الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

ACADEMIC LICENSE

NATIONAL PROGRAM

Establishment	Faculty / Institute	Department

Domain	Sector	Speciality
Science And Technologies	***Telecommunications***	***Telecommunications***

II – Half-yearly teaching organization sheets of the specialty

Semester 5

Teaching unit	Materials	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
	Titled			**Course**	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 3.1.1 Credits: 10 Coefficients: 5	Analog communications	6	3	3:00	1h30		67h30	82h30	40%	60%
	Signal processing	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 3.1.2 Credits: 8 Coefficients: 4	Waves and Propagation	4	2	1h30	1h30		45:00	55:00	40%	60%
	Telecommunications systems and networks	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological EU Code: UEM 3.1 Credits: 9 Coefficients: 5	Calculators and interfacing	3	2	1h30		1h00	37:30	37:30	40%	60%
	TP Waves and Propagation	2	1			1h30	10:30	27:30	100%	
	TPSignal processing	2	1			1h30	10:30	27:30	100%	
	Analog communications TP	2	1			1h30	10:30	27:30	100%	
EU Discovery Code: UED 3.1 Credits: 2 Coefficients: 2	Telephony	1	1	1h30			10:30	02:30		100%
	Transmission media	1	1	1h30			10:30	02:30		100%
Transversal EU Code: UET 3.1 Credits: 1 Coefficients: 1	Telecommunications sensors and measurements	1	1	1h30			10:30	02:30		100%
Total semester 5		**30**	**17**	**1:30**	**6:00**	**5:30**	**375h00**	**375h00**		

Semester 6

Teaching unit	Modules	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
	Titled			**Course**	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 3.2.1 Credits: 10 Coefficients: 5	Digital communications	6	3	3:00	1h30		67h30	82h30	40%	60%
	Antennas and Transmission Lines	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 3.2.2 Credits: 8 Coefficients: 4	Local computer networks	4	2	1h30	1h30		45:00	55:00	40%	60%
	Coding and Information Theory	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological EU Code: UEM 3.2 Credits: 9 Coefficients: 5	End of Cycle Project	4	2			3:00	45:00	55:00	100%	
	TPDigital communications	2	1			1h30	10:30	27:30	100%	
	TP Antennas Lines transmissions	2	1			1h30	10:30	27:30	100%	
	TP Local computer networks	1	1			1h00	3:00	10:00	100%	
EU Discovery Code: UED 3.2 Credits: 2 Coefficients: 2	Optoelectronics	1	1	1h30			10:30	02:30		100%
	Information security	1	1	1h30			10:30	02:30		100%
Transversal EU Code: UET 3.2 Credits: 1 Coefficients: 1	Entrepreneurship and business management	1	1	1h30			10:30	02:30		100%
Total semester 6		**30**	**17**	**12:00**	**6:00**	**7:00**	**375h00**	**375h00**		

III - Detailed program by subject

Semester: 5
Teaching unit: UEF 3.1.1
Matter:Analog communications

Teaching objectives:

Analog communication and the main functions of electronics are the basis of instrumentation and telecommunications systems, hence the objectives of this subject. The student, through this subject, will master the concepts of analog communication and telecommunications systems. He will then be able to understand the limits as well as the advantages of such systems.

Recommended prior knowledge:

Fundamental electronics 1, Fundamental telecommunications, signal theory.

Material content:

Chapter 1. Basic concepts of radiofrequency (1 week)
Analog transmission channels, Frequency bands, bandwidth, wavelength and power, The decibel scale.

Chapter 2. The components of a transmission chain (3 weeks)
RLC, quartz, VCO and PLL oscillators; Superheterodyne receivers, amplifiers, filters, mixers.

Chapter 3. Amplitude modulation and demodulation (2Weeks)
General (Transmission chain and Transmission channel),Definition and necessity of modulation, Principle, Shape of the modulated signal. Parameters (modulation index), Over-modulation, Different types of amplitude modulation (carrier-free, single-sideband), Spectra and bandwidth, Power, Modulation rate, Envelope detection demodulation, Demodulation synchronous or coherent, Demodulation and noise.

Chapter 4. Angular modulations and demodulations and frequency and phase demodulation (2 weeks)
Principle and parameters of frequency modulation,Shape of the FM modulated signal,Spectrum and Bessel functions, Bandwidth, FM demodulations (derivation and envelope detection), Analogy with phase modulation or PM, Relationship between frequency and phase modulation, Comparisons between angular modulations (FM and PM) and AM modulation (Bandwidth, Power and sensitivity to noise).

Chapter 5. Performance of different modulations in the presence of noise (2 Weeks)
Introduction, Additive noise (AWGN) and signal-to-noise ratio (SNR), Signal-to-Noise ratio on baseband links, Signal-to-Noise ratio in amplitude modulation, Signal-to-Noise ratio in frequency modulation, Signal-to-Noise ratio Noise in phase modulation, Effects of Intermodulation (IM), Order of IM, types and measurement of intermodulation, Reduction of intermodulation.

Chapter 6. Superheterodyne Receivers (3Weeks)
Structure of a classic AM receiver, Mixer, superheterodyne, Intermediate frequency (IF) filters, Image frequency problem and solution with the RF (Radio frequency) amplifier of the input, Automatic frequency control (AFC), Control automatic gain of the RF amplifier.

Chapter 7. Phase-locked loop (PLL) (2Weeks)
Operating principle, Loop gain, Tracking range, Latching range, Dynamic operation of a 1st order and 2nd order loop, Applications: synchronization, Application to frequency modulation and demodulation, frequency synthesizers.

Evaluation method:

Semester: 5
Teaching unit: UEF 3.1.1
Matter:Signal processing
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Familiarize the student with digital signal processing techniques such as spectral analysis and digital filtering.

Recommended prior knowledge

Signal theory, Mathematics 3, Fundamental electronics 1, Probability and statistics.

Content of the material:

The number of weeks displayed are indicated for information purposes only. It is obvious that the course manager is not required to strictly respect this dimensioning or the arrangement of the chapters.

Chapter 1. Reminders of the main results of Signal Theory (1 week)
Signals. Fourier series. Fourier transform and existence conditions. Parseval's theorem.Plancherel's theorem. Convolution and correlation.

Chapter 2.Random processes (4Weeks)
Notions on random variables (discrete and continuous, probability density, mathematical expectation, variance, standard deviation, etc.), Characteristics of random processes: average, autocorrelation functions, inter-correlation, stationarity in the broad and narrow sense , ergodism, power spectral density. Specific processes (Gauss process, Poisson process, telegraph signal, pseudo-random sequences). Noises (thermal noise, shot noise, etc.)

Chapter 3. Analysis and synthesis of analog filters (3Weeks)
Reminders on the Laplace transform. Temporal and frequency analysis of analog filters. Poles, zeros, p plane and Stability of analog filters. Passive and active filters, First and second order low pass filters, First and second order high pass filters, Band pass filters.Other analog filters (Butterworth, Chebyshev I and II, Ellipticals, etc.)

Chapter 4.Signal Sampling (3Weeks)
Sampling: Principles and definition (theoretical, averaging, blocking etc.). Anti-aliasing filter. Shannon condition. Restitution of the analog signal and interpolator filter. Quantizations, quantization noise. Examples of Analog-to-Digital Conversion and Digital-to-Analog Conversion.

Chapter5.Discrete Transforms (4 weeks)
Definition of TFTD (Discrete Time Fourier Transform), TFD (Discrete Fourier Transform), inverse TFD, Relationship between Fourier transform and TFD, Weighting windows, Properties of TFD and circular convolution, Fast algorithms of the TFD (FFT).Z transform and introduction to digital filtering (interest, equationstemporal,transfer function, classification, realization structures, etc.).

Evaluation mode:

Continuous monitoring: 40%; Final exam: 60%.

Bibliographic references:

1. S. Haykin, “Signals and systems”, John Wiley & Sons, 2nd ed., 2003.

Semester: 5
Teaching unit: UEF 3.1.2
Matter:Waves and Propagation
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Any remote transmission chain using the radio channel uses electromagnetic waves. These waves tend to be affected by the propagation media. It is therefore necessary to know how to study these electromagnetic waves, to be able to model them, to characterize them, taking into account the specificities of the environments where they propagate.

Recommended prior knowledge:

Physics 2, Waves and vibrations, Fundamental telecommunications.

Material content:

Chapter 1. Maxwell's equations (3 weeks)

- Reminders on scalar and vector operators.
-Maxwell's equations.
- Electromagnetic wave. Electromagnetic power (Poynting vector).

Chapter 2. Propagation of electromagnetic waves in dielectric media (3 weeks)

-Wave equationin a perfect dielectric medium. Case of emptiness.Plane, progressive, monochromatic wave. Polarization of the wave.
- Reflection/transmission between two LHI media (normal and oblique incidence).

Chapter 3. Propagation of electromagnetic waves in conductive mediaand the dissipative environments (2 weeks)

- Maxwell's equations and Propagation equation in a conductor.
- Skin effect.
-Reflection on a perfect conductive surface and standing waves.
-Maxwell's equations and propagation equation in adissipative medium.
- Propagation settings in onedissipative medium. Electrical characteristics of the ground.

Chapter 4.Reflection and refraction of plane waves (4 weeks)

- Behavior of the electromagnetic field when passing from one medium to another.
- TEM wave incident on the separation surface of two dielectrics. Polarized wave in the plane of incidence. Wave polarized normally to the plane of incidence.
-Snell-Descartes law.

Chapter 5.Propagation of Hertzian waves (3 weeks)

- Atmospheric layers (Troposphere- Stratosphere- Ionosphere).
- Different modes of atmospheric propagation. Atmospheric refraction.
- Reflection on the ground.
- Propagation modes by frequency band.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Semester: 5
Teaching unit: UEF 3.1.2
Matter:Telecommunications systems and networks
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The objective of this module is to familiarize the student with the basic notions of telecommunications networks. The student will understand the concepts of norms and standards. The characteristics and evaluation criteria of digital transmissions. How to protect these digital transmissions against errors mainly due to the types of channels used. Finally, examples of wired, wireless and also mobile telecommunications networks will be presented.

Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and Applications,Telecommunications law.

Material content:

Chapter 1. Digital transmission systems (4 weeks)

Introduction, Standardization organizations, Transmission medium and channels, Principle of a data link General structure of a transmission chain (Digitization of information, source of information, source coding, channel coding, modulation, demodulation, channel decoding, source decoding).

Chapter 2. Data transmission (4 weeks)

Operating modes, Link mode (point-to-point and multipoint), Transmission mode (parallel and serial, synchronous, asynchronous, isochronous), multiplexing (time, statistical time, frequency, wavelength), Bandwidth, Modulation speed, Bit rate.

Chapter 3. Modems and Interfaces (2 weeks)

Characteristics and standards, Nomenclatures, connections between two systems, dial-up modem, ADSL.

Chapter 4. Error protection (2 weeks)

Introduction, error rates, error detection, self-correcting code.

Chapter 5.Telecommunications networks (3 weeks)

Fixed, wireless, mobile networks, Examples.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Tanenbaum, “Networks”, 4th edition, Prentice Hall, 2003.
2. R. Perfect, “Telecommunications networks”, Hermes science publications, 2002.
3. E. Hollocou, “Telecommunications techniques and networks”, Armand Colin, 1991.
4. C. Servin, “Networks and telecoms”, Dunod, Paris, 2006.
5. D. Dromard and D. Seret, “Network architectures”,Pearsont Editions, 2009.
6. P. Polin, “Networks: fundamental principles”, Edition Hermès.
7. D. Comer, “TCP/IP, architectures, protocols and applications”, Editions Interéditions.
8. D. Present, S. Lohier, “Transmissions and Networks, courses and corrected exercises”, Dunod.
9. P. Clerc, P.Xavier, “Fundamental Principles of Telecommunications”, Ellipses, Paris, 1998.

Semester: 5
Teaching unit: UEM 3.1
Matter:Calculators and interfacing
VHS: 37h30 (Class: 1h30, TP: 1h00)
Credits: 3
Coefficient: 2

Teaching objectives:

Digital signal processing today requires real-time hardware implementation. Programmable circuits are at your fingertips. But their uses require perfect mastery by the specialist. The student must therefore begin by mastering the basic foundations of microprocessor systems followed by a detailed study on the operation of 16-bit microprocessor cards.

Recommended prior knowledge:

Combinatorial and sequential logic.

Material content:

Chapter 1. Approach to programmable circuits (1Week)
Basic architecture, Von Neumann model, central processing unit, main memory, input/output interfaces, buses, address decoding

Chapter 2. Architecture of a 16-bit microprocessor (5 weeks)
Internal architecture, Pinout, Special registers, Addressing modes, Instruction sets, Different architectures: RISC, CISC, Harvard

Chapter 3. General study of input-output interfaces (3 weeks)
General descriptions of PIO, USART, Timer circuits (pinout, internal architecture, simplified operating modes).

Chapter 4. Data exchange (2Weeks)
General, Data exchange protocols (by testing the device status bit (polling), by interruption, by direct memory access).

Chapter 5. Memories (2 weeks)
Organization of a memory, characteristics of a memory, different types of RAM and ROM memory, criteria for choosing a memory, concept of memory hierarchy, cache memories.

Chapter 6. Principles of implementing a synchronous logic system by a programmable circuit (2 weeks)
Configuration of a programmable circuit, Description, RTOS: real-time system for industrial applications.

TP Calculators and interfacing:

TP1: Introduction to the microprocessor kit and programming,
TP2: Arithmetic and logical operations,
TP3: Control loops and structures,
TP4: Subroutines,
TP5:I/O management (serial, parallel interfacing).

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

Semester: 5
Teaching unit: UEM 3.1
Matter:TP Waves and Propagation
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

The objective of this module, in the form of practical work, is to consolidate the theoretical knowledge of the subjectWaves and Propagation.

Recommended prior knowledge:

Physics 2, Waves and vibrations, Fundamental telecommunications.

Material content:

TP1: Electromagnetic waves

Introduction to wave transmission, Electromagnetic spectra.
- Demonstration of the existence of electromagnetic waves in our environment through a simple experiment (for example: by connecting a wire antenna or a simple 1m wire to the input of the oscilloscope).
- Emission and reception of waves (for example: emission and reception by two 1m parallel and very close wires. The first must be connected to the input of the GBF and the second to the input of the oscilloscope).

TP2:wave propagation in a coaxial line

Measurement of propagation parameters in the cable (propagation time, phase speed, primary parameters of the cable). Measurement of attenuation as a function of frequency. Measurement of cable dispersion as a function of frequency. Propagation in impulse regime, propagation in harmonic regime,direct and reflected wave, characteristic impedance, reflection coefficient, advantages and disadvantages of a coaxial line.

TP3:Propagation of electromagnetic waves in a waveguide

Decimeter waves and microwaves, the effects linked to propagation in a metal waveguide, guided propagation devices, measurement of important parameters such as the standing wave rate (TOS) and the wavelength of the guide.

TP4: Waves, reflection and adaptation

Measurement of the reflection coefficient in module and phase of any load. Characteristic impedance measurement. Measurement of the attenuation constant of a two-wire line, Adaptation of a load. Study of a line in impulse mode.

Evaluation method:

Continuous control: 100%

Semester: 5
Teaching unit: UEM 3.1
Material: TPSignal processing
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Familiarize the student with digital signal processing techniques such as spectral analysis and digital filtering.

Recommended prior knowledge:

Signal theory, Mathematics 3, Fundamental electronics 1, Probability and statistics.

Material content:

TP1: Getting started with Matlab:Reminders on usual commands:

- Help (Matlab help), Variables, Basic operations, Character string, Display, Input/output,Files (script/function), …
- Upgradefor using Matlab toolboxes [Toolbox /Matlab, signal and Simulink].

TP2: Generation and display of signals

- Sine, pulse, step, gate, rectangular, square, triangular, sawtooth,cardinal sine signal;Sampling study.

TP3: Random variables. Generation of random variables. Probability density. Distribution function. Generation of a random signal. Calculation of the correlation function and the PSD.

TP4: Fourier series.Transforms ofFourier Discrete direct (TFD) and inverse (TFD-1).Transforms ofDirect and inverse Fast Fourier (FFT, IFFT). Comparisons of calculation times between TFD and FFT in relation to the number of samples N.

TP5: Analysis and synthesis of analog filters (Butterworth, Tchebychev, Ellipticals, etc.). Transfer functions in p. Frequency responses, Poles and zeros in the p plane

Evaluation method:

Continuous control: 100%

Semester: 5
Teaching unit: UEM 3.1
Material: TPAnalog communications
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

This subject allows the student to put into practice the knowledge acquired during the analog communication course by analyzing circuits, understanding the operating principle and measurement.

Recommended prior knowledge:

Fundamental electronics 1, Fundamental telecommunications, signal theory.

Material content:

TP1:Amplitude modulation demodulation

Implement, study, analyze and understand amplitude modulation/demodulation techniques. Measure relevant parameters.

TP2:Frequency modulation demodulation

Implement, study, analyze and understand frequency modulation/demodulation techniques. Measure relevant parameters. Compare with analog modulation.

TP3:Frequency Transposition: Mixers

Study of the Frequency Transposition function (Mixer). Applications (frequency doubler, superheterodyne, modulation/demodulation, superheterodyne receiver, etc.).

TP4: PLL phase-locked loops

Study of a phase locked loop (Phase Locked Loop = PLL),Characterize the phase comparator used,Applications.

Evaluation method:

Continuous control: 100%

Semester: 5
Teaching unit: UED 3.1
Matter:Telephony
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Communications networks encompass a wide range of applications. Telephony, in particular, reflects one of the most used communication networks in today's society. Its operation, evolution, characteristics and future are of crucial importance for students specializing in digital telecommunications.

Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

Material content:

Chapter 1. Analog switching telephony **(3 weeks)**
History, evolution, principle and architecture

Chapter 2. Telephony transmission media **(2 weeks)**
Evaluation criteria, Electrical conductors, Wireless, Optical fiber

Chapter 3. GSM digital cellular telephony **(4 weeks)**
Networks, Protocols, Architecture and equipment, Principle diagrams, Measurements.

Chapter 4. The new generations of digital telephony **(4 weeks)**
3G and UMTS, 3.5 G, 4G, …

Chapter 5. Telephony interconnection equipment **(2 weeks)**
Switches, routers, interfaces, gateways

Evaluation method:

Exam: 100%

Bibliographic references:

1. C. Servin, “Networks and Telecoms”, Dunod, 2006.
2. G. Pujolle, “Networks and telecoms courses: With corrected exercises”, 3rd edition, Eyrolles, 2008.
3. RL Freeman, “Telecommunication System Engineering”, John Wiley & Sons, 2004.
4. D. Smith, J. Dunlop, “Telecommunications Engineering“, CRC Press 3rd Edition 1994.
5. J.C. Bellamy, “Digital Telephony”, John WileY & Sons, INC, 2000.
6. K. Doll, “Mobile Telephony“, Collection Que sais-je? PUF, 2003.
7. L. Ouakil, G. Pujolle, “Telephony over IP”, 2nd edition, 2008.
8. H. Holma, A. Toskala, “UMTS: Third generation mobile networks”, 2nd edition, 2001.
9. L. Merdrignac, “Telephone terminals”, Engineering techniques, 1990.
10. J. Pons, “Voice over IP: Internet, fixed and mobile - Main standards”, Engineering Techniques, 2009.
11. J. Cellmer, “Cellular networks, From the GSM system to the GPRS system”, Engineering techniques, 2004.
12. A. Oumnad,“Switched Telephone Network“, Course, http: //www.oumnad.123.fr/RTCP /RTCP.pdf.
13. D. Seret et al,“NETWORKS and TELECOMMUNICATIONS“, License 3 mathematics and computer science course, René Descartes University – Paris 5, 2005-2006.

Semester: 5
Teaching unit: UED 3.1
Matter:Transmission media
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Transmission channels and media form the central part of telecommunications systems. They often affect the transmitted signals by different types of disturbances and degradations mainly due to their characteristics. Knowing these transmission media is an absolute necessity for telecommunications students.

Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

Content of the material:

Chapter 1. Characteristics of transmission media (3Weeks)

Bandwidth, attenuation, noise sensitivity, characteristic impedance, reflection and transmission coefficients and standing wave ratio (SWR).

Chapter 2. Electrical conductors (2 weeks)

Coaxials, twisted pairs, standards and categories.

Chapter 3. Optical fibers (4 weeks)

Characteristics, types of optical fibers, advantages,areas of application of optical fiber (telecommunications, medicine, sensors (temperature, pressure, etc.), lighting).

Chapter 4. Radio beams (4 weeks)

General, main frequencies and bands or channels, satellite links.

Chapter 5.Light beams (infrared and visible) in free space (2 weeks)

Specters. Scopes.Interests and limits. Infrared sources. Visible light sources (Examples: LED and Laser). Applications.

Evaluation method:

Exam: 100%

Bibliographic references:

1. T. KAHAN, “Hertzian waves”,Editor. Paris: PUF, 1974.
2. PF Combes-"Transmission in free space and in lines",: Dunod, 1988.
3. PF Combes, “Microwaves, passive circuits, propagation, antennas, Courses and exercises”, Dunod, 1997.
4. G. DUBOST,“Free and guided propagation of electromagnetic waves / Radiation - Exercises with solutions and course reminders“.
5. J. Quinet,“Theory and practice of electronic circuits and amplifiers, Propagation of HF current along lines; Smith chart- Antenna. Maxwell's Equations and Applications“.

Semester: 5
Teaching unit: UET 3.1
Matter:Telecommunications sensors and measurements
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

In this module the student will learn the basic foundations of measurement systems mainly used in the field of telecommunications. He must also know the different sensors used as well as their characteristics.

Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

Content of the material:

Chapter 1. Characteristics of a measurement system (3 weeks)
Precision, resolution, response time, measuring range, linearity, physical quantity, sensor, etc.

Chapter 2. Classification of sensors in telecommunications (3 weeks)
Definition, liabilities, assets, software.

Chapter 3. Examples of sensors (3Sweeks)
Microphone, CCD sensors, RF field sensors, software digital sensors…

Chapter 4. Static and dynamic measurements in telecommunications (4 weeks)
Multimeters, spectrum analyzers, reflectometers, optical fiber testers. Link testers, data analyzers, etc.

Chapter 5. Case study (2 Sweeks)
Examples of measurements for mobile telephony or telephony via IP networks.

Evaluation method:

Exam: 100%

Bibliographic references:

1. M. Grout and P. Saloun, “Industrial instrumentation”, editionDunod, 2010.
2. G. Asch et al, “Data acquisition: From sensor to computer”, Editions Dunod.
3. K. Hoffmann, “An Introduction to Measurements using Strain Gages”, 1987.
4. J. Fraden, “Handbook of modern sensors: physics, designs and applications”, Springer
5. Mr.Ferretti, “Fiber optic sensors”, Engineering techniques.
6. W. Nawrocki, "Measurement Systems and Sensors", Artech House, 2005.
7. F. Gardiol, “Hyperfrequences”, Presses Polytechniques Romandes, 1996.

Semester: 6
Teaching unit: UEF 3.2.1
Matter:Digital communications
VHS: 67h30 (Class: 3h00, tutorial: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

Telecommunications systems are essentially composed of three parts, namely: the Transmitter, the Channel and the Receiver. At the transmitter and receiver level of digital telecommunications systems, several digital processing steps are carried out. The objective of this subject is to give the student the basic foundations of these numerical operations.

Recommended prior knowledge:

Fundamental telecommunications, Signal theory, Signal processing, Analog communication.

Material content:

Chapter 1. Baseband digital transmission (3 weeks)

Elements of a digital transmission chain, baseband modulation. Online Codes (Bit/Symbol Conversion and Formatting), Bipolar NRZ Code, Unipolar NRZ Code, Unipolar RZ Code, Biphase/Manchester Code, HDB3 Code (High Density Bipolar of order 3), M-ary Line Codes (Codes NRZ M-aires), Power spectral density of online codes, Criteria for choosing an online code. Concept of complex envelope.

Chapter 2. Optimal receiver (3 Weeks)

Structure of a receiver with M signals, vector representation of signals and noise, optimal detection (MAP detector for maximum a posteriori and ML detector for maximum likelihood), Structure of the optimal receiver (autocorrelation or filtering adapted on each of the channels then decision) .

Chapter 3. Transmission without interference between symbols (3 Weeks)

Effect of the Channel on the waveform of the line code, Characteristics of the Interference between symbols, Eye diagram, Condition of absence of interference between symbols, Nyquist criterion, raised cosine filter, Performance in terms error probability of an M-ary system with Nyquist filtering, Distribution of filtering between transmission and reception.

Chapter 4. Performance for baseband transmission (3 Weeks)

Detection of a binary signal and testing of hypotheses, maximum likelihood criterion, likelihood ratio, optimal binary receiver with two correlators, with a single correlator and based on an adapted filter. Probability of error for the case of Gaussian white noise with low pass filter and adapted filter.

Chapter 5. Narrowband digital modulations (3 Weeks)

Principle, Amplitude Shift Modulation (ASK), OOK Modulation, Symmetric M-ASK Modulations, Physical Realization and Performance, Phase Shift Modulation (PSK), Constellations, M-PSK Modulations, Physical Realization and Performance, Two-Way Modulation quadratic carriers (QAM), Physical realization and performance, Frequency shift keying (FSK), MSK modulation, Physical realization and performance of a binary FSK

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Semester: 6
Teaching unit: UEF 3.2.1
Matter:Antennas and Transmission Lines
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

To introduce students to the technologies relating to the transmission of radio frequency waves, the different types of antennas used and transmission lines in general. On the other hand, this material aims to provide some information regarding the basic foundations of microwaves.

Recommended prior knowledge:

Fundamental Electronics 1,Fundamental telecommunications, waves and propagation, Transmission media.

Material content:

Chapter 1. Propagation and transmission lines (4 weeks)

- Reminders: Incident wave, reflected wave and standing wave (Reflection, transmission coefficient and standing wave rate).
- Model of a transmission line with two parallel planes, (Equations of a line, Equivalent electrical diagram of a section of line with and without losses).
- Solution of the Telegraphists' equations. Calculation of powers (incident and reflected power. Power at the load) on the basis of three environments (Generator, Line and Load).
-The Smith chart and its use for impedance matching.

Chapter 2.Types of transmission lines and their applications (1Semaine)

- Example: Coaxial, two-wire andtwisted, etc.
-Calculation of the primary parameters of two-wire lines and coaxial cable.

Chapter 3. Basic characteristics of antennas (3 weeks)

- Radiation characteristics: Characteristic surface, Radiation diagram,Power surface density, Radiated power, Radiation intensity, Directivity, Efficiency, Gain, EIRP.
- Electrical Specifications :Electrical model and frequency behavior, Adaptation and adaptation condition, Bandwidth,Polarization of an antenna.

Chapter 4. Radiation of elementary antennas (3 weeks)

- Calculation of the long-distance electromagnetic field of the electric doublet (Characteristic surface, and Radiation diagram, radiated power, Equivalent height, Radiation resistance).
- Calculation of the long-distance electromagnetic field of a spatially isolated dipole antenna (characteristic surface and radiation pattern, radiated power, equivalent height, radiation resistance).

Chapter 5. Antenna Types and Their Applications (4 weeks)

Folded antenna, Loop antenna of different shapes (square, triangle, diamond, etc.), vertical or horizontal, Wire doublet antenna for HF waves, Yagi-Uda antenna with parasitic elements, very directive and with high gain, Antenna omnidirectional vertical quarter wave for very high frequencies (THF or VHF), Magnetic loop antenna of reduced dimensions, Helix antenna for decimeter waves with circular polarization,Parabolic antenna for centimeter waves (microwaves).

Semester: 6
Teaching unit: UEF 3.2.2
Matter:Local computer networks
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Introduce students to the world of telecommunications by teaching them the basic concepts of traditional and emerging local computer networks. Master the specific constraints of local networks. Choose a local network and associated equipment. Size, install, configure, diagnose a local network.

Recommended prior knowledge

Combinatorial and sequential logic.

Content of the material:

The number of weeks displayed are indicated for information purposes only. It is obvious that the course manager is not required to strictly respect this dimensioning or the arrangement of the chapters.

VSchapter 1. Concepts on data transmission (2 weeks)
Digital transmission systems (Introduction, standardization organizations, transmission medium and channels, principle of a data link), data transmission (Operating modes, bandwidth, modulation speed, bit rate, etc.), serial transmission and parallel transmission, synchronous and asynchronous transmission, transmission techniques, transmission media and means.

Chapter 2. Local networks (3 weeks)
The main organizations, IEEE model, network classification, the OSI model, the main components of a network, the different physical topologies.

Chapter 3. Ethernet Network (3 weeks)
Presentation (Addressing and Ethernet Frame), access method: CSMA/CD, rules and laws for the Ethernet Network, Ethernet frame formats, topologies, cables and connectors. Interconnection, repeaters, concentrators, bridge, switches. Concepts on the evolution of Ethernet networks (Fast Ethernet and Gigabit Ethernet, etc.)

Chapter 4. The TCP/IP protocol (5 weeks)
Presentation of the TCP/IP Model and comparison with OSI. Internet layer: ARP/RARP, IP and ICMP. IPv4 addressing: nomenclature, address classes,subnet mask, subnets and supernets, UDP, TCP.Address with class, Address without class, network segmentation, connectivity test (ping, tracert and pathping commands, etc.). IPv6 address, migration from IPv4 to IPv6

Chapter 5. Wireless local networks (WIFI) (2 weeks)
Introduction to WLAN (Wireless Local Area Network), presentation of WiFi or 802.11, features of the MAC layer. Access methods. Different topologies with and without infrastructure (or access point).

Evaluation mode:

Continuous monitoring: 40%; Final exam: 60%.

Semester: 6
Teaching unit: UEF 3.2.2
Matter:Coding and Information Theory
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Digital communication techniques and technologies have evolved significantly in recent years. Several constraints and difficulties are still posed, mainly linked to transmission channels. Therefore, to increase transmission rates and guarantee quality signals, we must use coding and compression methods. From this module, the student will have to learn the basic foundations for evaluating the characteristics of transmission channels and the different coding methods used.

Recommended prior knowledge:

Probability and statistics,Fundamental telecommunications,Theory and signal processing,Telecommunications systems and networks.

Content of the material:

Chapter 1. Information and coding (4Sweeks)
Principles of a digital transmission chain. Reminders about probabilities and random variables. Concept of quantity of information, measurement of information, mutual information, entropy and applications.

Chapter 2. Source coding (4Sweeks)
General, Shannon-Fanno coding, Huffman algorithms, arithmetic algorithm, Lempel-Zip algorithm, discrete source coding.

Chapter 3. Transmission channel (3Sweeks)
Definition of a transmission channel, models, discrete channel without memory, causal channel, symmetrical discrete channel, erasure channel. Transition matrix, channel capacity, capacity calculation examples.

Chapter 4. General principles of error correcting codes (4Sweeks)
Introduction to channel coding, Reminders on linear algebra. Shannon channel coding theorems. Concepts on block coding and trellis coding. Parameters of a linear code. Hamming distance, Concept of a minimum distance of a code. Generating matrices. Examples of linear codes.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Semester: 6
Teaching unit: UEM 3.2
Subject: End of Cycle Project
VHS: 45h00 (TP: 3h00)
Credits: 4
Coefficient: 2

Teaching objectives:

Assimilate knowledge from different subjects in a global and complementary manner. Concretely put into practice the concepts instilled during the training. Encourage a sense of autonomy and a spirit of initiative in students. Teach him to work in a collaborative setting by arousing intellectual curiosity in him.

Recommended prior knowledge:

The entire Bachelor's program.

Material content:

The theme of the End of Cycle Project must come from a concerted choice between the tutor teacher and a student (or a group of students: pair or even three). The content of the subject must necessarily fit with the objectives of the training and the real skills of the student (Bachelor level). It is also preferable that this theme takes into account the social and economic environment of the establishment. When the nature of the project requires it, it can be subdivided into several parts.

Noticed:

During the weeks during which the students are immersed in the purpose of their project and its feasibility (bibliographic research, search for software or hardware necessary for carrying out the project, revision and consolidation of teaching having a direct link with the subject, etc.), the subject manager must take advantage of this face-to-face time to remind students of the essential content of the two subjects.Writing methodology''And ''Presentation methodology''addressed during the first two semesters of the common base.

At the end of this study, the student must submit a written report in which he must explain as explicitly as possible:

- The detailed presentation of the study theme, emphasizing its interest in its socio-economic environment.
- The means implemented: methodological tools, bibliographical references, contacts with professionals, etc.
- Analysis of the results obtained and their comparison with the initial objectives.
- Criticism of the discrepancies observed and possible presentation of other additional details.
- Identification of the difficulties encountered by highlighting the limits of the work carried out and the follow-up to be given to the work carried out.

The student or group of students finally presents their work (in the form of a brief oral presentation or on a poster) in front of their tutor teacher and an examining teacher who can ask questions and thus evaluate the work accomplished on the plan. technical and that of the presentation.

Evaluation method:

Controlcontinuous: 100%

Semester: 6
Teaching unit: UEM 3.2
Matter:TPDigital communications
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Give the student the basic foundations of these numerical operations.

Recommended prior knowledge:

Fundamental telecommunications, Signal theory, Signal processing, Analog communication.

Material content:

TP1:Baseband modulation/demodulation
Online coding (different codes such as NRZ, Biphase, Miller, Bipolar, etc.), Baseband demodulation.

TP2:Baseband transmission in the presence of white Gaussian noise
Bit/symbol conversion, shaping filter, AWGN channel, receive filter, sampling, decision and decoding.

TP3:PAM type digital modulation/demodulation (ASK), FSK, PSK, and QAM on infinite band channel.
Implement, study, analyze and understand digital modulation/demodulation techniques such asPAM (ASK), FSK, PSK, and QAM. Measure relevant parameters like BER.

TP4:BPSK, QPSK and MPSK type digital modulation/demodulation on limited band channel.
Implement, study, analyze and understand digital modulation/demodulation techniques such as BPSK, QPSK, M-PSK and M-QAM. Measure relevant parameters like BER. Eye Diagram and Constellation.

Evaluation method:

Continuous control: 100%

Semester: 6
Teaching unit: UEM 3.2
Material: TP Antennas Transmission lines
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

This teaching allows the student to understand through experience the basic principles of propagation on transmission lines as well as the radiation mechanisms of antennas.

Recommended prior knowledge:

Fundamental Electronics 1,Fundamental telecommunications, waves and propagation, Transmission media.

Material content:

TP1:SWR measurements and adaptation of a transmission line. Measurement of frequency, power, wavelength, coupling.Measurement of the reflection coefficient in module and phase of any load, Measurement of the characteristic impedance.

TP2:Far field measurement as a function of antenna distance.Measurement of basic parameters of an antenna (gain, directivity, opening angle at -3db, etc.). Checking the reciprocity of an antenna.

TP3:Adaptation of antennas and measurement of the reflection coefficient.

TP4:Antenna polarization and polarization losses.

TP5: Diagram measurementradiation of different types of antennas.

Evaluation method:

Continuous control: 100%

Semester: 6
Teaching unit: UEM 3.2
Matter:TP Local computer networks
VHS: 3:00 p.m. (TP: 1:00 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Consolidate the knowledge learned in the courseLocal computer networks.

Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and Applications,Telecommunications Systems and Networks, Telecommunications Law.

Material content:

TP1: Creation and testing of RJ45 or twisted pair cables (crossed, straight)

TP2: Implementation of a peer-to-peer network between two PCs (IP addressing, folder sharing).

TP3: Configuration and implementation of a multi-station network with switches (IP addressing, tests with ipconfig, ping, arp, tracert, etc.).

TP4: Creation of a WiFi network, and configuration of an access point (static and dynamic IP addressing by DHCP, securing the access point, etc.)

TP5: Operation of TCP/IP protocols (Encapsulation Process) by analysis of data frames (Use of Wireshark).

NB: Practical work can be carried out on a real local computer network and/or using a simulator.

Evaluation method:

Continuous control: 100%

Semester: 6
Teaching unit: UED 3.2
Matter:Optoelectronics
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Nowadays the transmission medium is the most relevant element in an especially digital transmission system. Optical fiber is part of this trend and brings considerable improvements in terms of broadband. Mastering optical transmission is the essential objective of this subject.

Recommended prior knowledge:

Fundamental electronics 1,Fundamental telecommunications, Transmission media.

Content of the material:

Chapter 1. Optical fibers (3 weeks)
Notions of guidance and geometric optics, Multi-mode and single-mode optical fibers, Attenuation and dispersion in optical fibers, Transmission windows, Manufacturing of optical fibers.

Chapter 2. Optical cables and their applications (2 weeks)
Different types of optical cables, Submarine cables, Connection of optical fibers, Connection faults in optical fibers.

Chapter 3. Light Emitters and Receivers (3 weeks)
The LED, the Laser, the PIN photodiode and the APD.

Chapter 4. Optical fiber transmission chain (4 weeks)
Structure of an optical fiber transmission system, The transmission and reception block, EDFA optical amplifiers, The link budget.

Chapter 5. Methods for measuring optical links (3 weeks)
OTDR Reflectometer, Error Rate Measurement and Eye Diagram.

Evaluation method:

Exam: 100%

Bibliographic references:

1. JM Mur, “Optical fibers: Fundamental notions (cables, connectors, components, protocols, networks)”, ENI Epsilon, 2012.
2. Z. Toffano, “Optoelectronics: Photonic components and optical fibers”, Ellipses, 2001.
3. R. Maciejko, “Optoelectronics”, Presses Internationales Polytechnique, 2002.
4. RC Houze, “Lasers, principle and operation”.
5. DA Dealoue, “Telecommunications by optical fibers“, Sciences Technology.
6. P. Lecoy, “Communications on optical fibers“, Hermès, Lavoisier, 2014.
7. E. Rosencher, B. Vinter, “Optoelectronics”, 2nd edition, Collection Sciences Sup, Dunod, 2002.

Semester: 6
Teaching unit: UED 3.2
Matter:Information security
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

In the field of telecommunications and computer networks, information security has become a major issue. Making students understand the basics of computer security and its criteria is the objective of this subject. Understanding the basic foundations of the techniques and technologies used in communications network security is also the goal of this subject.

Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and Applications,Telecommunications systems and networks.

Material content:

Chapter 1. Introduction to Information Security (2 weeks)
What is security?, Threats and Attacks, The objectives of information security: Confidentiality, Integrity, Availability, Security measures.

Chapter 2. Cryptography and Cryptanalysis Concepts (5 weeks)
Principles of cryptography, Symmetric cryptography, Asymmetric cryptography, Conventional cryptography, Encryption and decryption (by block, by stream, Integrity and authenticity).

Chapter 3. Firewall Security (2 weeks)
Basic definitions of a firewall, Security policies, Tools in firewalls.

Chapter 4. Switching Safety (2 weeks)
Concepts on VLANs, "data link" layer attacks and responses.

Chapter 5. Virtual Private Networks (VPN) (2 weeks)
Principle of operation of a VPN, The different types of VPN, The protocols used.

Chapter 6. Wireless Network Security (2 weeks)
WEP: Wired Equivalent Privacy, WEP problems, WPA: Wi-Fi Access Protocol, … etc.

Evaluation method:

Exam: 100%

Bibliographic references:

1. O. Paul, "Prevention of denials of service in public networks",Information systems security, 2003.
2. F. Raynal, "Hidden channels",Information systems security, 2003.
3. T. Noel, "Mobile IP",Information Systems Security,2002.
4. D.Trezentos, "Standard for wireless networks: IEEE 802.11",Information systems security, 2002.
5. vs.Chiaramonti, "Electronic data interchange",Information systems security, 2001.

Semester: 6
Teaching unit: UET 3.2
Subject: Entrepreneurship and business management
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

- Prepare for professional integration at the end of your studies;
- Develop entrepreneurial skills among students;
- Raise awareness among students and familiarize them with the possibilities, challenges, procedures, characteristics, attitudes and skills required by entrepreneurship;
- Prepare students so that one day they can create their own business or, at least, better understand their work in an SME.

Recommended prior knowledge:

No special knowledge, except mastery of the language of instruction.

Targeted skills :

Ability to analyze, synthesize, work in a team, communicate well orally and in writing, be autonomous, plan and meet deadlines, be reactive and proactive. Be made aware of entrepreneurship by presenting an overview of management knowledge useful for creating activities.

Material content:

Chapter 1 – Operational preparation for employment: **(2 weeks)**

Writing the cover letter and developing the CV, Job interview, etc., Documentary research on professions in the sector, Conducting interviews with professionals in the profession and Simulation of job interviews.

Chapter 2 - Entrepreneurship and entrepreneurial spirit: **(2 weeks)**

Getting started, Businesses around you, Entrepreneurial motivation, Knowing how to set goals, Knowing how to take risks

Chapter 3 - The profile of an entrepreneur and the profession of Entrepreneur: **(3 weeks)**

The qualities of an entrepreneur, Knowing how to negotiate, Knowing how to listen, The place of SMEs and VSEs in Algeria, The main success factors when creating a VSE/SME

Chapter 4 – Finding a Good Business Idea: **(2 weeks)**

Creativity and innovation, Recognizing and evaluating business opportunities

Chapter 5–Lancerand Running a Business: **(3 weeks)**

Choosing an appropriate market, Choosing the location of your business, Legal forms of business, Finding help and financing to start a business, Recruiting staff, Choosing your suppliers

Chapter 6 - Development of the business project: **(3 weeks)**

The Business Model and the Business Plan, Realize your business project with the Business Model Canvas