People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
National Pedagogical Committee for Science and Technology

Yahia Fares
University of Médéa

TRAINING PROGRAM OFFER
L.M.D.

ACADEMIC LICENSE

NATIONAL PROGRAM
2025– 2026
(3rd update)

Establishment	Faculty / Institute	Department
Yahia Fares University of Medea	**Faculty of Technology**	**Electrical Engineering**

Domain	Sector	Specialty
Science and technologies	***Telecommunications***	***Telecommunications***

I – Semester courses organization sheets for the specialty

Semester 1

Teaching unit	Subjects	Credits	Coefficient	Weekly hourly volume			semesterial Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Title			Lessons	Tutorial	Labs			Continuous assessment	Review
Fundamental TU 1 Code: FTU 1.1.1 Credits: 10 Coefficients : 5	Analysis 1	6	3	1h30	3h00		67h30	82h30	40%	60%
	Algebra 1	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental TU 2 Code: FTU 1.1.2 Credits: 12 Coefficients : 6	Mechanical element	6	3	1h30	3h00		67h30	82h30	40%	60%
	Structure of matter	6	3	1h30	3h00		67h30	82h30	40%	60%
Methodological TU Code: MTU 1.1 Credits: 6 Coefficients : 4	Labs mechanical elements	2	1			1h30	22h30	22h30	100%	
	Labs structure of the material	2	1			1h30	22h30	22h30	100%	
	Computer and application structure	2	2	1h30		1h00	37h30	22h30	40%	60%
Transversal TU Code: TTU 1.1 Credits: 2 Coefficients : 2	Ethical and deontological dimension (the foundations)	1	1	1h30			22h30	02h30		100%
	Careers in science and technologies	1	1	1h30			22h30	02h30		100%
Total semester 1		**30**	**17**	**9h00**	**12h00**	**4h00**	**375h00**	**375h00**		

Semester 2

Teaching unit	Subjects	Credits	Coefficient	Weekly hourly volume			Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Title			Lesson	Tutorial	Labs			Continuous assessment	Review
Fundamental TU 1 Code: FTU 1.2.1 Credits: 10 Coefficients : 5	Analysis 2	6	3	1h30	3h00		67h30	82h30	40%	60%
	Algebra 2	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental TU 2 Code: FTU 1.2.2 Credits: 12 Coefficients: 6	Electricity and magnetism	6	3	1h30	3h00		67h30	82h30	40%	60%
	Thermodynamics	6	3	1h30	3h00		67h30	82h30	40%	60%
Methodological TU Code: MTU 1.2 Credits: 6 Coefficients : 4	Labs Electricity and magnetism	2	1			1h30	22h30	22h30	100%	
	Thermodynamics Lab	2	1			1h30	22h30	22h30	100%	
	Introduction to programming	2	2	1h30		1h00	37h30	22h30	40%	60%
Transversal TU Code: TTU 1.2 Credits: 2 Coefficients : 2	Free - open source software	2	2	1h30	1h30		45h00	05h00		60%
Total semester 2		**30**	**17**	**9h00**	**10h30**	**5h30**	**375h00**	**375h00**		

Semester 3

Teaching unit	Subjects	Credits	Coefficient	Weekly hourly volume			Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Title			Lesson	Tutorial	Labs			Continuous assessment	Review
Fundamental TU 1 Code: FTU 2.1.1 Credits: 10 Coefficients : 5	Analysis 3	6	3	1h30	3h00		67h30	82h30	40%	60%
	Waves and vibrations	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental TU 2 Code: FTU 2.1.2 Credits: 8 Coefficients : 4	Fundamental Electronics 1	4	2	1h30	1h30		45h00	55h00	40%	60%
	Basic Electrical Engineering 1	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodological TU Code: MTU 2.1 Credits: 10 Coefficients : 6	Probability and statistics	4	2	1h30	1h30		45h00	55h00	40%	60%
	Python Programming	2	2	1h30		1h30	45h00	30h00	40%	60%
	Electronics and Electrical Engineering Practical Work	2	1			1h30	22h30	22h30	100%	
	Waves and Vibrations	2	1			1h00	15h00	15h00	100%	
Discovery TU Code: DTU 2.1 Credits: 2 Coefficients : 2	Energy and environment	1	1	1h30			22h30	02h30		100%
	State of the art of electrical engineering	1	1	1h30			22h30	02h30		100%
Total semester 3		**30**	**17**	**12h00**	**9h00**	**4h00**	**375h00**	**375h00**		

Semester 4

Teaching unit	Subjects	Credits	Coefficient	Weekly hourly volume			Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Title			Lesson	Tutorial	Labs			Continuous assessment	Review
Fundamental TU 1 Code: FTU 2.2.1 Credits: 10 Coefficients : 5	Fundamental telecommunications	6	3	1h30	3h00		67h30	82h30	40%	60%
	Combinatorial logic and sequential	4	2	1h30	1h30		45h00	55h00	40%	100%
Fundamental TU 2 Code: FTU 2.2.2 Credits: 6 Coefficients : 3	Signal theory	4	2	1h30	1h30		45h00	55h00	40%	60%
	Telecommunications and applications	2	1	1h30			22h30	22h30		100%
Methodological TU Code: MTU 2.2 Credits: 12 Coefficients : 7	Numerical methods	5	3	1h30	1h30	1h30	67h30	82h30	40% (20%TUTORIAL+20%LABS)	60%
	Electrical measurements and electronics	3	2	1h30		1h00	37h30	37h30	40%	60%
	Fundamental Telecommunications LABS	2	1			1h30	22h30	17h30	100%	
	Combinatorial Logic Lab and sequential	2	1			1h30	22h30	17h30	100%	
Transversal TU Code: TTU 2.2 Credits: 2 Coefficients : 2	Information and communication technologies	2	2	1h30	1h30		45h00	05h00		60%
Total semester 4		**30**	**17**	**10h30**	**7h30**	**7h00**	**375h00**	**375h00**		

Semester 5

Teaching unit	Subjects	Credits	Coefficient	Weekly hourly volume			Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Title			Lesson	Tutorial	Labs			Continuous assessment	Review
Fundamental TU 1 Code: FTU 3.1.1 Credits: 10 Coefficients : 5	Analog Communications	6	3	1h30	3h00		67h30	82h30	40%	60%
	Signal processing	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental TU 2 Code: FTU 3.1.2 Credits: 8 Coefficients : 4	Waves and Propagation	4	2	1h30	1h30		45h00	55h00	40%	60%
	Telecommunication systems and networks	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodological TU Code: MTU 3.1 Credits: 9 Coefficients : 5	Computers and interfacing	3	2	1h30		1h00	37h30	37h30	40%	60%
	Waves and Propagation Lab	2	1			1h30	22h30	27h30	100%	
	Signal Processing Lab	2	1			1h30	22h30	27h30	100%	
	LABS Analogue Communications	2	1			1h30	22h30	27h30	100%	
Discovery TU Code: DTU 3.1 Credits: 2 Coefficients : 2	Telephony and telecommunications law	1	1	1h30			22h30	02h30		100%
	Supports de transmission	1	1	1h30			22h30	02h30		100%
Transversal TU Code: TTU 3.1 Credits: 1 Coefficients : 1	Sensors and measurements in telecommunications	1	1	1h30			22h30	02h30		100%
Total semester 5		**30**	**17**	**12h00**	**7h30**	**5h30**	**375h00**	**375h00**		

Semester 6

Teaching unit	Subjects	Credits	Coefficient	Weekly hourly volume			Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Title			Lesson	Tutorial	Labs			Continuous assessment	Review
Fundamental TU 1 Code: FTU 3.2.1 Credits: 10 Coefficients : 5	Digital Communications	6	3	1h30	3h00		67h30	82h30	40%	60%
	Antennas and Transmission Lines	4	2	1h30	1h30		45h00	55h00	40%	60%
Fundamental TU 2 Code: FTU 3.2.2 Credits: 8 Coefficients : 4	Local computer networks	4	2	1h30	1h30		45h00	55h00	40%	60%
	Coding and Information Theory	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodological TU Code: MTU 3.2 Credits: 9 Coefficients : 5	End of Cycle Project	4	2			2h30	37h30	42h30	100%	
	LABS Digital Communications	2	1			1h30	22h30	27h30	100%	
	LABS Antennas Lines Transmissions	2	1			1h30	22h30	27h30	100%	
	LABS Local Computer Networks	1	1			1h30	22h30	22h30	100%	
Discovery TU Code: DTU 3.2 Credits: 2 Coefficients : 2	Optoelectronics	1	1	1h30			22h30	02h30		100%
	Information Security	1	1	1h30			22h30	02h30		100%
Transversal TU Code: TTU 3.2 Credits: 1 Coefficients : 1	Entrepreneurship and start-ups	1	1	1h30			22h30	02h30		100%
Total semester 6		**30**	**17**	**10h30**	**7h30**	**7h30**	**375h00**	**375h00**		

Overall summary of the training:

EU / VH	FTU	MTU	DTU	TTU	Total
Lesson	720h00	120h00	225h00	180h00	1245h00
Tutorial	495h00	22h30	---	---	517h30
Labs	---	487h30	---	---	487h30
Personal work	1485h00	720h00	25h00	20h00	2250h00
Other (specify)	---	---	---	---	---
Total	2700h00	1350h00	250h00	200h00	4500h00
Credits	108	54	10	8	180
% in credits for each TU	60 %	30 %	10 %		100 %

II - Detailed program by subject

I – Detailed program by subject of the semester S1

Fundamental Unit 1

Material 1: Analysis 1
Chapter 1. Properties of the R set
Chapter 2. Real numerical sequences
Chapter 3. Real functions with a single variable
Chapter 4. Limited development
Chapter 5. Simple integrals

Subject 2: Algebra 1
Chapter 1. Sets, Relationships, and Applications (5 weeks)
Chapter 2. Complex numbers (5 weeks)
Chapter 3. Vector space (5 weeks)

Fundamental Unit 2

Material 1: Mechanical element
Chapter 1. Reminder
Chapter 2. Kinematics
Chapter 3. Dynamic
Chapter 4. Rotational movement
Chapter 5. Work, power, energy

Matter 2: Structure of matter
Chapter 1. Fundamentals (2 weeks)
Chapter 2. Main constituents of the material (3 weeks)
Chapter 3. Radioactivity – Nuclear reactions (2 weeks)
Chapter 4. Electronic structure of the atom (2 weeks)
Chapter 5. Periodic Classification of Elements (3 weeks)
Chapter 6. Chemical Bonds (3 weeks)

Methodological Unit

Subject 1 : Labs Mechanical element
Lab1: Measurement and calculations of uncertainties
Lab2 : Free fall
Lab2 : Inclined plane
Lab3: Circular movement
Lab4 : Single clock
Lab5 : Oscillating pendulum
Lab6: Solid-solid friction

Subject 2: Labs Structure of the Matter
Lab1: Preliminary practical work: Safety in the chemistry laboratory and description of equipment and glassware.
Lab2: Change of state of water: Transition from liquid to solid state and from liquid to vapor.
Lab3: Determination of the quantity of material.
Lab4: Determination of molecular weight.

Lab5: Calculation of uncertainties - Determination of ionic radius
Lab6: Determination of partial molar volumes in a binary solution.
Lab7: Qualitative analysis of Cations (1st, 2nd, 3rd and 4th group).
Lab8: Qualitative analysis of Anions.
Lab9: Identification of metal ions by the flame method
Lab10: Separation and recrystallization of benzoic acid.
Lab11: Construction and study of some compact structures.
Lab12: Study of ionic structures

Subject 3 : Structure of computers and applications

Part 1. Introduction to Computer Science (5 weeks)

1- Definition of computer science 2- Evolution of computer science and computers
3- Information coding systems 4- Principle of operation of a computer
5- Hardware part of a computer 6- System part: The basic systems (operating systems (Windows, Linux, Mac OS,...) Programming languages, application software

Part 2. Notions of algorithm and program (10 weeks)

1- Concept of an algorithm 2- Representation in flowchart 3- Structure of a program
4- The approach and analysis of a problem 5- Data structure: Constants and variables, Types of data 6- Operators: assignment operator, Relational operators, Logical operators, Arithmetic operations, Priorities in operations 7- Input/output operations
8- Control structures: Conditional control structures, Repetitive control structures
Practical work:
Lab1: initiation and familiarization with the computer machine from a hardware and operating systems point of view.
Lab2: introduction to the use of a programming environment (Editing, Assembly, Compilation, etc.)
Labs on the application of programming techniques seen in class.

Transversal Unit

Subject 1: Ethical and deontological dimension (the foundations)

Chapter 1. Fundamentals (2 weeks)
Chapter 2. The Referential (2 weeks)
Chapter 3. The University Franchise (3 weeks)
Chapter 4. University values (2 weeks)
Chapter 6. Rights and Duties (2 weeks)
Chapter 7. University Relations (2 weeks)
Chapter 8. Practices (2 weeks)

Subject 2: Careers in science and technology

Chapter 1. What is engineering sciences?
Chapter 2. Courses in Electronics, Telecommunications, Biomedical Engineering, Electrical Engineering, Electromechanics, Optics & Precision Mechanics
Chapter 3. Automation and Industrial Engineering
Chapter 4. Process Engineering, Hydrocarbons and Petrochemical Industries
Chapter 5. Industrial Health and Safety (HSI) and Mining Engineering
Chapter 6. HVAC and Transport Engineering
Chapter 7. Courses in Civil Engineering, Hydraulics and Public Works
Chapter 8. Aeronautics, Mechanical Engineering, Marine Engineering and Metallurgy

II – Detailed program by subject of the semester S2

Fundamental Unit 1

Material 1: Analysis 2
Chapter 1. Ordinary differential equations
1. Ordinary differential equations of the first order
2. Second-order differential equations
Chapter 2. Functions of several variables. Notions of limit, continuity, partial derivatives, differentiability
Chapter 3. Integrals
1. Dual Integrals
2. Triple Integrals

Subject 2: Algebra 2
Chapter 1. Vector spaces
Chapter 2. Linear Applications
Chapter 3. Matrices, associated matrices and determinants
Chapter 4. Systems of linear equations
Chapter 5. Reduction of dies.

Fundamental Unit 2

Subject 1: Electricity and magnetism
Chapter 1. Electrostatic field and potential
Chapter 2. The Drivers
Chapter 3. Electric current
Chapter 4. Magnetostatic

Subject 2: Thermodynamics
Chapter 1. Thermodynamics basics
Chapter 2. Thermodynamic properties of pure substances
Chapter 3. Fundamental Concepts of Thermodynamics
Chapter 4. Balances of physical processes

Methodological Unit

Subject 1 : Labs Electricity and magnetism
Lab1: Presentation of the instruments and measurement tools (Voltmeter, Ammeter, Rheostat, Oscilloscopes, Generator, etc.).
Lab2: Kirchhoff's laws (law of meshes, law of knots).
Lab3: Thévenin's theorem.
Lab4: Association and Measurement of Inductors and Capacitances
Lab5: Charging and discharging a capacitor
Lab6 : Oscilloscope
Lab7: Labs on Magnetism

Subject 2: Labs in thermodynamics
Lab1: Study of the equation of state of an ideal gas.
Lab2: Water value of the calorimeter.

Lab3: Heat mass: heat density of liquid and solid bodies.
Lab4: Study of the solidification of pure water.
Lab5: Latent heat: Latent heat of melting ice.
Lab6: Determination of the latent heat of vaporization.
Lab7: Reaction heat: Determination of the energy released by a chemical reaction (HCl/NaOH).
Lab8: The thermodynamic functions of an Acid–Base equilibrium.
Lab9: Study of the variation of pressure as a function of the equilibrium temperature (l-g) for a pure system: water.
Lab10: Vapour pressure of a solution.
Lab11: Equilibrium diagram for a binary system.
Lab12: Balance diagram for a ternary system.

Subject 3: Introduction to programming
Chapter 1. Introduction to Computer Science and Programming (1 Weeks)
Chapter 2. Structure of a C Program and Data Types (2 Weeks)
Chapter 3. Inputs/Outputs and Expressions (2 Weeks)
Chapter 4. Conditional Control and Iterative Control Structures (3 Weeks)
Chapter 5. Functions and Tables and Strings (3 Weeks)
Chapter 6. Pointers and Dynamic Allocation (2 Weeks)
Chapter 7. Structures and Enumerations (2 Weeks)
Practical work:
Lab 1: Getting to grips with the environment
Lab 2: Variables and expressions
Lab 3: Conditional Structures and Iterative Structures
Lab 4: Functions
Lab 5: One-dimensional and multi-dimensional tables
Lab 6: Strings
Lab 7: Pointers and Dynamic Allocation
Lab 8: Files

Transversal Unit

Subject 1: Free and Open Source Software
Chapter 1. Foundations of Free Software (2 weeks)
Chapter 2. Legal framework and licenses (2 weeks)
Chapter 3. Free operating systems (3 weeks)
Chapter 4. Open source office solutions (3 weeks)
Chapter 5. Creative Solutions & Development (3 weeks)
Chapter 6. Prospects and future of free software (2 weeks)
Workshops
Workshop 1: Discovering Linux
Workshop 2: Software Management on Linux
Workshop 3: Migration to LibreOffice
Workshop 4: Spreadsheets and free presentations
Workshop 5: Image processing and graphic design
Workshop 6: Web and Open Databases
Workshop 7: Collaborative Development

III – Detailed program by subject of the semester S3

Fundamental Unit 1

Material 1: Analysis 3

Chapter 1. Vector analysis
Chapter 2. Numerical and integer series
I- Numerical series
II- Whole series
Chapter 3. Fourier series
Chapter 4. Fourier and Laplace transforms
I- Laplace transform
II- Laplace transform

Subject 2: Waves and Vibrations

Part A: Vibration
Chapter 1. Introduction to Lagrange equations (2 weeks)
Chapter 2. Free oscillations of systems at a degree of freedom (2 weeks)
2.1 Undamped Oscillations
2.2 Free Oscillations of Damped-Systems
Chapter 3. Forced oscillations of systems at a degree of freedom (1 week)
Chapter 4. Free Oscillations of Two-Degrees-of-Freedom Systems (1 week)
Chapter 5. Forced oscillations of two-degree-of-freedom systems (2 weeks)
Part B: Waves
Chapter 1. Phenomena of one-dimensional propagation (2 weeks)
Chapter 2. Vibrating Strings (2 weeks)
Chapter 3. Acoustic waves in fluids (1 week)
Chapter 4. Electromagnetic waves (2 weeks)

Fundamental Unit 2

Subject 1: Fundamental Electronics 1

Chapter 1. Continuous Regime and Fundamental Theorems (3 weeks)
Chapter 2. Passive quadrupoles (3 weeks)
Chapter 3. Diodes (3 weeks)
Chapter 4. Bipolar transistors (3 weeks)
Chapter 5. Operational amplifiers: (3 weeks)

Subject 2: Fundamental Electrical Engineering 1

Chapter 1. Mathematical reminders on complex numbers (NC) (1 week)
Chapter 2. Reminders of the fundamental laws of electricity (2 weeks)
Chapter 3. Electrical circuits and powers (3 weeks)
Chapter 4. Magnetic circuits (3 weeks)
Chapter 5. Transformers (3 weeks)
Chapter 6. Introduction to Electrical Machines (3 weeks)

Methodological Unit

Subject 1: Probability and statistics

Part A: Statistics

Chapter 1. Basic definitions	(1 week)
Chapter 2. Single-variable statistical series	(3 weeks)
Chapter 3. Two-variate statistical series	(3 weeks)

Part B: Probability

Chapter 1. Combinatorial analysis	(1 week)
Chapter 2. Introduction to Probability	(2 weeks)
Chapter 3. Packaging and independence	(1 week)
Chapter 4. Random variables	(1 week)
Chapter 5. Common discrete and continuous probability distributions	(3 weeks)

Subject 2: Python Programming

Chapter 1. Install and use Python
Chapter 2. Basics
Chapter 3. Conditional structures
Chapter 4. Loops
Chapter 5. Functions
Chapter 6. Lists and tuples
Chapter 7. Dictionaries
Chapter 8. Objects and Classes
Chapter 9. The files

Labs :

Lab 1 : Getting started with the Python environment	(1 week)
Lab 2 : Variables, data types, and operations	(1 week)
Lab 3 : Conditional and repetitive structures	(1 week)
Lab 4 : Functions and modularity	(1 week)
Lab 5 : Data structures	(1 week)
Lab 6 : File Manipulation and Final Project	(1 week)

Subject 3: Labs in Electronics and Electrical Engineering

Labs in electronics 1
Lab 1: Fundamental theorems
Lab 2: Characteristics of passive filters
Lab 3: Characteristics of the diode / rectifier
Lab 4: Stabilized power supply with Zener diode
Lab 5: Characteristics of a transistor and operating point
Lab 6: Operational amplifiers.

Labs in electrical engineering 1
Lab 1: Measurement of voltages and currents in single-phase
Lab 2: Measuring voltages and currents in three-phase
Lab 3: Measurement of active and reactive power in three-phase
Lab 4: Magnetic circuits (hysteresis cycle)
Lab 5: Transformer Testing
Lab 6: Electrical machines (demonstration).

Subject 4: Labs Waves and Vibrations

Lab1 : Mass – spring
Lab2 : Simple clock
Lab3 : Torsion pendulum
Lab4 : Oscillating electrical circuit in free and forced regime
Lab5 : Coupled Pendulums
Lab6: Transverse Oscillations in Vibrating Wires
Lab7 : Groove pulley according to Hoffmann
Lab8: Electromechanical Systems (The Electrodynamic Loudspeaker)
Lab9: Pohl's pendulum
Lab10: Propagation of longitudinal waves in a fluid.

Discovery Unit

Subject 1: State of the art of electrical engineering

Part 1: The Electrical Engineering family: Electronics, Electrical engineering, automation, Telecommunications, ... etc.

Part 2: Impact of Electrical Engineering on the development of society: Advances in Microelectronics, Automation and supervision, Robotics, Telecommunications development, Instrumentation in the development of health, ...

Subject 2: Energy and environment

Chapter 1. The different energy resources
Chapter 2. Energy storage
Chapter 3. Consumption, reserves and trends in energy resources
Chapter 4. The different types of pollution
Chapter 5. Detection and treatment of pollutants and waste
Chapter 6. Impact of pollution on health and the environment.

IV – Detailed program by subject of the semester S4

Fundamental Unit 1

Subject 1: Basic telecommunications

Chapter 1. General information on telecommunications (3 weeks)
Chapter 2. Communication Systems (4 weeks)
Chapter 3. Analog transmission technology (4 weeks)
Chapter 4. Digital transmission techniques (4 weeks)

Subject 2: Combinatorial and sequential logic

Chapter 1. Boolean Algebra and Simplification of Logical Functions (2 weeks)
Chapter 2. Numeral Systems and Information Coding (2 weeks)
Chapter 3. Transcoder combinatorial circuits (2 weeks)
Chapter 4. Combinatorial circuits (2 weeks)
Chapter 5. Combinatorial comparison circuits (2 weeks)
Chapter 6. The seesaws (2 weeks)
Chapter 7. Counters (2 weeks)
Chapter 8. The Registers (1 week)

Fundamental Unit 2

Subject 1: Signal theory

Chapter 1. General information about signals (3 weeks)
Chapter 2. Fourier analysis (4 weeks)
Chapter 3. Laplace transform (3 weeks)
Chapter 4. Convolution Product (2 weeks)
Chapter 5. Signal correlation (3 weeks)

Subject 2: Telecommunications and Applications

Chapter 1. Introduction to Telecommunications Applications (3 weeks)
Chapter 2. Introduction to Telephony (4 weeks)
Chapter 3. Introduction to Broadcasting and Television (4 weeks)
Chapter 4. Other telecommunications applications (4 weeks)

Methodological Unit

Subject 1: Numerical methods

Chapter 1. Solving the nonlinear equations f(x)=0 (3 weeks)
Chapter 2. Polynomial interpolation (2 weeks)
Chapter 3. Function approximation: (2 weeks)
Chapter 4. Digital integration (2 weeks)
Chapter 5. Solving ordinary differential equations (2 weeks)

Chapter 6. Method for the direct solution of systems of linear equations (2 weeks)
Chapter 7. Approximate method of solving systems of equations
Linear (2 weeks)
Practical work:
Chapter 1. Solving nonlinear equations (3 weeks)
Chapter 2. Interpolation and approximation (3 weeks)
Chapter 3. Digital integrations (3 weeks)
Chapter 4. Differential equations (2 weeks)
Chapter 5. Systems of linear equations (4 weeks)

Subject 2: Electrical and electronic measurements
Chapter 1. Measurements, quantities, and uncertainties (5 weeks)
Chapter 2. Measurement methods (6 weeks)
1. Voltage measurements. 2. Measurement of currents. 3. Resistance measurements.
4. Impedance measurements. 5. Continuous Power Measurements.
6. Alternating Power Measurements. 7. Phase shift measurements.
8. Frequency and period measurements.
Chapter 3. Measuring devices (4 weeks)
Analog measuring devices.
Digital measuring devices.
Practical work:
Lab1: Resistance measurement.
Lab2: Inductance measurement.
Lab3: Capacity measurement.
Lab4: Phase shift measurement.
Lab5: Single-phase power measurement.
Lab6: Three-phase power measurement.

Subject 3: Labs Basic telecommunications
Lab1 : Study of the basic circuits for rectification and filtering
Lab2: Principles of AM Amplitude Modulation and Demodulation
Lab3: Principles of FM Frequency Demodulation
Lab4: Principles of Modulation of PM Phase Demodulation
Lab5: Analog-to-Digital and Digital-to-Analog Converters

Subject 4: Labs Combinatorial and sequential logic
Lab1: TTL and CMOS integrated circuit technology.
Lab2: Simplification of logical equations through practice
Lab3: Study and realization of usual combinatorial logic functions
Lab4: Study and realization of an arithmetic combinatorial circuit
Lab5: Study and realization of a logical combinatorial circuit
Lab6: Study and realization of a logical combinatorial circuit
Lab7: Study and construction of meter circuits
Lab8: Study and production of registers

Transversal Unit

Subject 1: Information and communication technologies

Chapter 1: Introduction science communication (1 week)
Chapter 2: Desk Research and ICT (1 week)
Chapter 3: Referencing and bibliography (1 week)
Chapter 4: Structure of a scientific document (1 week)
Chapter 5: Writing the scientific document (3 weeks)
Chapter 6: Introduction to Oral Presentation and Speaking Skills (2 weeks)
Speaking techniques:
Chapter 7: Visual aids and ICT for the presentation (1 week)
Chapter 8: Professional Writing (1 week)
Chapter 9: Interpersonal Communication and Listening (1 week)
Chapter 10: Ethics and Academic Integrity (1 week)
Chapter 11: Scientific Standards and Practices (1 week)
Workshops:
Workshop 1: Note-taking exercise during a short video or a scientific text.
Workshop 2: Bibliographic research workshop.
Workshop 3: Quotation exercise.
Workshop 4: Writing a detailed plan (IMRaD) for a given research topic.
Workshop 5: Writing a 150-200 word abstract from a scientific article.
Workshop 6: Presentation preparation exercise. Short individual oral presentations on a familiar theme.
Workshop 7: Creation of a short slide show (3–5 slides) on a simple scientific topic.
Workshop 8: Writing a professional email to a teacher or supervisor.
Workshop 9: Role play.
Workshop 10: Formatting a standard document in Word or LaTeX.

V – Detailed program by subject of semester S5

Fundamental Unit 1

Subject 1: Analogue communications

Chapter 1. Radio Frequency Basics (1 week)
Chapter 2. The components of a transmission chain (3 weeks)
Chapter 3. Amplitude modulation and demodulation (2 weeks)
Chapter 4. Angular modulations and demodulations and demodulation of frequency and phase (2 weeks)
Chapter 5. Performance of different modulations in the presence of noise (2 weeks)
Chapter 6. Superheterodyne receptors (3 weeks)
Chapter 7. Phase Locked Loop (PLL) (2 weeks)

Subject 2: Signal processing

Chapter 1. Reminders of the main results of Signal Theory (1 week)
Chapter 2. Random processes (4 weeks)
Chapter 3. Analysis and synthesis of analog filters (3 weeks)
Chapter 4. Signal Sampling (3 weeks)
Chapter 5. Discrete Transforms (4 weeks)

Fundamental Unit 2

Subject 1: Waves and Propagation

Chapter 1. Maxwell's equations (3Weeks)
Chapter 2. Propagation of electromagnetic waves in the media dielectric (3Weeks)
Chapter 3. Propagation of electromagnetic waves in the media conductors and dissipative media (2Weeks)
Chapter 4. Plane wave reflection and refraction (4 weeks)
Chapter 5. Propagation of Hertzian waves (3Weeks)

Subject 2: Telecommunication systems and networks

Chapter 1. Digital transmission systems (4 weeks)
Chapter 2. Data transmission (4 weeks)
Chapter 3. Modems & Interfaces (2 weeks)
Chapter 4. Error protection (2 weeks)
Chapter 5. Telecommunications networks (3 weeks)

Methodological Unit

Material 1: Computers and interfacing

Chapter 1. Programmable Circuits Approach (1 week)
Chapter 2. Architecture of a 16-bit microprocessor (5 weeks)

Chapter 3. General study of I/O interfaces (3 weeks)
Chapter 4. Data exchanges (2 weeks)
Chapter 5. Memoirs (2 weeks)
Chapter 6. Principles of Implementing a Logical System synchronous by a programmable circuit (2 weeks)
Practical work:
Lab1: Introduction to the Microprocessor Kit and programming,
Lab2: Arithmetic and logical operations,
Lab3: Loops and control structures,
Lab4: The sub-programs,
Lab5: I/O management (Serial interfacing, parallel).

Subject 2 : Labs on Waves and Propagation
Lab1: Electromagnetic waves
Lab2: Wave propagation in a coaxial line
Lab3: Propagation of electromagnetic waves in a waveguide
Lab4: Waves, reflection and adaptation

Subject 3 : Labs Signal Processing
Lab1: Getting started with Matlab.
Lab2: Signal generation and display.
Lab3: Generation of random variables. Probability density. Dispatch function. Random signal generation. Calculation of the correlation function and the DSP.
Lab4: Fourier series. Direct Discrete (TFD) and Inverse (TFD-1) Fourier transforms. Direct and inverse fast Fourier transforms (FFT, IFFT). Comparisons of computation times between TFD and FFT with respect to the number of N samples.
Lab5: Analysis and synthesis of analog filters (Butterworth, Chebyshev, Ellipticals, etc.) etc). Transfer functions in p. Frequency responses, Poles and zeros in the p plane.

Subject 1 : Labs Analogue communications
Lab1 : Amplitude modulation / demodulation
Lab2 : Frequency modulation/ demodulation
Lab3 : Frequency Transposition : Mixers
Lab4: PLL Phase-Locked Loops

Discovery Unit

Subject 1: Telephony
Chapter 1. Analogue switched telephony (3 weeks)
Chapter 2. Telephony transmission media (2 weeks)
Chapter 3. GSM cellular digital telephony (4 weeks)
Chapter 4. The new generations of digital telephony (4 weeks)
Chapter 5. Telephony interconnection equipment (2 weeks)

Material 2: Transmission Supports

Chapter 1. Transmission Media Features (3 weeks)
Chapter 2. Electrical conductors (2 weeks)
Chapter 3. Optical fibers (4 weeks)
Chapter 4. Microwave Links (4 weeks)
Chapter 5. Light beams (infrared and visible) in free space (2 weeks)

Transversal Unit

Subject 1: Sensors and measurements in telecommunications

Chapter 1. Characteristics of a measurement system (3 weeks)
Chapter 2. Classification of sensors in telecommunication (3 weeks)
Chapter 3. Examples of sensors (3 weeks)
Chapter 4. Static and dynamic measurements in telecommunications (4 weeks)
Chapter 5. Case Study (2 weeks)

VI – Detailed program by subject of the semester S6

Fundamental Unit 1

Subject 1: Digital Communications

Chapter 1. Digital baseband transmission	(3 weeks)
Chapter 2. Optimal receiver	(3 weeks)
Chapter 3. Transmission without interference between symbols	(3 weeks)
Chapter 4. Performance for baseband transmission	(3 weeks)
Chapter 5. Narrowband Digital Modulations	(3 Weeks)

Subject 2: Antennas and Transmission Lines

Chapter 1. Propagation and transmission lines	(4Weeks)
Chapter 2. Types of transmission lines and their applications	(1Week)
Chapter 3. Basic Characteristics of Antennas	(3 weeks)
Chapter 4. Radiation from elementary antennas	(3 weeks)
Chapter 5. Types of antennas and their applications	(4Weeks)

Fundamental Unit 2

Subject 1: Local computer networks

Chapter 1. Basics of data transmission	(2 weeks)
Chapter 2. Local networks	(3 weeks)
Chapter 3. Ethernet Network	(3 weeks)
Chapter 4. The TCP/IP protocol	(5 weeks)
Chapter 5. Wireless Local Area Networks (WIFI)	(2 weeks)

Subject 2: Coding and Information Theory

Chapter 1. Information and coding	(4 weeks)
Chapter 2. Source Coding	(4 weeks)
Chapter 3. Transmission channel	(3 weeks)
Chapter 4. General principles of error-correcting codes	(4 weeks)

Methodological Unit

Subject 1: End-of-Cycle Project

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 trio). The substance of the subject must be in line with the objectives of the training and the real aptitudes of the student (Bachelor's 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.

Subject 2: Labs Digital communications

Lab1: Baseband modulation/demodulation

Lab2: Baseband transmission in the presence of Gaussian white noise

Lab3: Digital modulation/demodulation of the PAM (ASK), FSK, PSK, and QAM type on infinite band channel.

Lab4: Digital modulation/demodulation of the BPSK, QPSK and MPSK type on a limited band channel.

Subject 3: Labs Antennas Transmission lines

Lab1: Measurements of the SWR and adaptation of a transmission line. Measurement of frequency, power, wavelength, coupling. Measurement of the modulus and phase reflection coefficient of any load, Measurement of the characteristic impedance.

Lab2: Measurement of the far-field as a function of the distance from the antenna. Measurement of basic parameters of an antenna (gain, directivity, aperture angle at -3db, ...). Verification of the reciprocity of an antenna.

Lab3: Adaptation of antennas and measurement of the reflection coefficient.

Lab4: Antenna polarization and polarization losses.

Lab5: Measurement of the radiation pattern of the different types of antennas.

Subject 4 : Labs Local computer networks

Lab1: Realization and testing of RJ45 or twisted pair cables (crossed, straight)

Lab2: Implementation of a peer-to-peer network between two PCs (IP addressing, folder sharing).

Lab3: Configuration and implementation of a multi-station network with switches (IP addressing, tests with ipconfig, ping, arp, tracert, ... etc.).

Lab4: Creation of a WiFi network, and configuration of an access point (static and dynamic IP addressing by DHCP, securing the access point, etc.). etc.)

Lab5: How the TCP/IP (Encapsulation Process) protocols work by analyzing data frames (Using Wireshark).

Discovery Unit

Subject 1: Optoelectronics

Chapter 1. Optical fibers	(3 weeks)
Chapter 2. Optical cables and their applications	(2 weeks)
Chapter 3. Light Emitters and Receptors	(3 weeks)
Chapter 4. Fiber optic transmission chain	(4 weeks)
Chapter 5. Optical Link Measurement Methods	(3 weeks)

Subject 2: Information Security

Chapter 1. Introduction to Information Security	(2 weeks)
Chapter 2. Cryptography and cryptanalysis concepts	(5 weeks)
Chapter 3. Firewall Security	(2 weeks)
Chapter 4. Switching security	(2 weeks)

Chapter 5. Virtual Private Networks (VPNs) (2 weeks)
Chapter 6. Wireless network security (2 weeks)

Transversal Unit

Subject 1: Entrepreneurship, Start-Up

Chapter 1. Introduction to Entrepreneurship (2 weeks)
Chapter 2. Identification of innovative opportunities (1 week)
Chapter 3. Business Model Canvas (3 weeks)
Chapter 4. Introduction to the Business Plan (2 weeks)
Chapter 5. Start-up financing (3 weeks)
Chapter 6. Communication and leadership (1 week)
Chapter 7. Legal and administrative aspects (1 week)
Chapter 8. From concept to realization - Implementation of the innovative project (2 weeks)