issues of companies and companies-S5-ITII		4				2	*0*
• PSI		8				2	*0.2*
• SSAT		28				10	*0.5*
• Toeic & Professional English		22.5				10	*0.15*
• Economy		20					*0.15*
TOTAL	0	84.5	0	0	0	24	

Company - S5 ECTS : 10

Manager : NACEUR Maha

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Casuel S5							*1*
TOTAL	0	0	0	0	0	0	

Sum of semester

	Lect	Tut	PW	Proj	WP	Asst	ECTS
Sum	54	136.5	94	0	0	24	30
Face-to-face sum	284.5						

Semester 6 - unit *SRT 3*

Humanities — ECTS : 4

Manager : KINGSTON John

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Analysis of professional practice		4					*0*
• Issues of companies and companies-S6-ITII		16				6	*0.25*
• PSI - S6 - ITII		8				2	*0*
• SSAT		21				12.5	*0.25*
• Toeic & public speaking		22.5				10	*0.25*
• Accounting business game + Biodiversity fresco		35					*0.25*
TOTAL	0	106.5	0	0	0	30.5	

Signals and systems for telecommunication — ECTS : 4

Manager : EL ZOGHBI Mohamad

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Numerical methods	2	2	16				*0.35*
• Probability and statistics	7	7					*0.25*
• Deterministic signals and linear systems	7	7	12				*0.4*
TOTAL	16	16	28	0	0	0	

Electronic technologies — ECTS : 3

Manager : GUYONNET Philippe

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Electonic functions	5	5	12				*0.5*
• Microprocessors	5	5	12				*0.5*
TOTAL	10	10	24	0	0	0	

Software development — ECTS : 4

Manager : NACEUR Maha

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Database management and administration	3	3	16				*0.4*
• Object oriented programming	6	6	24				*0.6*
TOTAL	9	9	40	0	0	0	

Systems and networks technologies — ECTS : 5

Manager : NACEUR Maha

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• System administration	2	2	18				*0.4*
• Ethernet and switching	3	3	12				*0.3*
• Internet and routing	2	2	16				*0.3*
TOTAL	7	7	46	0	0	0	

corporate Induction — ECTS : 10

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Casuel S6							*1*
TOTAL	0	0	0	0	0	0	

Sum of semester

	Lect	Tut	PW	Proj	WP	Asst	ECTS
Sum	42	148.5	138	0	0	30.5	30
Face-to-face sum	328.5						

Semester 7 - unit *SRT4*

Systems and sofware engineering S7 — ECTS : 5

Manager : GUYONNET Philippe

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Software engineering	8	7	15				*0.3*
• Embedded systems modeling and design	5	5					*0.1*
• Transversal project I				30			*0.6*
TOTAL	13	12	15	30	0	0	

Processing and transmission of information S7 — ECTS : 5

Manager : EL ZOGHBI Mohamad

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Cryptography	10	3					*0.2*
• Medium frequency electronic functions	8	7	15				*0.4*
• Random signal processing and information theroy	10	10	10				*0.4*
TOTAL	28	20	25	0	0	0	

Networks administration and applications S7 — ECTS : 6

Manager : NACEUR Maha

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Automating network administration tasks	5	5	15				*0.3*
• Web development	5	5	20				*0.4*
• Virtualization	5	5	15				*0.3*
TOTAL	15	15	50	0	0	0	

Business (company) S7 — ECTS : 10

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Casuel S7							*1*
TOTAL	0	0	0	0	0	0	

Humanities S7 — ECTS : 4

Manager : KINGSTON John

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• AP - S7 - ITII		2					*0*
• Issues of companies and companies-S7-ITII		8					*0*
• PSI - S7 - ITII		16				20	*0.15*
• SSAT - S7 - ITII		28				10	*0.35*
• Corporate culture		15				16	*0.125*
• Toeic		15					*0.125*
• Business economy		16					*0.25*
TOTAL	0	100	0	0	0	46	

Sum of semester

	Lect	Tut	PW	Proj	WP	Asst	ECTS
Sum	56	147	90	30	0	46	30
Face-to-face sum	323						

Semester 8 - unit *SRT 4*

Systems and software engineering S8 — ECTS : 4

Manager : EL ZOGHBI Mohamad

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Mobile application development	5		15				*0.35*
• Responsible digital	5		5				*0.15*
• Transversal Project II				30			*0.5*
TOTAL	10	0	20	30	0	0	

Telecommunications systems S8 — ECTS : 3

Manager : EL ZOGHBI Mohamad

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Digital Communications	4	4	10				*0.5*
• Hyper Frequency Electronics	4	4	15				*0.5*
TOTAL	8	8	25	0	0	0	

Embedded systems and software S8 — ECTS : 5

Manager : GUYONNET Philippe

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Real-time executives	4	4	12				*0.2*
• Embedded SoC and OS	6	6	16				*0.4*
• Microprocessor systems	6	6	16				*0.4*
TOTAL	16	16	44	0	0	0	

Multimedia and networks S8 — ECTS : 5

Manager : MOTTA CRUZ Eduardo

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Regulation	5	5					*0.1*
• Operator networks I	6	6	18				*0.35*
• Data storage	6	4	6				*0.2*
• Multimedia technologies and standards	6	6	16				*0.35*
TOTAL	23	21	40	0	0	0	

Business (company) S8 — ECTS : 10

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Casuel S8							*1*
TOTAL	0	0	0	0	0	0	

Humanities S8 ECTS : 3

Manager : KINGSTON John

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Analysis of the pratice		4					*0*
• Issues of society and companies-S8- ITII		12				10	*0.4*
• SSAT - S8 - ITII		21				40	*0.35*
• Corporate culture		15				8	*0.25*
TOTAL	0	52	0	0	0	58	

Sum of semester

	Lect	Tut	PW	Proj	WP	Asst	ECTS
Sum	57	97	129	30	0	58	30
Face-to-face sum	313						

Semester 9 - unit *SRT 5*

QoS and network S9 — ECTS : 4

Manager : PARREIN Benoit

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Embedded software	5	5	15				*0.35*
• QoS et QoE	5	5	10				*0.3*
• Operators Networks II	5	5	8				*0.35*
TOTAL	15	15	33	0	0	0	

Administration and security S9 — ECTS : 3

Manager : PARREIN Benoit

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Advanced system administration	5	5	10				*0.4*
• Networks security	20	10					*0.6*
TOTAL	25	15	10	0	0	0	

Systems and architetures RF S9 — ECTS : 2

Manager : EL ZOGHBI Mohamad

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Antennas and sensors	5		10				*0.5*
• RF devices and microwaves	7		15				*0.5*
TOTAL	12	0	25	0	0	0	

Technical project R&D S9 — ECTS : 4

Manager : MOTTA CRUZ Eduardo

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Industrialization of electronic systems	8						*0.1*
• Technical project R&D				45			*0.9*
TOTAL	8	0	0	45	0	0	

Companies S9 — ECTS : 14

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Casuel S9							*1*
TOTAL	0	0	0	0	0	0	

Humanities S9 ECTS : 3

Manager : KINGSTON John

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• PFE Preparation Workshop	4						*0*
• SSAT - S9 - ITII		28					*0.3*
• Business management - negotiation		36					*0.4*
• Quality Security Environment		20					*0.3*
TOTAL	4	84	0	0	0	0	

Sum of semester

	Lect	Tut	PW	Proj	WP	Asst	ECTS
Sum	64	114	68	45	0	0	30
Face-to-face sum	291						

Semester 10 - unit *SRT 5*

Embedded networks and systems - S10 ECTS : 6

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• Embedded wireless applications	4	4	8				*0.2*
• Connected objects and adapted networks	5		10				*0.15*
• Wireless companies networks	5	5	15				*0.3*
• Networks supervision	24	4					*0.35*
TOTAL	38	13	33	0	0	0	

Advanced telecommunications systems - S10 ECTS : 4

Manager : EL ZOGHBI Mohamad

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• THD technologies architecture	4	4	8				*0.25*
• Digital communications : advanced techniques	5	5	10				*0.35*
• Engineering of mobile telecom systems	5	5	15				*0.4*
TOTAL	14	14	33	0	0	0	

Company - S10 ECTS : 15

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• PFE writing workshop		4					*0*
• Casuel S10							*0*
• PFE defense		8					*1*
TOTAL	0	12	0	0	0	0	

Humanities - S10 ECTS : 3

Manager : KINGSTON John

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• SSAT - S10 - ITII		28					*0.8*
• Business law and economic intelligence		21					*0.2*
TOTAL	0	49	0	0	0	0	

R&D technical project S10 ECTS : 2

Course	Lect	Tut	PW	Proj	WP	Asst	*Coef*
• R&D technical project				30			*1*
TOTAL	0	0	0	30	0	0	

Sum of semester

	Lect	Tut	PW	Proj	WP	Asst	ECTS
Sum	52	88	66	30	0	0	30
Face-to-face sum	236						

Part II

Sheets of courses

Accounting business game + Biodiversity fresco

Hours

Lect	Tut	PW	Proj	WP	Asst
	35				

Evaluation

One evaluation : *Oral*

Manager : Chrystèle GONCALVES

Advanced system administration

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	10			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• System administration	·	·	·	✓	·
• Automation of system administration tasks	·	·	✓	·	·
• Cloud service orchestration	·	·	✓	·	·

Manager : Benoit PARREIN

Algorithms and C language

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	20			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Analysis

Hours

Lect	Tut	PW	Proj	WP	Asst
8	7				

Evaluation

2 evaluations :

- *Contrôle écrit 1*
- *Contrôle écrit 2*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Knowing how to develop a periodic or periodized function in Fourier series	·	·	✓	·	·
• alculate the convolution product of two functions and know its relation to the Fourier transform	·	✓	·	·	·
• Master the calculation of direct and inverse Fourier transforms	·	·	✓	·	·
• Master the calculation of direct and inverse Laplace transforms, and their application to the resolution of differential equations	·	✓	·	·	·

Manager : Pascal CHARGE

Antennas and sensors

Hours

Lect	Tut	PW	Proj	WP	Asst
5		10			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the manufacturing technologies, properties and applications of microsystems and sensors	✓	·	·	·	·
• Know how to develop an antenna design strategy	·	✓	·	·	·
• Know how to describe an antenna on simulation software (IE3D, HFSS, Microwave Studio) and optimize its performance	·	·	✓	·	·
• Know how to characterize an antenna in an anechoic chamber	·	·	✓	·	·

Manager : Eduardo MOTTA CRUZ

Automating network administration tasks

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Outline

Automation of administration tasks with Linux:- Presentation of the DevOps approach (culture, automation, measurement, sharing)- DevOps and the Cloud- Integration and continuous deployment- Automation (bash scripting, declarative configuration management solutions, Docker)- Infrastructure monitoring and performance metrics on Linux- The DevOps culture in companies

Goals

- Know the DevOps approach- Know how to automate the deployment and supervision of an application on Linux

Prerequisites

- Algorithm- Scripting Bash- Virtualization- Linux

Learning outcomes

Learning outcomes	N	A	M	E	O
• Manage hardware and software resources in an operating system	·	·	✓	·	·
• Automation of Windows and Unix/Linux administration tasks	·	·	✓	·	·

Manager : Benoit PARREIN

Basics in electronic

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know and know how to apply Kirchhoff's laws to simple circuits.	·	·	✓	·	·
• Model a quadrupole and know how to use its model.	·	✓	·	·	·
• Know how to analyze a simple circuit in any regime.	·	✓	·	·	·
• Know how to use an analog circuit simulator.	·	✓	·	·	·

Manager : Philippe GUYONNET

Basics of mathematics

Hours

Lect	Tut	PW	Proj	WP	Asst
10	10				

Evaluation

One evaluation : *Contrôle écrit*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Calculate the derivative of the usual functions, products of functions and functions composed of a single variable.	·	·	✓	·	·
• Calculate the integral of the usual functions and of a rational function. Control the change of variable, integration by parts.	·	·	✓	·	·
• Solve a first and second order linear differential equation.	·	·	✓	·	·
• Calculate a rotational, gradient divergence, a partial derivative, a double and curvilinear integral.	·	·	✓	·	·
• Multiply 2 matrices, invert a matrix, calculate the vectors and eigenvalues, solve a linear system.	·	·	✓	·	·

Manager : Yide WANG

Business economy

Hours

Lect	Tut	PW	Proj	WP	Asst
	16				

Evaluation

One evaluation : *Devoir sur table*

Manager : Chrystèle GONCALVES

Business law and economic intelligence

Hours

Lect	Tut	PW	Proj	WP	Asst
	21				

Evaluation

One evaluation : *Contrôle continu*

Manager : Gwenael THOREL

Business management - negotiation

Hours

Lect	Tut	PW	Proj	WP	Asst
	36				

Evaluation

One evaluation : *Contrôle continu*

Manager : John KINGSTON

Casuel S10

Hours

Lect	Tut	PW	Proj	WP	Asst

Evaluation

One evaluation : *Dépôt*

Casuel S5

Hours

Lect	Tut	PW	Proj	WP	Asst

Evaluation

One evaluation : *Dépôt*

Manager : Maha NACEUR

Casuel S6

Hours

Lect	Tut	PW	Proj	WP	Asst

Evaluation

One evaluation : *Dépôt*

Casuel S8

Hours

Lect	Tut	PW	Proj	WP	Asst

Evaluation

One evaluation : *Dépôt*

Connected objects and adapted networks

Hours

Lect	Tut	PW	Proj	WP	Asst
5		10			

Evaluation

2 evaluations :

- *Rapport TP*
- *Contrôle écrit*

Outline

- Basic: recall of concepts and objects connected networks; issues connected objects; use cases.

- From the physical interconnection applications: review of technologies constantly evolving IEEE 802.15.4, ZigBee, Z-Wave, Bluetooth, 2G / 3G / 4G, etc; inventory of different protocol families to the constraints of connected objects: 6LoWPAN, COAP, CORE, software overlays ...

- Security: the security of connected objects, basics of cryptography, review of the main security protocols, cryptographic algorithm and architecture

- Energy performance: discovery of the main challenges connected objects; how to combine the life and continuing communication of connected objects.

- Operating systems and platforms of connected objects: review of platform and operating systems; "Big Data": taking account of the data in the design of the object, how to treat the plurality of recovered data.

Goals

Understand the concepts , issues and use cases connected objects
Identify the benefits to be gained for users
Choose the underlying IT architecture
Know exploit the collected data value

Prerequisites

Electronics and Electromagnetism HF .
Programming languages ??(Java , C).
Networks of operators.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Identify the technologies involved in the connected objects , limitations and opportunities	·	·	✓	·	·
• Assess the constraints to be taken into account in the design of connected objects to develop secure systems and safe	·	·	✓	·	·
• Know the platforms , operating systems and " frameworks " to develop existing systems IoT	·	·	✓	·	·

Manager : Mohamad EL ZOGHBI

Corporate culture

Hours

Lect	Tut	PW	Proj	WP	Asst
	15				8

Evaluation

2 evaluations :

- *CC*
- *DS*

Corporate culture

Hours

Lect	Tut	PW	Proj	WP	Asst
	15				16

Evaluation

2 evaluations :

- *CC*
- *DS*

Cryptography

Hours

Lect	Tut	PW	Proj	WP	Asst
10	3				

Evaluation

One evaluation : *Contrôle écrit*

Bibliography

B. Schneier, Cryptographie appliquée, Wiley, 2001, 846 p.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Practical understanding of the different aspects of security (integrity, confidentiality, authentication, non-repudiation, availability)	✓	·	·	·	·
• Know how to operate a secure exchange using a secret key encryption algorithm (DES algorithmic mechanism, standard attacks, weak keys, technological implementation problems)	·	·	✓	·	·
• Knowing how to operate a secure exchange using a public-private dual-key encryption algorithm	·	·	✓	·	·
• Understanding of some standard attacks (MiM, chosen clear text attack, known clear text attack ...)	✓	·	·	·	·
• Understanding the structure of a public and private block chain	✓	·	·	·	·

Manager : Benoit PARREIN

Data storage

Hours

Lect	Tut	PW	Proj	WP	Asst
6	4	6			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Bibliography

Cloud Storage, Dossier Techniques de l'Ingénieur, Bernard Aubineau, Alain Clément, Jean-Claude Maury, disponible en BU, 2012

Learning outcomes

Learning outcomes	N	A	M	E	O
• Master a complete storage architecture within a computer system	·	·	✓	·	·
• Interfacing this architecture in a production IT system	·	✓	·	·	·
• Develop a business recovery / continuity plan	·	✓	·	·	·

Manager : Benoit PARREIN

Database management and administration

Hours

Lect	Tut	PW	Proj	WP	Asst
3	3	16			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Manager : Maha NACEUR

Deterministic signals and linear systems

Hours

Lect	Tut	PW	Proj	WP	Asst
7	7	12			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Master analog-to-digital and digital-to-analog conversions	·	·	✓	·	·
• Calculate and interpret the frequency representation of a discrete signal	·	·	·	✓	·
• Calculate the Laplace transform (TL) and the Z transform (TZ)	·	·	·	✓	·
• Use TL and TZ to characterize a linear time invariant system	·	·	·	✓	·
• Synthesize and implement digital filters	·	·	✓	·	·

Manager : Mohamad EL ZOGHBI

Digital Communications

Hours

Lect	Tut	PW	Proj	WP	Asst
4	4	10			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the digital modulation techniques for the transmission of information (architecture and operation of modulators / demodulators)	·	✓	·	·	·
• Know coding techniques for the transmission of information	·	✓	·	·	·
• To be able to design and build digital communication systems both in baseband and by digital modulation of carrier (s)	·	✓	·	·	·

Manager : Mohamad EL ZOGHBI

Digital communications : advanced techniques

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	10			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the theory of optimal maximum likelihood receivers for memoryless digital modulation	·	·	✓	·	·
• Know how to theoretically evaluate the performance of a modulation in terms of error probability and spectral efficiency	·	✓	·	·	·
• Understand the problem of equalization and know the structure and operation of the simplest equalizers	·	·	✓	·	·
• Know CDMA and OFDM techniques as well as their main applications	·	✓	·	·	·
• Knowing how to generate pseudo-chaotic codes and quantify the performance of these sequences	·	·	✓	·	·
• Know how to create a chaos-based cryptosystem	·	✓	·	·	·

Manager : Mohamad EL ZOGHBI

Digital electronics

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Knowing how to analyze a combinatorial logic function built from standard combinatorial blocks	·	✓	·	·	·
• Know how to analyze the VHDL model of a combinatorial logic function	·	✓	·	·	·
• Know how to analyze a sequential logic function built from standard sequential blocks	·	✓	·	·	·
• Know how to analyze the VHDL model of a sequential logic function based on binary counters	·	✓	·	·	·

Manager : Philippe GUYONNET

Economy

Hours

Lect	Tut	PW	Proj	WP	Asst
	20				

Evaluation

One evaluation : *Devoir sur table*

Manager : Chrystèle GONCALVES

Electonic functions

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	12			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• To be able to model in small signal an assembly with transistor in LF	·	·	✓	·	·
• Know the three basic assemblies to a transistor	·	·	✓	·	·
• Know how to specify and simulate an LF filtering function	·	·	✓	·	·

Manager : Philippe GUYONNET

Electromagnetism

Hours

Lect	Tut	PW	Proj	WP	Asst
4	3				

Evaluation

One evaluation : *Contrôle écrit*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know how to use mathematical formalism, including vector analysis, applied to EM	·	✓	·	·	·
• Know how to deal with classic examples of electrostatics	·	·	✓	·	·
• Establish the equation of resistance and any capacity	·	·	✓	·	·
• Know how to describe and solve magnetic phenomena in static conditions	·	✓	·	·	·
• Understanding the origin of Maxwell's equations	✓	·	·	·	·

Manager : Eduardo MOTTA CRUZ

Embedded SoC and OS

Hours

Lect	Tut	PW	Proj	WP	Asst
6	6	16			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the architecture of modern SoCs	·	·	✓	·	·
• Master the concepts of embedded OS including Linux	·	·	✓	·	·
• Know how to develop new services: applications, scripts and configurations	·	·	✓	·	·

Manager : Philippe GUYONNET

Embedded software

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Embedded software design methodology	·	✓	·	·	·
• Taking into account on-board constraints	✓	·	·	·	·
• Mastery of the Android environment	·	·	✓	·	·
• Knowledge of embedded software environments (Autosar, java)	✓	·	·	·	·

Manager : Eduardo MOTTA CRUZ

Embedded systems modeling and design

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5				

Evaluation

One evaluation : *Contrôle écrit*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the need for a methodology for designing systems	·	✓	·	·	·
• Distinguish between functional and technological aspects	·	✓	·	·	·
• Consider the different levels of abstraction of an application	·	✓	·	·	·

Manager : Philippe GUYONNET

Embedded wireless applications

Hours

Lect	Tut	PW	Proj	WP	Asst
4	4	8			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Configure an embedded linux kernel for a measurement application	·	·	✓	·	·
• Configure a WIFI connection for a measurement application	·	·	✓	·	·
• Use an embedded Linux platform for a measurement application	·	·	✓	·	·

Manager : Mohamad EL ZOGHBI

Engineering of mobile telecom systems

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the fundamentals of cellular networks	·	·	✓	·	·
• Know how to plan and size a cellular network	·	✓	·	·	·

Manager : Mohamad EL ZOGHBI

Ethernet and switching

Hours

Lect	Tut	PW	Proj	WP	Asst
3	3	12			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Carry out, troubleshoot and validate a network cabling infrastructure	·	·	✓	·	·
• Install and configure active equipment	·	·	✓	·	·
• Deploy, maintain and troubleshoot a local network infrastructure based on wired technologies	·	·	✓	·	·

Manager : Maha NACEUR

Guided wave propagation

Hours

Lect	Tut	PW	Proj	WP	Asst
6	6				

Evaluation

One evaluation : *Contôle écrit*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the need for the rise in frequency	✓	·	·	·	·
• Understand under which conditions a guiding structure can propagate a signal	·	✓	·	·	·
• Understand what a mode of propagation is	·	✓	·	·	·
• Understand which modes can propagate in a waveguide and how they are characterized (TE, TM, TEM modes, n-order modes, electric and magnetic field maps)	·	✓	·	·	·

Manager : Eduardo MOTTA CRUZ

Hyper Frequency Electronics

Hours

Lect	Tut	PW	Proj	WP	Asst
4	4	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know how to deal with a propagation problem on a transmission line.	·	·	✓	·	·
• Know how to deal with an adaptation problem by using the Smith chart.	·	·	✓	·	·
• Know how to deal with a high frequency circuit design problem	·	·	✓	·	·

Manager : Mohamad EL ZOGHBI

Industrialization of electronic systems

Hours

Lect	Tut	PW	Proj	WP	Asst
8					

Evaluation

One evaluation : *Contrôle écrit*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Identify the phases of the development of an industrial project	·	·	✓	·	·
• Being able to organize the development of a project	·	✓	·	·	·
• Know the roles of actors and organizations involved in industrial processes	✓	·	·	·	·
• Know the key equipment for manufacturing and controlling electronic products	·	✓	·	·	·
• Know the main stages in the manufacture of electronic products	·	✓	·	·	·

Manager : Eduardo MOTTA CRUZ

Internet and routing

Hours

Lect	Tut	PW	Proj	WP	Asst
2	2	16			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understanding how the Internet works	·	·	✓	·	·
• Design the architecture of a local network	·	✓	·	·	·
• Interconnect local networks	·	·	✓	·	·
• Interconnecting local networks to the Internet	·	·	✓	·	·
• Deploy applications and services on the Internet	·	✓	·	·	·
• Know the history of the Internet	·	·	✓	·	·

Manager : Benoit PARREIN

Issues of companies and companies-S6- ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	16				6

Evaluation

One evaluation : *Contrôle écrit*

Manager : Maha NACEUR

Issues of society and companies-S8- ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	12				10

Evaluation

One evaluation : *Contrôle écrit*

Manager : Philippe GUYONNET

Medium frequency electronic functions

Hours

Lect	Tut	PW	Proj	WP	Asst
8	7	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Knowing how to analyze the response of a transfer function using an analog oscilloscope, knowing how to measure: phase, modulation rate, modulation index	·	·	·	✓	·
• Know how to model a signal in the time and frequency domains	·	·	✓	·	·
• Know how to break down an electrical diagram into elementary block diagrams. Know the circuit limitations	·	·	✓	·	·

Manager : Eduardo MOTTA CRUZ

Microprocessor systems

Hours

Lect	Tut	PW	Proj	WP	Asst
6	6	16			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Master the hardware characteristics of 16 and 32-bit microprocessor cores	·	·	✓	·	·
• Master the basic tools and languages for programming microprocessor systems	·	✓	·	·	·
• To be able to develop an application of medium complexity on a 32-bit microcontroller-based system and using standard peripherals	·	·	✓	·	·

Manager : Philippe GUYONNET

Microprocessors

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	12			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the vocabulary of the discipline	·	·	✓	·	·
• To be able to understand the internal architecture of a microprocessor, to identify its hardware resources	·	·	✓	·	·
• To be able to analyze the structure of a microsystem in order to exploit its resources	·	·	✓	·	·
• Being able to write a C program implementing logical I / O as well as a Timer with or without interruptions	·	·	✓	·	·

Manager : Philippe GUYONNET

Mobile application development

Hours

Lect	Tut	PW	Proj	WP	Asst
5		15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Contrôle pratique*

Outline

Event-Driven Programming
GUIs for Smartphone
Exploitation of communicating functions smartphones (WiFi, Bluetooth, NFC, GPS ...)

Goals

Develop client-server applications for tablets and / or smartphones

Prerequisites

Java
Databases

Learning outcomes

Learning outcomes	N	A	M	E	O
• Programming event mechanisms	·	·	✓	·	·
• Create graphical user interfaces for Smartphone	·	·	✓	·	·
• Implement client-server applications	·	·	✓	·	·

Manager : Maha NACEUR

Multimedia technologies and standards

Hours

Lect	Tut	PW	Proj	WP	Asst
6	6	16			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the speech signal (characteristics and modeling) and associated compression techniques and standards	✓	·	·	·	·
• Understand audio compression standards	✓	·	·	·	·
• Understand the principles of JPEG2000 compression for still images	✓	·	·	·	·
• Know the video signal, analog and digital formats	✓	·	·	·	·
• Know the principles of motion estimation in a coding context	✓	·	·	·	·

Manager : Abdelhakim SAADANE

Network administration

Hours

Lect	Tut	PW	Proj	WP	Asst
2	2	12			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Manager : Maha NACEUR

Networks security

Hours

Lect	Tut	PW	Proj	WP	Asst
20	10				

Evaluation

One evaluation : *Contrôle écrit*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Network and system security concepts	✓	·	·	·	·
• Access control	·	✓	·	·	·
• The IPSec protocol	·	·	✓	·	·
• PKI architectures	✓	·	·	·	·

Manager : Eduardo MOTTA CRUZ

Networks supervision

Hours

Lect	Tut	PW	Proj	WP	Asst
24	4				

Evaluation

One evaluation : *Contrôle écrit*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Configure collection and trace tools	·	·	✓	·	·
• Methodically diagnose and troubleshoot	·	·	✓	·	·

Manager : Eduardo MOTTA CRUZ

Numerical methods

Hours

Lect	Tut	PW	Proj	WP	Asst
2	2	16			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the algorithms and their properties allowing the numerical resolution of basic problems	·	·	✓	·	·
• Transcribe an engineering problem into a numerical calculation problem and size it (cost / precision).	·	✓	·	·	·
• Know how to distinguish method error and calculation error in the interpretation of the imprecision of the results obtained	·	✓	·	·	·

Manager : Philippe GUYONNET

Object oriented programming

Hours

Lect	Tut	PW	Proj	WP	Asst
6	6	24			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Manager : Maha NACEUR

Operating systems

Hours

Lect	Tut	PW	Proj	WP	Asst
6	6	16			

Evaluation

2 evaluations :

- *Contôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand and know how an operating system works.	·	·	✓	·	·
• Know how to use the UNIX operating system.	·	✓	·	·	·
• Know how to program simple language applications	·	·	✓	·	·

Manager : Maha NACEUR

Operator networks I

Hours

Lect	Tut	PW	Proj	WP	Asst
6	6	18			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Outline

The MPLS protocol : introduction, terminology MPLS , MPLS components, allocation and distribution of labels , AtoM , MPLS VPN

MPLS PW : discover the IPv6 protocol , the reasons for its adoption, its characteristics, the new possibilities offered by this protocol :

Introduction: history , why IPv6 ? principles

Applications and integration level : equipment, systems and applications compatible / incompatible IPv6

Deploying IPv6 Internet

Migration strategies

Header and addressing

Control, and auto- naming

IPv6 and DNS

IPv6 encapsulation

PW IPv6

Goals

Understand the problems of operators of networks through an access network and an MPLS backbone network type. Mastering the operation and parameterization of an IPv6 network.

Prerequisites

- Networks fundamentals (Including OSI layered model, IPv4 adressing scheme)
- Packet switching and routing within IPv4 networks

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the Metro- Ethernet architecture	✓	·	·	·	·
• Understand the MPLS protocol	·	·	✓	·	·
• Set a MPLS Network	·	·	·	✓	·
• Designing an IPv6 network infrastructure	·	·	✓	·	·
• Migrate or coexist with an IPv4 infrastructure / to IPv6	·	·	✓	·	·
• Operate services on IPv6	·	·	·	✓	·
• Understand the BGP protocol	·	·	·	✓	·
• VXLAN frame analysis	·	·	·	✓	·
• Understand the underlay and overlay in a network	·	·	·	✓	·
• Understand and apply the basic Internet protocols in both IPv4, IPv6	·	·	✓	·	·

Manager : Benoit PARREIN

Operators Networks II

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	8			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Outline

Unbundling concepts, types and unbundling strategies
Topology wired local loop (copper, FO)
Concept of NRA / NRO
The concentration point
Transport and connection to the gathering system
xDSL technology

Goals

Understand the architecture of local loop "copper / optical / radio" and configure the associated equipment

Prerequisites

Network architecture, MPLS networks - IPV6

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the issues of the local loop to access the operator network	✓	·	·	·	·
• Mastering the deployment complexity of a local loop	·	·	✓	·	·
• Intervening in the deployment and maintenance of local loops	·	·	✓	·	·
• Configure network access equipment at the heart of an operator	·	·	·	✓	·

Manager : Eduardo MOTTA CRUZ

PFE defense

Hours

Lect	Tut	PW	Proj	WP	Asst
	8				

Evaluation

One evaluation : *Soutenance*

Manager : Abdelhakim SAADANE

PSI

Hours

Lect	Tut	PW	Proj	WP	Asst
	8				2

Evaluation

One evaluation : *CV numérique*

Manager : Maha NACEUR

PSI - S6 - ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	8				2

Evaluation

One evaluation : *Présentation*

Manager : Maha NACEUR

PSI - S7 - ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	16				20

Evaluation

One evaluation : *Présentation*

Manager : Philippe GUYONNET

Probability and statistics

Hours

Lect	Tut	PW	Proj	WP	Asst
7	7				

Evaluation

2 evaluations :

- *Contrôle 1*
- *Contrôle 2*

Outline

Bref recall of combinatorial analysis
  Probabilities and conditional probabilities
  Dependence and independence of events
  Total Probability Theorem and Bayes Theorem
  Random variable
  Classic random variable laws
  Central limit theorem
  Law of large number
  Confidence interval at a predefined threshold
  Chi-2 test
  Comparison of two means (homogeneity test)
  Correlation test between two populations
  Student's Law

Goals

This course presents the probability, the conditional probability, the different laws of probability to model a physical phenomenon. It also introduces some statistical tools necessary for engineering students such as the central limit theorem, the law of large numbers, the estimation by confidence interval, the comparison test, the chi-2 test, the Student law. .

Prerequisites

Basic analysis
  Algebra

Learning outcomes

Learning outcomes	N	A	M	E	O
• Manipulate a conditional probability	·	·	✓	·	·
• Apply binomial, Poisson, hypergeometric, geometric and Gaussian laws	·	·	✓	·	·
• Calculate the probability density function and the distribution function of a random variable. Calculate moments, including the mean and variance of a random variable	·	·	✓	·	·
• Use and apply the central limit theorem. Master the concept of confidence interval	·	·	✓	·	·

Manager : Yide WANG

QoS et QoE

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	10			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Outline

The main indicators of QoS and QoE.

Sizing equipment , service continuity and availability of resources.

Notions of availability (MTBF , MTTR) .

Notions redundancy (1 + 1.1 + n, loop programming) .

Quality of Experience Elements : latency , throughput, " allways -on " accessibility and usability of applications. Quality " end-to- end".

QoS monitoring systems : binary and quality alarms .

qualification and verification procedures of QoS and QoE.

Goals

Understand the main indicators of Quality of Service and Quality of Customer Experience in Multimedia telecommunications networks; know the qualification procedures of the equipment concerned and master the techniques for measuring QoS and QoE.

Prerequisites

Carrier networks , cellular networks, multimedia terminals

Learning outcomes

Learning outcomes	N	A	M	E	O
• Knowing the supervision systems of QoS and QoE	✓	·	·	·	·
• Assess the relevance and implémentare the improvement solutions QoE and QoS : dimenseionnement , redundancy, routing	·	·	✓	·	·
• Mastering the multimedia infrastructure equipment qualification procedures	·	·	✓	·	·
• Controlling QoS and QoE verification technique using multimedia terminals	·	·	·	✓	·

Manager : Benoit PARREIN

Quality Security Environment

Hours

Lect	Tut	PW	Proj	WP	Asst
	20				

Evaluation

One evaluation : *QCM + exercices*

Manager : John KINGSTON

R&D technical project

Hours

Lect	Tut	PW	Proj	WP	Asst
			30		

Evaluation

One evaluation : *Rapport + soutenance*

RF devices and microwaves

Hours

Lect	Tut	PW	Proj	WP	Asst
7		15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know the main architectures of high frequency devices and "front-ends"	·	✓	·	·	·
• Know how to determine the specifications of the elements of a transmission chain	·	✓	·	·	·
• Know the current technologies	·	✓	·	·	·
• Know the main approaches to designing passive or active circuits	·	✓	·	·	·
• Know how to use a high frequency CAD platform (HP ADS, IE3D, MOMENTUM, Microwave Studio, HFSS)	·	✓	·	·	·

Manager : Eduardo MOTTA CRUZ

Random signal processing and information theroy

Hours

Lect	Tut	PW	Proj	WP	Asst
10	10	10			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Characterize a random signal	·	·	✓	·	·
• Model a random signal	·	·	✓	·	·
• Estimate the parameters of a random signal	·	·	✓	·	·
• Detect a characteristic of a random signal	·	·	✓	·	·
• Know the basics of information theory	·	·	✓	·	·

Manager : Jean-François DIOURIS

Real-time executives

Hours

Lect	Tut	PW	Proj	WP	Asst
4	4	12			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• State the specificities and the different classes for real-time applications	·	·	✓	·	·
• Describe several real-time scheduling policies	·	✓	·	·	·
• Set up a synchronization relationship between 2 tasks	·	·	✓	·	·
• Set up a data exchange protected by mutual exclusion between 2 tasks	·	✓	·	·	·
• Communicate 2 tasks using a mailbox	·	✓	·	·	·

Manager : Philippe GUYONNET

Regulation

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5				

Evaluation

One evaluation : *Contrôle écrit*

Outline

1. The regulation of frequency : the spectrum , a scarce commodity
2. Regulatory bodies (ITU , CEPT , ANFR) : Objectives and Powers
3. ANFR : international agreements, spectrum allocation , management of the National Table of the allocation of frequencies, treatment interference .
4. ARCEP : competition , net neutrality, universal service benefits, obligations and indicators.
5. Measurements of electric fields : reference levels and public exposure to electric fieds, the ANFR Protocol, use of sensors , perimeter protection , Abeille law
6. The overal framework of telecommunication regulation
7. Regulation related to personal data protection

Goals

The objectives of this module is to decline the organizational and technical telecommunications mechanisms, and to alert the students to get on to control the radio spectrum.

Prerequisites

Knowledge of the spectrum of electromagnetic propagation
Notions on main telecommunications systems
Basics on Electric Field techniques measurements

Learning outcomes

Learning outcomes	N	A	M	E	O
• Knowing the national and international frequencies regulators	✓	·	·	·	·
• Understanding the necessity of the austere management of the radio electric spectrum	·	·	✓	·	·
• Controlling exposure thresholds electric fields and measurement protocols	·	✓	·	·	·
• Knowing the main rules related to personal data protection	·	✓	·	·	·
• Being able to understand the major risks in relation to personal data protection	·	·	✓	·	·
• Learn how to handle this data protection regulation	·	✓	·	·	·

Manager : Eduardo MOTTA CRUZ

Responsible digital

Hours

Lect	Tut	PW	Proj	WP	Asst
5		5			

Evaluation

One evaluation : *Contrôle écrit*

Outline

1) Environmental aspects of human activities and technologies, 2) Regulation aspects, 3) Ecodesign of an equipment or an application , 4) Energy efficiency of telecommunications, 5) Software Ecodesign, 6) Case studies

Goals

The purpose is to provide to the students the knowledge to use a eco-friendly approach for the design of Information and Communication Technologies, taking into account the life-cycle of the equipments (production (consumption of ressources), use period (energy efficiency, human health, ...), end of life (disposal and recycling)) and regulation aspects.

Prerequisites

Software development, network technology, telecommunications

Learning outcomes

Learning outcomes	N	A	M	E	O
• Use of a eco-design approach	·	·	✓	·	·
• knowledge of the green regulations	·	✓	·	·	·
• Evaluation of the hardware energy efficiency	·	·	✓	·	·
• Evaluation of the software energy efficiency	·	·	✓	·	·

Manager : Philippe GUYONNET

SSAT

Hours

Lect	Tut	PW	Proj	WP	Asst
	21				12.5

Evaluation

One evaluation : *Mode projet*

Manager : Maha NACEUR

SSAT

Hours

Lect	Tut	PW	Proj	WP	Asst
	28				10

Evaluation

One evaluation : *Rapport étonnement*

Manager : Maha NACEUR

SSAT - S10 - ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	28				

Evaluation

One evaluation : *Contrôle écrit*

Manager : Eduardo MOTTA CRUZ

SSAT - S7 - ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	28				10

Evaluation

One evaluation : *Bilan*

Manager : Philippe GUYONNET

SSAT - S8 - ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	21				40

Evaluation

One evaluation : *Mode projet*

Manager : Philippe GUYONNET

SSAT - S9 - ITII

Hours

Lect	Tut	PW	Proj	WP	Asst
	28				

Evaluation

One evaluation : *Contrôle écrit*

Manager : Eduardo MOTTA CRUZ

Software engineering

Hours

Lect	Tut	PW	Proj	WP	Asst
8	7	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Use UML to express design choices	·	✓	·	·	·
• Design according to object principles to promote maintainability	·	✓	·	·	·
• Use a code analysis tool to detect faults	·	✓	·	·	·
• Set up a software forge (depot, deployment)	·	✓	·	·	·
• Implement good unit testing practices	·	✓	·	·	·
• Set up a testing process for a software project	✓	·	·	·	·
• Exploit the principles and specificities of the programming language for the quality of the source code	·	✓	·	·	·

Manager : Julien COHEN

System administration

Hours

Lect	Tut	PW	Proj	WP	Asst
2	2	18			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Manage an IT department	·	✓	·	·	·
• Contribute to an IT support service	·	·	·	✓	·
• Administer windows systems (server and workstation)	·	·	·	✓	·
• Administer Unix systems (server and workstation)	·	·	·	✓	·

Manager : Maha NACEUR

THD technologies architecture

Hours

Lect	Tut	PW	Proj	WP	Asst
4	4	8			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Outline

Fibre-to-the-Node (FTTN), Fibre-to-the-Building (FTTB) and Fibre-to-thePremises (FTTP)
Hybrid Fibre Coaxial (HFC) networks and other privately operated fibre broadband infrastructure.
Engineering of broadband networks (P2P, PON, EPON, GEPON, ...)

Learning outcomes

Learning outcomes	N	A	M	E	O
• Characterize an optical link	·	·	✓	·	·
• Characterize fibers and optical components of the different types of networks	·	·	✓	·	·
• Identify the types of fibers and components suitable for each type of network	·	·	✓	·	·

Manager : Mohamad EL ZOGHBI

Technical project R&D

Hours

Lect	Tut	PW	Proj	WP	Asst
			45		

Evaluation

One evaluation : *Soutenance*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Know how to grasp an R&D problem (in the field of telecommunications networks)	·	✓	·	·	·
• Know how to conduct a bibliographic study	·	✓	·	·	·
• Know how to train in new tools and implement new concepts / techniques independently	·	·	·	✓	·
• Know how to restore the results obtained by popularizing if necessary	·	·	✓	·	·
• Mastering project management	·	·	✓	·	·

Manager : Eduardo MOTTA CRUZ

Toeic

Hours

Lect	Tut	PW	Proj	WP	Asst
	15				

Evaluation

2 evaluations :

- *CC*
- *DS*

Toeic & Professional English

Hours

Lect	Tut	PW	Proj	WP	Asst
	22.5				10

Evaluation

2 evaluations :

- *CC*
- *DS*

Toeic & public speaking

Hours

Lect	Tut	PW	Proj	WP	Asst
	22.5				10

Evaluation

2 evaluations :

- *CC*
- *DS*

Transversal Project II

Hours

Lect	Tut	PW	Proj	WP	Asst
			30		

Evaluation

One evaluation : *Rapport final*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Manage the complexity associated with the implementation of a project (specification, interdisciplinary control, industrial watch)	·	·	✓	·	·
• Implement project management techniques	·	·	✓	·	·
• Manage relationships with a client to whom we have made contractual commitments	·	·	✓	·	·
• Manage relationships within a team in order to increase operational efficiency	·	·	✓	·	·
• Learn to find and make the best use of information not present in the lessons taught	·	·	✓	·	·

Manager : Philippe GUYONNET

Transversal project I

Hours

Lect	Tut	PW	Proj	WP	Asst
			30		

Evaluation

One evaluation : *Rapport final*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Manage the complexity associated with the implementation of a project (specification, interdisciplinary control, industrial watch)	·	·	✓	·	·
• Implement project management techniques	·	✓	·	·	·
• Gérer des relations avec un client vis à vis duquel on a pris des engagements contractuels	·	✓	·	·	·
• Manage relationships within a team in order to increase operational efficiency	·	✓	·	·	·
• Learn to find and make the best use of information not present in the lessons taught	·	✓	·	·	·

Manager : Philippe GUYONNET

Virtualization

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Design the architecture of virtualized services	·	·	✓	·	·
• Deploy virtual machines	·	·	✓	·	·
• Exploiting virtualized services	·	·	✓	·	·
• Have an overview of the challenges and opportunities offered by virtualization	·	·	✓	·	·
• Understand the impacts and changes that virtualization brings to a business	·	·	✓	·	·
• See the benefits and considerations of virtualization	·	·	✓	·	·

Manager : Maha NACEUR

Web development

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	20			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the client-server and n-tier architecture	·	·	✓	·	·
• evelop dynamic web solutions	·	·	✓	·	·
• nstall, configure and administer a content management system (CMS)	·	·	✓	·	·
• Secure websites	·	·	✓	·	·
• Write content in an extensible markup language	·	·	✓	·	·
• Install, operate and maintain a web server	·	·	✓	·	·

Manager : Maha NACEUR

Web programming

Hours

Lect	Tut	PW	Proj	WP	Asst
3	3	16			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Manager : Maha NACEUR

Wireless companies networks

Hours

Lect	Tut	PW	Proj	WP	Asst
5	5	15			

Evaluation

2 evaluations :

- *Contrôle écrit*
- *Rapport TP*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Design the deployment of a WiFi infrastructure	·	·	✓	·	·
• Implementation of wireless network equipment	·	·	✓	·	·
• Measure and analyze performance	·	·	✓	·	·
• Configure and maintain a WiFi infrastructure	·	·	✓	·	·

Manager : Mohamad EL ZOGHBI