Professional Master's Degree
Telecommunications Engineering

tech global university

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Professional Master's Degree

Telecommunications Engineering

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Global University**
- Credits: **60 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: www.techtitute.com/us/information-technology/professional-master-degree/master-telecommunications-engineering

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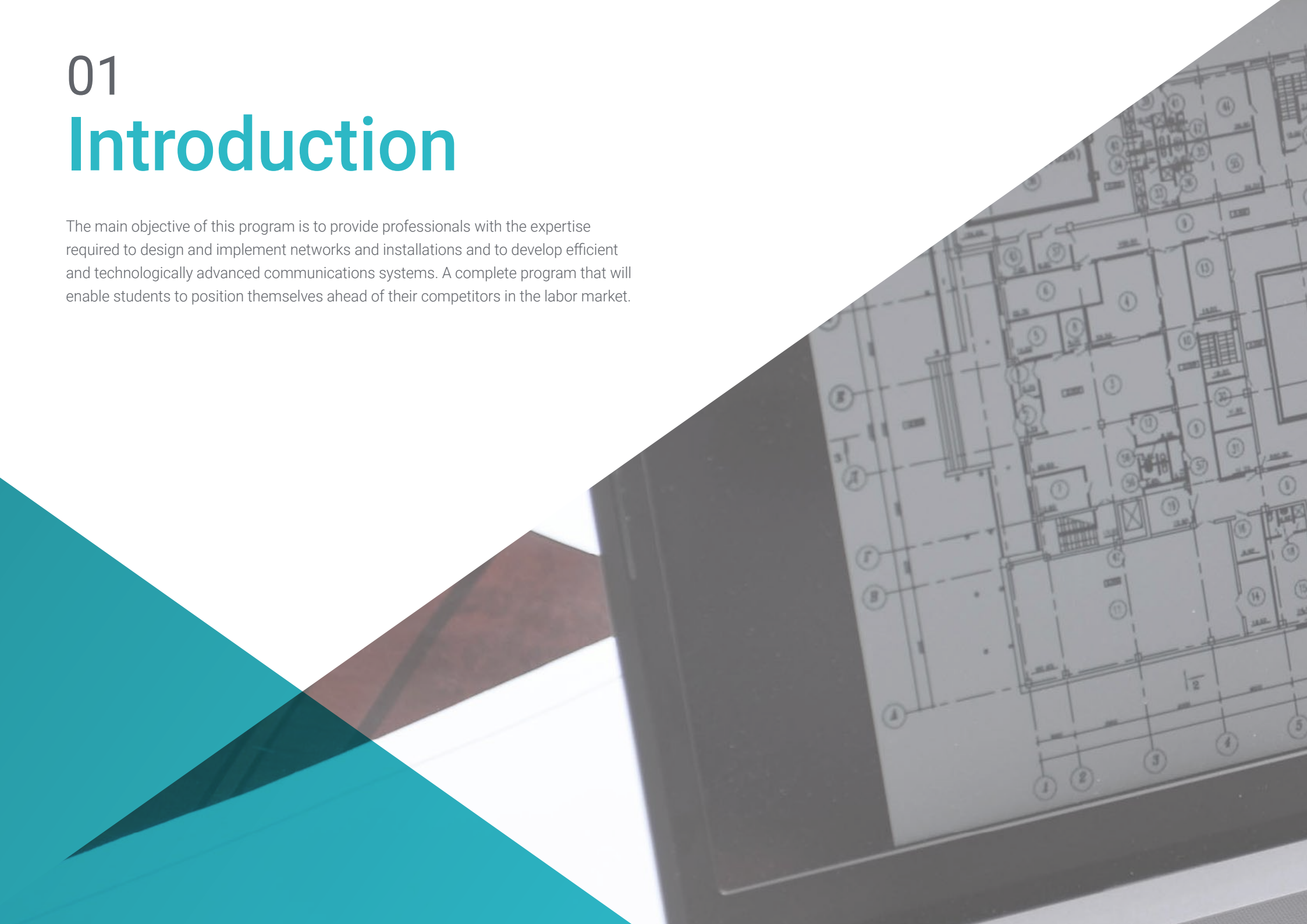
01

Introduction

The main objective of this program is to provide professionals with the expertise required to design and implement networks and installations and to develop efficient and technologically advanced communications systems. A complete program that will enable students to position themselves ahead of their competitors in the labor market.



A high-quality program created to shape competent and competitive specialists"

As one of the fastest evolving fields, telecommunications is seeing constant advances. It is therefore necessary to have IT experts who can adapt to these changes and who have first-hand knowledge of the latest tools and techniques.

The Professional Master's Degree in Telecommunication Engineering addresses a complete range of topics relating to this field. It has a clear advantage over other Professional Master's Degrees that focus on each topic in isolation, preventing students from learning about the interrelation with other areas comprising the multidisciplinary field of telecommunications. The teaching team on this Professional Master's Degree has carefully selected each of the topics of this program to offer the student the most comprehensive academic experience possible, always relating teaching to topical events.

This program is aimed at those interested in attaining expert knowledge of Telecommunications Engineering. The main objective of this Professional Master's Degree is for students build expertise in simulated work environments and in rigorous and realistic conditions so that they can then apply it in the real world.

Furthermore, as it is a 100% online program, students are not conditioned by fixed schedules or the need to move to another physical location, but can access the contents at any time of the day, balancing their work or personal life with their academic life.

This **Professional Master's Degree in Telecommunications Engineering** contains the most complete and up-to-date educational program on the market. The most important features include:

- Case studies presented by experts in Telecommunications Engineering
- Graphic, schematic, and practical contents which provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where self-assessment can be undertaken to improve learning
- A special emphasis on innovative methodologies in of Telecommunications Engineering
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

Don't miss this opportunity to study this TECH Professional Master's Degree in Telecommunications Engineering" It's the perfect opportunity to advance your career"

A cutting-edge educational program that will allow you to acquire the latest and most innovative knowledge in this professional field"

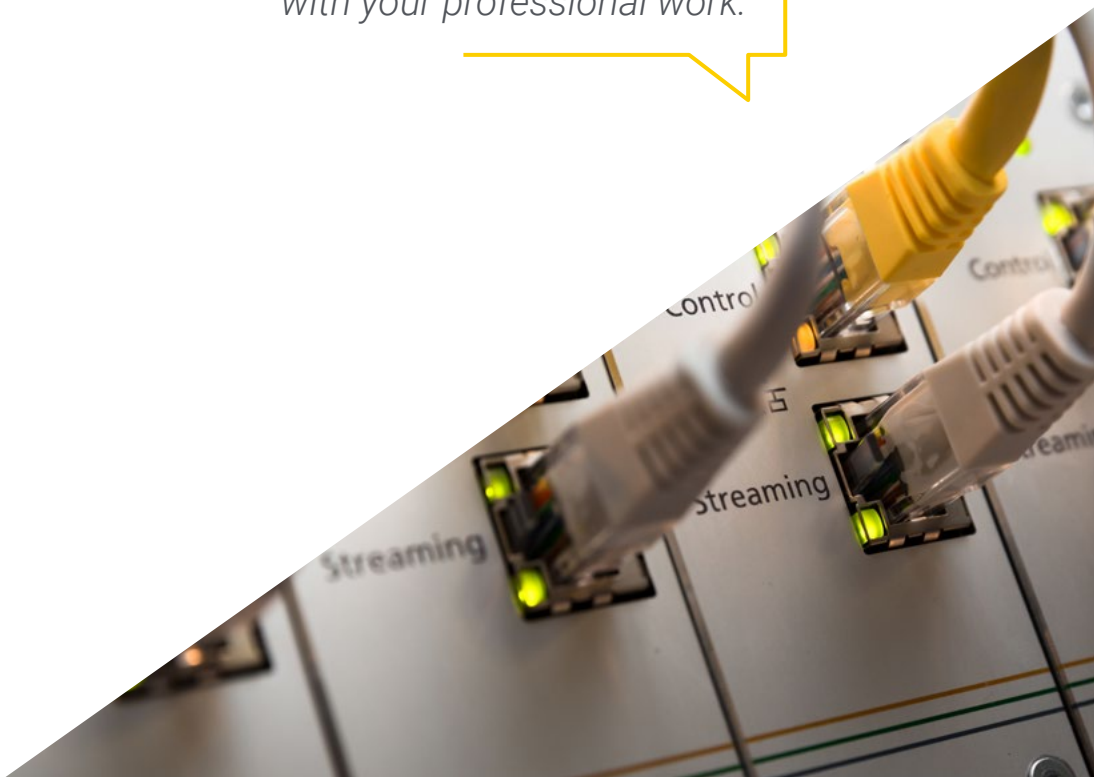
This program uses the best teaching material, enabling contextual study that will facilitate learning.

This 100% online program will allow you to combine your studies with your professional work.

The teaching staff includes professionals from the field of information and communication technology, who contribute their professional experience to this program, as well as renowned specialists from leading societies and prestigious universities.

Multimedia content, developed with the latest educational technology, will allow professionals to learn in a contextual and situated learning environment, i.e., a simulated environment that will provide immersive learning designed to prepare them for real situations.

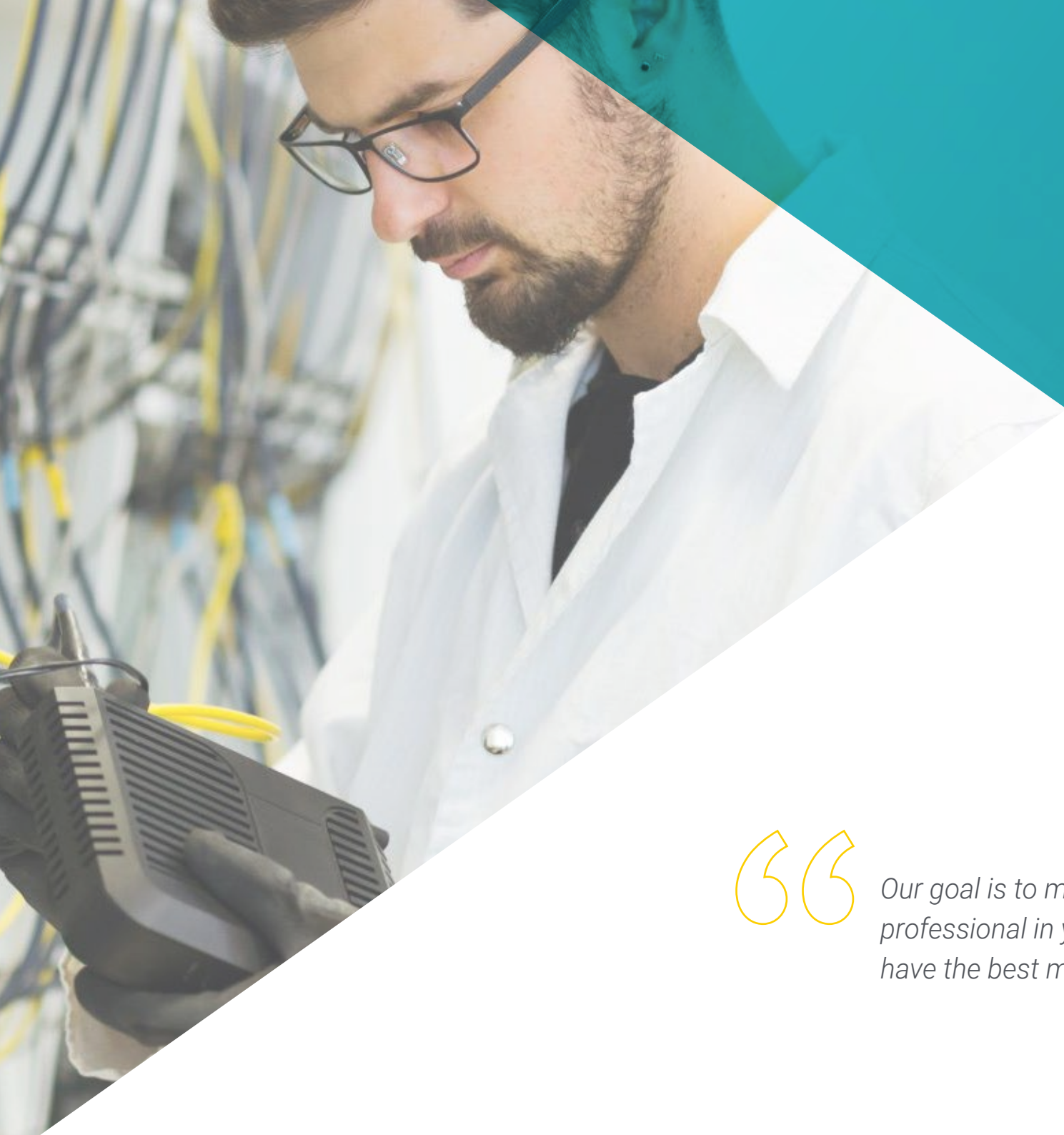
The design of this program focuses on Problem-Based Learning, by means of which professionals must try to solve the different professional practice situations that are presented to them throughout the academic program. For this purpose, will be assisted by an innovative interactive video system developed by renowned and experienced experts in Telecommunications Engineering.



02

Objectives

The Professional Master's Degree in Telecommunications Engineering is aimed at enabling professionals to keep abreast of the main developments in this area.



Our goal is to make you the best professional in your sector. And for this we have the best methodology and content"

General Objective

- Enable students to project, calculate, design, implement and manage networks, equipment, installations and systems in all areas of Telecommunications Engineering

Achieve your professional growth objectives with this high-quality program, with the assurance of being in the best hands"

Specific Objectives

Module 1. Electronics and Basic Instrumentation

- Learn about the operation and limitations of basic electronic workstation instruments
- Know and implement the basic techniques for measuring the electrical parameters of signals, evaluating the associated errors and their possible correction techniques
- Master the basic features and behavior of the most common passive components and be able to select them for a given application
- Understand the basic features of linear amplifiers
- Know about, design and run basic circuits using the best operational amplifiers
- Understand the operation of capacitively coupled multi-stage feedback-free amplifiers and be able to design them
- Analyze and know how to apply the basic techniques and configurations in integrated analog circuits

Module 2. Analog and Digital Electronics

- Know the basic concepts of digital and analog electronics
- Master the different logic gates and their characteristics
- Analyze and design digital circuits, both combinational and sequential
- Distinguish between and evaluate the advantages and disadvantages of synchronous and asynchronous sequential circuits, and of using a clock signal
- Develop your knowledge of integrated circuits and logic families
- Understand the different sources of energy, especially photovoltaic solar and thermal solar energy
- Gain basic knowledge of electrical engineering, electrical distribution and power electronics

Module 3. Random Signals and Linear Systems

- Understand the fundamentals of probability calculation
- Know the basic theory of variables and vectors
- In-depth mastery of random processes and their temporal and spectral characteristics
- Apply the concepts of deterministic and random signals to the characterization of disturbances and noise
- Know the fundamental properties of systems
- Master linear systems and the related functions and transformations
- Apply concepts of linear and time invariant systems (LTI systems) for process modeling, analysis, and prediction

Module 4. Computer Networks

- Acquire essential knowledge of computer networks on the Internet
- Understand the operation of the different layers that define a networked system, such as the application, transport, network and link layers
- Understand the composition of LANs, their topology, and their network and interconnection elements
- Learn how IP addressing and Subnetting work
- Understand wireless and mobile network structures, including the new 5G network
- Know the different network security mechanisms, as well as the different Internet security protocols

Module 5. Digital Systems

- Understand the structure and operation of microprocessors
- Know how to use the instruction set and machine language
- Be able to use hardware description languages
- Know the basic features of microcontrollers
- Analyze the differences between microprocessors and microcontrollers
- Master the basic features of advanced digital systems

Module 6. Communications Theory

- Know the fundamental features of the different types of signals
- Analyze the different disturbances that can occur in signal transmission
- Master signal modulation and demodulation techniques
- Understand the theory of analog communications and its modulations
- Understand the theory of digital communications and its transmission models
- Be able to apply this knowledge to specify, deploy and maintain communications systems and services

Module 7. Switching Networks and Telecommunication Infrastructures

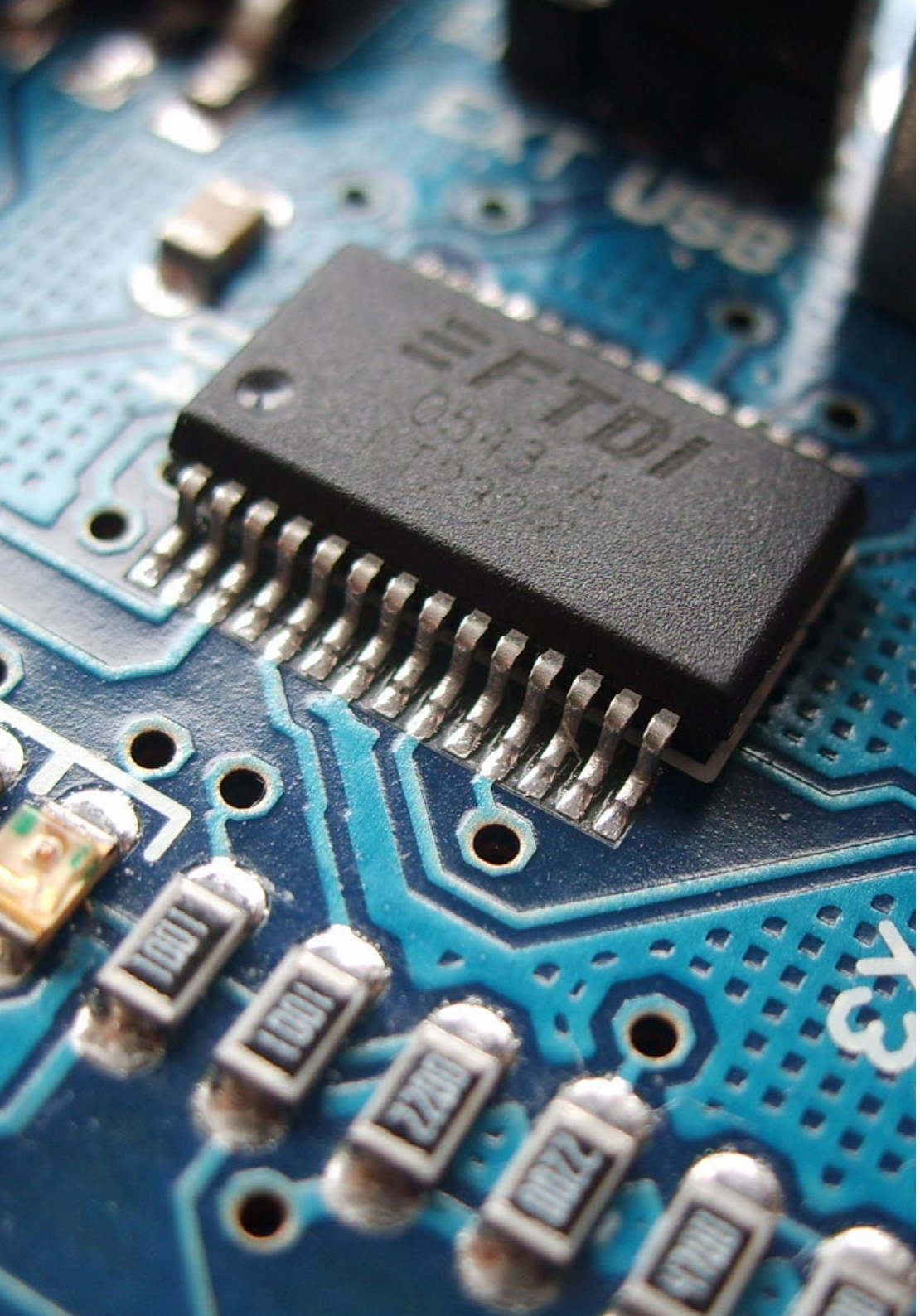
- Differentiate between the concepts of access and transport networks, circuit-switched and packet-switched networks, fixed and mobile networks, as well as distributed network systems and applications, voice, data, audio and video services
- Get to know the methods of network interconnection and routing, as well as the basics of network planning and dimensioning based on traffic parameters
- Master the fundamental principles of service quality
- Analyze the performance (delay, loss probability, blocking probability, etc.) of a telecommunications network
- Understand and apply the standards and regulations derived from protocols and websites of international standardization organizations
- Learn about the planning of common telecommunication infrastructures in residential contexts

Module 8. Mobile Communications Networks

- Analyze the fundamental concepts of mobile communications networks
- Know the principles of mobile communications
- Master the architecture and protocols of mobile communications networks
- Know the basic technologies used in GSM, UMTS and LTE networks
- Understand the signaling systems and the different network protocols of GSM, UMTS and LTE networks
- Understand the functional entities of GSM, UMTS and LTE and their interconnection with other networks
- Know the access, link control and radio resource control mechanisms for an LTE system
- Understand the fundamental concepts of the radio spectrum

Module 9. Radio Networks and Services

- Know the access, link control and radio resource control mechanisms for an LTE system
- Understand the fundamental concepts of the radio spectrum
- Know the specific services for radio networks
- Know the IP multicast techniques that are best suited to the connectivity provided by radio networks Understand the impact of radio networks on end-to-end quality of service and know the mechanisms currently available to mitigate them
- Master WLAN, WPAN, WMAN wireless networks
- Analyze the different satellite network architectures and know the different services supported by a satellite network



Module 10. Systems Engineering and Network Services

- Master the fundamental concepts of service engineering
- Know the basic principles of configuration management for evolving software systems
- Know the technologies and tools for the provision of telematic services
- Know the different architectural styles of a software system, understand their differences and know how to choose the most appropriate one according to system requirements
- Understand validation and verification processes and their relationships with other life cycle phases
- Be able to integrate systems for the capture, representation, processing, storage, management and presentation of multimedia information for the construction of telecommunication services and telematic applications
- Become familiar with the common components for the detailed design of a software system
- Gain the ability to program, simulate and validate telematic, networked and distributed services and applications
- Understand the processes and procedures for transition, configuration, deployment and operation
- Understand network management, automation and optimization processes

03

Skills

After passing the assessments on the Professional Master's Degree in Telecommunications Engineering, the professional will have acquired the necessary skills for excellent and up-to-date practice based on the most innovative teaching methodology.

This program will help you acquire the skills you need to excel in your daily work"

General Skills

- Design and implement telecommunication networks, installations and systems

Study at the one of the world's leading private online universities"

Specific Skills

- Know about the operation and basic instrumentation of electronic devices
- Master all aspects of analog and digital electronics
- Develop knowledge of linear systems and random signals
- Use hardware description languages and know the features of digital systems
- Know about the history and advances in communication theory
- Gain knowledge of computer systems and telecommunication infrastructures in order to be able to work with them
- Work with mobile communication networks and radio services
- Create telecommunications services and telematic applications

04

Course Management

This academic program includes the most specialized teaching staff in the current educational market. They are specialists selected by TECH to develop the whole syllabus. In this way, starting from their own existence and the latest evidence, they have designed the most up-to-date content that provides a guarantee of quality in such a relevant subject.

TECH offers the most specialized teaching staff in the field of study. Enroll now and enjoy the quality you deserve"

International Guest Director

Sinan Akkaya is an outstanding technology leader with extensive international engineering, management and leadership experience, specializing in access networks and enterprise infrastructure construction and operations. In this regard, he has demonstrated a strong ability to lead large-scale teams and projects, focusing on advanced technology implementation, innovation and product development. His experience ranges from strategic planning to operational execution of complex wireless network solutions and communication systems.

As such, in his role as Director of Radio Access Network Engineering, at AT&T, he has led the Radio Frequency and Network Engineering activities for the Northern California and Nevada region , where he has overseen the implementation of 4G and 5G networks, as well as network expansion to over 900 sites. Under his leadership, the region has achieved the highest EBITDA in the company, highlighted by his ability to manage large budgets, optimize operating costs and ensure network performance. In addition, he has played a key role in the implementation of emerging technologies, such as Massive MIMO and 5G mm-wave, as well as in the management of services such as FirstNet, focused on public safety.

He has also worked in consulting for large telecom operators, OEMs and global companies, providingtechnical and strategic advice to optimize networks and improve the quality of services. He has also supervised multidisciplinary teams, managed network investments in excess of $500 million annually and made significant contributions to the expansion and optimization of telecommunications networks. He has been a frequent speaker at international conferences, where he has shared his knowledge and perspective on technology trends and strategies for the evolution of wireless networks.

Mr. Akkaya, Sinan

- Director of Radio Access Network Engineering at AT&T, San Ramon, California, United States
- Manager of Radio Frequency Engineering at AT&T
- Senior RF Engineer at Wireless Facilities International
- Radio Frequency Engineer at Lightbridge Communications Corporation
- RF Design Engineer at Turkcell
- Product Manager at General Electric
- Master of Science in Electrical and Electronic Engineering at Newcastle University
- Bachelor of Science in Electrical and Electronic Engineering from Orta Doğu Technical University
- Member of: American Heart Association

Thanks to TECH, you will be able to learn with the best professionals in the world"

05

Structure and Content

The syllabus has been designed by renowned professionals with wide-ranging experience in Telecommunications Engineering.

We have the most complete and up-to-date academic program on the market. We strive for excellence and for you to achieve it too"

Module 1. Electronics and Basic Instrumentation

1.1. Basic Instrumentation
- 1.1.1. Introduction. Signals and Their Parameters
- 1.1.2. Basic Electrical Magnitudes and their Measurement
- 1.1.3. Oscilloscope
- 1.1.4. Digital Multimeter
- 1.1.5. Function Generator
- 1.1.6. Laboratory Power Supply

1.2. Electronic Components in the Laboratory
- 1.2.1. Main Types and Concepts of Tolerance and Series
- 1.2.2. Thermal Behavior and Power Dissipation Maximum Voltage and Current
- 1.2.3. Concepts of Variation Coefficients, Drift and Non-Linearity.
- 1.2.4. Most Common Specific Parameters of the Main Types Catalog Selection and Limitations

1.3. Junction Diodes, Diode Circuits, Diodes for Special Applications
- 1.3.1. Introduction and Operation
- 1.3.2. Circuits with Diodes
- 1.3.3. Diodes for Special Applications
- 1.3.4. Zener Diode

1.4. The Bipolar Junction Transistor BJT and FET/MOSFET
- 1.4.1. Transistor Basics
- 1.4.2. Polarization and Transistor Stabilization
- 1.4.3. Transistor Circuits and Applications
- 1.4.4. Single-Stage Amplifiers
- 1.4.5. Amplifier Types, Voltage, Current
- 1.4.6. Alternating Models

1.5. Basic Concepts of Amplifiers Circuits with Optimal Operational Amplifiers
- 1.5.1. Amplifier Types Voltage, Current, Transimpedance, and Transconductance
- 1.5.2. Typical Parameters: Input and Output Impedances, Direct and Inverse Transfer Functions
- 1.5.3. Viewing as Quadripoles and Parameters
- 1.5.4. Amplifier Connection: Cascade, Series-Series, Series-Parallel, Parallel-Series, Parallel-Series and Parallel, Parallel
- 1.5.5. Concept of Operational Amplifier General Characteristics. Use as a Comparator and as an Amplifier
- 1.5.6. Inverting and Non-Inverting Amplifier Circuits Precision Trackers and Rectifiers Voltage Current Control
- 1.5.7. Elements for Instrumentation and Operational Calculation: Adders, Subtractors, Differential Amplifiers, Integrators and Differentiators
- 1.5.8. Stability and Feedback: Astables and Triggers

1.6. Single-stage Amplifiers and Multi-stage Amplifiers
- 1.6.1. General Concepts of Device Polarization
- 1.6.2. Basic Polarization Circuits and Techniques. Implementation for Bipolar and Field Effect Transistors Stability, Drift and Sensitivity
- 1.6.3. Basic Small-Signal Amplifier Configurations: Common Emitter-Source, Base-Gate, Collector-Drainer Properties and Variants
- 1.6.4. Performance in the Face of Large Signal Fluctuations and Dynamic Range
- 1.6.5. Basic Analog Switches and their Properties
- 1.6.6. Effects of Frequency on Single-Stage Configurations: Case of Medium Frequencies and their Limits
- 1.6.7. Multi-stage Amplification with R-C and Direct Coupling Amplification, Frequency Range, Polarization and Dynamic Range Considerations

1.7. Basic Configurations in Integrated Analog Circuits
- 1.7.1. Differential Input Configurations Bartlett's Theorem Polarization, Parameters and Measures
- 1.7.2. Functional Polarization Blocks: Current Mirrors and their Modifications Active Loads and Level Changers
- 1.7.3. Standard Input Configurations and their Properties: Single Transistor, Darlington Pairs and their Modifications, Cascode
- 1.7.4. Output Configurations

1.8. Active Filters
- 1.8.1. General Aspects
- 1.8.2. Operational Filter Design
- 1.8.3. Low Pass Filters
- 1.8.4. High Pass Filters
- 1.8.5. Band Pass and Band Elimination Filters
- 1.8.6. Other Types of Active Filters

1.9. Analog-to-Digital Converters (A/D)
- 1.9.1. Introduction and Functionalities
- 1.9.2. Instrumental Systems
- 1.9.3. Converter Types
- 1.9.4. Converter Features
- 1.9.5. Data Processing

1.10. Sensors
- 1.10.1. Primary Sensors
- 1.10.2. Resistive Sensors
- 1.10.3. Capacitive Sensors
- 1.10.4. Inductive and Electromagnetic Sensors
- 1.10.5. Digital Sensors
- 1.10.6. Signal Generating Sensors
- 1.10.7. Other Types of Sensors

Module 2. Analogue and Digital Electronics

2.1. Introduction: Digital Concepts and Parameters
- 2.1.1. Analog and Digital Magnitudes
- 2.1.2. Binary Digits, Logic Levels and Digital Waveforms
- 2.1.3. Basic Logical Operations
- 2.1.4. Integrated Circuits
- 2.1.5. Introduction to Programmable Logic
- 2.1.6. Measuring Instruments
- 2.1.7. Decimal, Binary, Octal, Hexadecimal, BCD Numbers
- 2.1.8. Arithmetical Operations with Numbers
- 2.1.9. Error Detection and Correction Codes
- 2.1.10. Alphanumeric Codes

2.2. Logic Gates
- 2.2.1. Introduction
- 2.2.2. The Investor
- 2.2.3. The AND Gate
- 2.2.4. The OR Gate
- 2.2.5. The NAND Gate

2.2.6. The NOR Gate
2.2.7. Exclusive OR and NOR Gates
2.2.8. Programmable Logic
2.2.9. Fixed Function Logic
2.3. Boolean Algebra
2.3.1. Boolean Operations and Expressions
2.3.2. Boolean Algebra Laws and Rules
2.3.3. DeMorgan's Theorems
2.3.4. Boolean Analysis of Logic Circuits
2.3.5. Simplification Using Boolean Algebra
2.3.6. Standard Forms of Boolean Expressions
2.3.7. Boolean Expressions and Truth Tables
2.3.8. Karnaugh Maps
2.3.9. Minimization of a Sum of Products and Minimization of a Product of Sums
2.4. Basic Combinational Circuits
2.4.1. Basic Circuits
2.4.2. Combinational Logic Implementation
2.4.3. The Universal Property of NAND and NOR Gates
2.4.4. Combinational Logic with NAND and NOR Gates
2.4.5. Operation of Logic Circuits with Impulse Trains
2.4.6. Adders
2.4.6.1. Basic Adders
2.4.6.2. Binary Adders in Parallel
2.4.6.3. Carry Adders
2.4.7. Comparators
2.4.8. Decoders
2.4.9. Coders
2.4.10. Code Converters
2.4.11. Multiplexers
2.4.12. Demultiplexers
2.4.13. Applications
2.5. Latches, Flip-Flops and Timers
2.5.1. Basic Concepts
2.5.2. Latches
2.5.3. Flank Fired Flip-Flops
2.5.4. Operating Characteristics of Flip-Flops
2.5.4.1. Type D
2.5.4.2. Type J-K
2.5.5. Monostables
2.5.6. Astables
2.5.7. The 555 Timer
2.5.8. Applications
2.6. Counters and Shift Registers
2.6.1. Asynchronous Counter Operation
2.6.2. Synchronous Counter Operation
2.6.2.1. Ascending
2.6.2.2. Descending
2.6.3. Design of Synchronous Counters
2.6.4. Cascade Counters
2.6.5. Counter Decoding
2.6.6. Application of Counters
2.6.7. Basic Functions of the Shift Registers
2.6.7.1. Displacement Registers with Serial Input and Parallel Output
2.6.7.2. Shift Registers with Parallel Input and Serial Output
2.6.7.3. Shift Registers with Parallel Input and Output
2.6.7.4. Bidirectional Shift Registers
2.6.8. Counters Based on Shift Registers
2.6.9. Applications of Counter Registers

2.7. Memories, Introduction to SW and Programmable Logic
- 2.7.1. Principles of Semiconductor Memory
- 2.7.2. RAM Memory
- 2.7.3. ROM Memory
  - 2.7.3.1. Read Only
  - 2.7.3.2. PROM
  - 2.7.3.3. EPROM
- 2.7.4. Flash Memory
- 2.7.5. Memory Expansion
- 2.7.6. Special Types of Memory
  - 2.7.6.1. FIFO
  - 2.7.6.2. LIFO
- 2.7.7. Optical and Magnetic Memory
- 2.7.8. Programmable Logic: SPLD and CPLD
- 2.7.9. Macrocells
- 2.7.10. Programmable Logic: FPGA
- 2.7.11. Programmable Logic Software
- 2.7.12. Applications

2.8. Analog Electronics: Oscillators
- 2.8.1. Oscillator Theory
- 2.8.2. Wien Bridge Oscillator
- 2.8.3. Other RC Oscillators
- 2.8.4. Colpitts Oscillator
- 2.8.5. Other LC Oscillators
- 2.8.6. Crystal Oscillator
- 2.8.7. Quartz Crystals
- 2.8.8. 555 Timer
  - 2.8.8.1. Astable Operation
  - 2.8.8.2. Monostable Operation
  - 2.8.8.3. Circuits
- 2.8.9. BODE Diagrams
  - 2.8.9.1. Amplitude
  - 2.8.9.2. Phase
  - 2.8.9.3. Transference Functions

2.9. Power Electronics: Thyristors, Converters, Inverters
- 2.9.1. Introduction
- 2.9.2. Converter Concept
- 2.9.3. Converter Types
- 2.9.4. Parameters for Characterizing Converters
  - 2.9.4.1. Periodic Signal
  - 2.9.4.2. Time Domain Representation
  - 2.9.4.3. Frequency Domain Representation
- 2.9.5. Powered Semiconductors
  - 2.9.5.1. Ideal Element
  - 2.9.5.2. Diode
  - 2.9.5.3. Thyristor
  - 2.9.5.4. GTO (Gate Turn-off Thyristor)
  - 2.9.5.5. BJT (Bipolar Junction Transistor)
  - 2.9.5.6. MOSFET
  - 2.9.5.7. IGBT (Insulated Gate Bipolar Transistor)
- 2.9.6. AC/DC Converters Rectifiers
  - 2.9.6.1. Concept of Quadrant
  - 2.9.6.2. Uncontrolled Rectifiers
    - 2.9.6.2.1. Simple Half Wave Bridge
    - 2.9.6.2.2. Full Wave Bridge
  - 2.9.6.3. Controlled Rectifiers
    - 2.9.6.3.1. Simple Half Wave Bridge
    - 2.9.6.3.2. Full Wave Controlled Bridge
  - 2.9.6.4. DC/DC Converters
    - 2.9.6.4.1. DC/DC Converter Reducer
    - 2.9.6.4.2. Step-up DC/DC Converter
  - 2.9.6.5. DC/AC Converters Inverters
    - 2.9.6.5.1. Square Wave Inverter
    - 2.9.6.5.2. PWM Inverter
  - 2.9.6.6. AC/AC Converters Cycloconverters
    - 2.9.6.6.1. All/Nothing Control
    - 2.9.6.6.2. Phased Control

2.10. Electric Power Generation, Photovoltaic Installation Legislation
- 2.10.1. Components of a Photovoltaic Solar Installation
- 2.10.2. Introduction to Solar Energy
- 2.10.3. Classification of Photovoltaic Solar Installations
  - 2.10.3.1. Autonomous Applications
  - 2.10.3.2. Networked Applications
- 2.10.4. Elements of an FSI
  - 2.10.4.1. Solar Cell: Basic Characteristics
  - 2.10.4.2. The Solar Panel
  - 2.10.4.3. The Regulator
  - 2.10.4.4. Accumulators Types of Cells
  - 2.10.4.5. The Investor
- 2.10.5. Networked Applications
  - 2.10.5.1. Introduction
  - 2.10.5.2. Elements of a Grid-Connected Photovoltaic Solar Installation
  - 2.10.5.3. Design and Calculation of Grid-connected Photovoltaic Systems
  - 2.10.5.4. Design of a Solar Farm
  - 2.10.5.5. Design of Building-Integrated Installations
  - 2.10.5.6. Interaction of the Installation with the Electrical Grid
  - 2.10.5.7. Analysis of Potential Disturbances and Quality of Supply
  - 2.10.5.8. Measurement of Electrical Consumption
  - 2.10.5.9. Safety and Protection in the Installation

Module 3. Random Signals and Linear Systems

3.1. Probability Theory
- 3.1.1. Concept of Probability Probability Margin
- 3.1.2. Conditional Probability and Independent Events
- 3.1.3. Theorem of Total Probability Bayes' Theorem
- 3.1.4. Compound Experiments Bernoulli Trials

3.2. Random Variables
- 3.2.1. Definition of a Random Variable
- 3.2.2. Probability Distributions
- 3.2.3. Main Distributions
- 3.2.4. Functions of Random Variables
- 3.2.5. Functions of Random Variables
- 3.2.6. Generator Functions

3.3. Random Vectors
- 3.3.1. Definition of Random Vector
- 3.3.2. Joint Distribution
- 3.3.3. Marginal Distributions
- 3.3.4. Conditional Distributions
- 3.3.5. Linear Relationship Between Two Variables
- 3.3.6. Multivariate Normal Distribution

3.4. Random Processes
- 3.4.1. Definition and Description of Random Process
- 3.4.2. Random Processes in Discrete Time
- 3.4.3. Random Processes in Continuous Time
- 3.4.4. Stationary Processes
- 3.4.5. Gaussianian Processes
- 3.4.6. Markovian Processes

3.5. Queuing Theory in Telecommunications
- 3.5.1. Introduction
- 3.5.2. Basic Concepts
- 3.5.2. Description of Models
- 3.5.2. Example of the Application of Queuing Theory in Telecommunications

3.6. Random Processes Temporary Characteristics
- 3.6.1. Concept of Random Process
- 3.6.2. Process Classification
- 3.6.3. Principles of Statistics
- 3.6.4. Stationarity and Independence
- 3.6.5. Temporary Averages
- 3.6.6. Ergodicity

3.7. Random Processes Spectrum Characteristics
- 3.7.1. Introduction
- 3.7.2. Power Density Spectrum
- 3.7.3. Properties of the Density Spectrum of Power
- 3.7.3. Relationships Between the Power Spectrum and the Autocorrelation

3.8. Signals and Systems. Properties
- 3.8.1. Introduction to Signals
- 3.8.2. Introduction to Systems
- 3.8.3. Basic Properties of Systems:
  - 3.8.3.1. Linearity
  - 3.8.3.2. Invariance in Time
  - 3.8.3.3. Causality
  - 3.8.3.4. Stability
  - 3.8.3.5. Memory
  - 3.8.3.6. Invertibility

3.9. Linear Systems with Random Inputs
- 3.9.1. Fundamentals of Linear Systems
- 3.9.2. Response of Linear Systems to Random Signals
- 3.9.3. Systems with Random Noise
- 3.9.4. Spectral Characteristics of the System Response
- 3.9.5. Bandwidth and the Temperature Equivalent of Noise
- 3.9.6. Noise Source Modeling

3.10. LTI Systems
- 3.10.1. Introduction
- 3.10.2. Discrete Time LTI Systems
- 3.10.3. Continuous Time LTI Systems
- 3.10.4. Properties of LTI Systems
- 3.10.5. Systems Described by Differential Equations

Module 4. Computer Networks

4.1. Computer Networks on the Internet
- 4.1.1. Networks and Internet
- 4.1.2. Protocol Architecture

4.2. The Application Layer
- 4.2.1. Model and Protocols
- 4.2.2. FTP and SMTP Services
- 4.2.3. DNS Service
- 4.2.4. HTTP Operation Model
- 4.2.5. HTTP Message Formats
- 4.2.6. Interaction with Advanced Methods

4.3. The Transport Layer
- 4.3.1. Communication Between Processes
- 4.3.2. Connection-Oriented Transportation: TCP and SCTP

4.4. The Network Layer
- 4.4.1. Circuit and Packet Switching
- 4.4.2. IP Protocol (v4 and v6)
- 4.4.3. Routing Algorithms

4.5. The Link Layer
- 4.5.1. Link Layer, Error Detection and Correction Techniques
- 4.5.2. Multiple Access Links and Protocols
- 4.5.3. Link Level Addressing

4.6. LAN Networks
- 4.6.1. Network Topologies
- 4.6.2. Network and Interconnection Elements

4.7. IP Addressing
- 4.7.1. IP Addressing and Subnetting
- 4.7.2. Overview: An HTTP Request

4.8. Wireless and Mobile Networks
- 4.8.1. 2G, 3G and 4G Mobile Networks and Services
- 4.8.2. Networks, 5G

4.9. Network Security
- 4.9.1. Fundamentals of Communications Security
- 4.9.2. Access Control
- 4.9.3. System Security
- 4.9.4. Fundamentals of Cryptography
- 4.9.5. Digital Signature

4.10. Internet Security Protocols
- 4.10.1. IP Security and Virtual Private Networks (VPN)
- 4.10.2. Web Security with SSL/TLS

Module 5. Digital Systems

5.1. Basic Concepts and Functional Organization of the Computer
- 5.1.1. Basic Concepts
- 5.1.2. Functional Structure of Computers
- 5.1.3. Concept of Machine Language
- 5.1.4. Basic Parameters for Measuring the Performance of a Computer
- 5.1.5. Conceptual Levels of Computer Description
- 5.1.6. Conclusions

5.2. Representation of Machine-Level Information
- 5.2.1. Introduction
- 5.2.2. Text Representation
  - 5.2.2.1. ASCII Code (American Standard Code for Information Interchange)
  - 5.2.2.2. Coding with Unicode
- 5.2.3. Sound Representation
- 5.2.4. Image Representation
  - 5.2.4.1. Bitmaps
  - 5.2.4.2. Vector Maps
- 5.2.5. Vector Maps
- 5.2.6. Representation of Numerical Data
  - 5.2.6.1. Integer Representation
  - 5.2.6.2. Representation of Real Numbers
    - 5.2.6.2.1. Rounding
    - 5.2.6.2.2. Special Situations
- 5.2.7. Conclusions

5.3. Diagram of Computer Operation
- 5.3.1. Introduction
- 5.3.2. Internal Processor Elements
- 5.3.3. Sequencing the Internal Workings of a Computer
- 5.3.4. Management of Control Instructions
  - 5.3.4.1. Management of Control Instructions
  - 5.3.4.2. Handling of Subroutine Call and Return Instructions
- 5.3.5. Interruptions
- 5.3.6. Conclusions

5.4. Description of a Computer at the Machine and Assembly Language Level
- 5.4.1. Introduction: RISC vs CISC Processors
- 5.4.2. A RISC Processor: CODE-2
  - 5.4.2.1. CODE-2 Features
  - 5.4.2.2. Description of CODE-2 Machine Language
  - 5.4.2.3. Methodology for the execution of CODE-2 Machine Language Programs
  - 5.4.2.4. Description of CODE-2 Assembly Language
- 5.4.3. The CISC family: 32-bit Intel Processors (IA-32)
  - 5.4.3.1. Evolution of the Intel® Family of Processors
  - 5.4.3.2. Basic Structure of the 80×86 Processor Family
  - 5.4.3.3. Syntax, Instruction Format and Operand Types
  - 5.4.3.4. Basic Instruction Set for the 80×86 Processor Family
  - 5.4.3.5. Assembler Directives and Memory Location Reserve
- 5.4.4. Conclusions

5.5. Processor Organization and Design
- 5.5.1. Introduction to CODE-2 Processor Design
- 5.5.2. Control Signals for the CODE-2 Processor
- 5.5.3. Design of the Data Processing Unit
- 5.5.4. Control Unit Design
  - 5.5.4.1. Wired and Microprogrammed Control Units
  - 5.5.4.2. Cycle of the CODE-2 Control Unit
  - 5.5.4.3. Design of the CODE-2 Microprogrammed Control Unit
- 5.5.5. Conclusions

5.6. Inputs and Outputs: Buses
- 5.6.1. Input/Output Organization
- 5.6.1.1. Input/Output Controllers
- 5.6.1.2. Input/Output Port Routing
- 5.6.1.3. I/O Transfer Techniques
- 5.6.2. Basic Interfacing Structures
- 5.6.3. Buses
- 5.6.4. Internal Structure of a PC

5.7. Microcontrollers and PICs
- 5.7.1. Introduction
- 5.7.2. Basic Features of Microcontrollers
- 5.7.3. Basic Features of PICs
- 5.7.4. Differences Between Microcontrollers, PICs and Microprocessors

5.8. A/D Converters and Sensors
- 5.8.1. Signal Sampling and Reconstruction
- 5.8.2. A/D Converters
- 5.8.3. Sensors and Transducers
- 5.8.4. Basic Digital Signal Processing
- 5.8.5. Basic Circuits and Systems for A/D Conversion

5.9. Programming of a Microcontroller System
- 5.9.1. System Design and Electronic Configuration
- 5.9.2. Configuration of a Development Environment for Micro-Controlled Digital Systems Using Free Tools
- 5.9.3. Description of Microcontroller Language
- 5.9.4. Programming of Microcontroller Functions
- 5.9.5. Final Assembly of the System

5.10. Advanced Digital Systems: FPGAs and DSPs
- 5.10.1. Description of other Advanced Digital Systems
- 5.10.2. Basic Features of FPGAs
- 5.10.3. Basic Features of DSPs
- 5.10.4. Hardware Description Languages

Module 6. Communications Theory

6.1. Introduction: Telecommunication Systems and Transmission Systems
- 6.1.1. Introduction
- 6.1.2. Basic Concepts and History
- 6.1.3. Telecommunication Systems
- 6.1.4. Transmission Systems

6.2. Signal Characterization
- 6.2.1. Deterministic, Random Signal
- 6.2.2. Periodic and Non-Periodic Signal
- 6.2.3. Energy or Power Signal
- 6.2.4. Baseband and Passband Signal
- 6.2.5. Basic Parameters of a Signal
  - 6.2.5.1. Average Value
  - 6.2.5.2. Average Energy and Power
  - 6.2.5.3. Maximum Value and Efficiency Value
  - 6.2.5.4. Energy and Power Spectral Density
  - 6.2.5.5. Power Calculation in Logarithmic Units

6.3. Disturbances in Transmission Systems
- 6.3.1. Optimal Channel Transmission
- 6.3.2. Classification of Disturbances
- 6.3.3. Linear Distortion
- 6.3.4. Non-Linear Distortion
- 6.3.5. Dissonance and Interference
- 6.3.6. Noise
  - 6.3.6.1. Types of Noise
  - 6.3.6.2. Characterization
- 6.3.7. Narrow Passband Signals

6.4. Analog Communications Concepts
- 6.4.1. Introduction
- 6.4.2. General Concepts
- 6.4.3. Baseband Transmission
  - 6.4.3.1. Modulation and Demodulation
  - 6.4.3.2. Characterization
  - 6.4.3.3. Multiplexing
- 6.4.4. Mixers
- 6.4.5. Characterization
- 6.4.6. Type of Mixers

6.5. Analog Communications Linear Modulations
- 6.5.1. Basic Concepts
- 6.5.2. Amplitude Modulation (AM)
  - 6.5.2.1. Characterization
  - 6.5.2.2. Parameters
  - 6.5.2.3. Modulation/Demodulation
- 6.5.3. Double Band Lateral Modulation (DBL)
  - 6.5.3.1. Characterization
  - 6.5.3.2. Parameters.
  - 6.5.3.3. Modulation/Demodulation
- 6.5.4. Single Side Band (SSB) Modulation
  - 6.5.4.1. Characterization
  - 6.5.4.2. Parameters.
  - 6.5.4.3. Modulation/Demodulation
- 6.5.5. Vestigial Sideband Modulation (VSB)
  - 6.5.5.1. Characterization
  - 6.5.5.2. Parameters.
  - 6.5.5.3. Modulation/Demodulation
- 6.5.6. Quadrature Amplitude Modulation (QAM)
  - 6.5.6.1. Characterization
  - 6.5.6.2. Parameters.
  - 6.5.6.3. Modulation/Demodulation
- 6.5.7. Noise in Analog Modulations
  - 6.5.7.1. Approach
  - 6.5.7.2. Noise in DBL
  - 6.5.7.3. Noise in BLU
  - 6.5.7.4. Noise in AM

6.6. Analog Communications Angular Modulations
- 6.6.1. Phase and Frequency Modulation
- 6.6.2. Narrow Band Angular Modulation
- 6.6.3. Spectrum Calculation
- 6.6.4. Generation and Demodulation
- 6.6.5. Angular Demodulation with Noise
- 6.6.6. Noise in PM
- 6.6.7. Noise in FM
- 6.6.8. Comparison Between Analog Modulations

6.7. Digital Communications. Introduction. Transmission Models
- 6.7.1. Introduction
- 6.7.2. Fundamentals of Parameters
- 6.7.3. Advantages of Digital Systems
- 6.7.4. Limitations of Digital Systems
- 6.7.5. PCM Systems
- 6.7.6. Modulations in Digital Systems
- 6.7.7. Demodulations in Digital Systems

6.8. Digital Communications. Digital Base Band Transmission
- 6.8.1. Binary PAM Systems
  - 6.8.1.1. Characterization
  - 6.8.1.2. Signal Parameters
  - 6.8.1.3. Spectral Model
- 6.8.2. Basic Binary Sampling Receiver
  - 6.8.2.1. Bipolar NRZ
  - 6.8.2.2. Bipolar RZ
  - 6.8.2.3. Probability of Error

6.8.3. Optimal Binary Receiver
6.8.3.1. Context
6.8.3.2. Calculating the Probability of Error
6.8.3.3. Filter Design for the Optimal Receiver
6.8.3.4. SNR Calculation
6.8.3.5. Loans
6.8.3.6. Characterization
6.8.4. M-PAM Systems
6.8.4.1. Parameters.
6.8.4.2. Constellations
6.8.4.3. Optimum Receiver
6.8.4.4. Bit Error Rate (BER)
6.8.5. Signal Vector Space
6.8.6. Constellation of a Digital Modulation
6.8.7. M-signal Receivers
6.9. Digital Communications: Digital Bandpass Transmission, Digital Modulations
6.9.1. Int roduction
6.9.2. ASK Modulation
6.9.2.1. Characterization
6.9.2.2. Parameters.
6.9.2.3. Modulation/Demodulation
6.9.3. QAM Modulation
6.9.3.1. Characterization
6.9.3.2. Parameters.
6.9.3.3. Modulation/Demodulation
6.9.4. PSK Modulation
6.9.4.1. Characterization
6.9.4.2. Parameters.
6.9.4.3. Modulation/Demodulation
6.9.5. FSK Modulation
6.9.5.1. Characterization
6.9.5.2. Parameters.
6.9.5.3. Modulation/Demodulation
6.9.6. Other Digital Modulations
6.9.7. Comparison of Digital Modulations
6.10. Digital Communications Comparative, IES, Eye Diagrams
6.10.1. Comparison of Digital Modulations
6.10.1.1. Energy and Potency of Modulations
6.10.1.2. Embedded
6.10.1.3. Noise Protection
6.10.1.4. Spectral Model
6.10.1.5. Channel Coding Techniques
6.10.1.6. Synchronization Signals
6.10.1.7. SNR Symbol Error Probability
6.10.2. Limited Bandwidth Channels
6.10.3. Interference Between Symbols (IES)
6.10.3.1. Characterization
6.10.3.2. Limitations
6.10.4. Optimal Receiver in PAM without IES
6.10.5. Eye Diagrams

Module 7. Switching Networks and Telecommunication Infrastructures

7.1. Introduction to Switching Networks
7.1.1. Switching Techniques
7.1.2. LAN Local Area Networks
7.1.3. Review of Topologies and Transmission Media
7.1.4. Basic Concepts of Transference
7.1.5. Methods of Accessing the Medium
7.1.6. Network Interconnection Equipment
7.2. Switching Techniques and Switch Structure. ISDN and FR Networks
7.2.1. Switched Networks
7.2.2. Circuit-Switching Networks
7.2.3. RDSI
7.2.4. Packet-Switched Networks
7.2.5. FR

7.3. Traffic Parameters and Network Dimensioning
- 7.3.1. Fundamental Concepts of Traffic
- 7.3.2. Loss Systems
- 7.3.3. Queueing Systems
- 7.3.4. Examples of Traffic Modeling Systems

7.4. Quality of Service and Traffic Management Algorithms
- 7.4.1. Service Quality
- 7.4.2. Effects of Congestion
- 7.4.3. Congestion Control
- 7.4.4. Traffic Control
- 7.4.5. Traffic Management Algorithms

7.5. Access Networks: WAN Access Technologies
- 7.5.1. Wide Area Networks
- 7.5.2. WAN Access Technologies
- 7.5.3. xDSL Access
- 7.5.4. FTTH Access

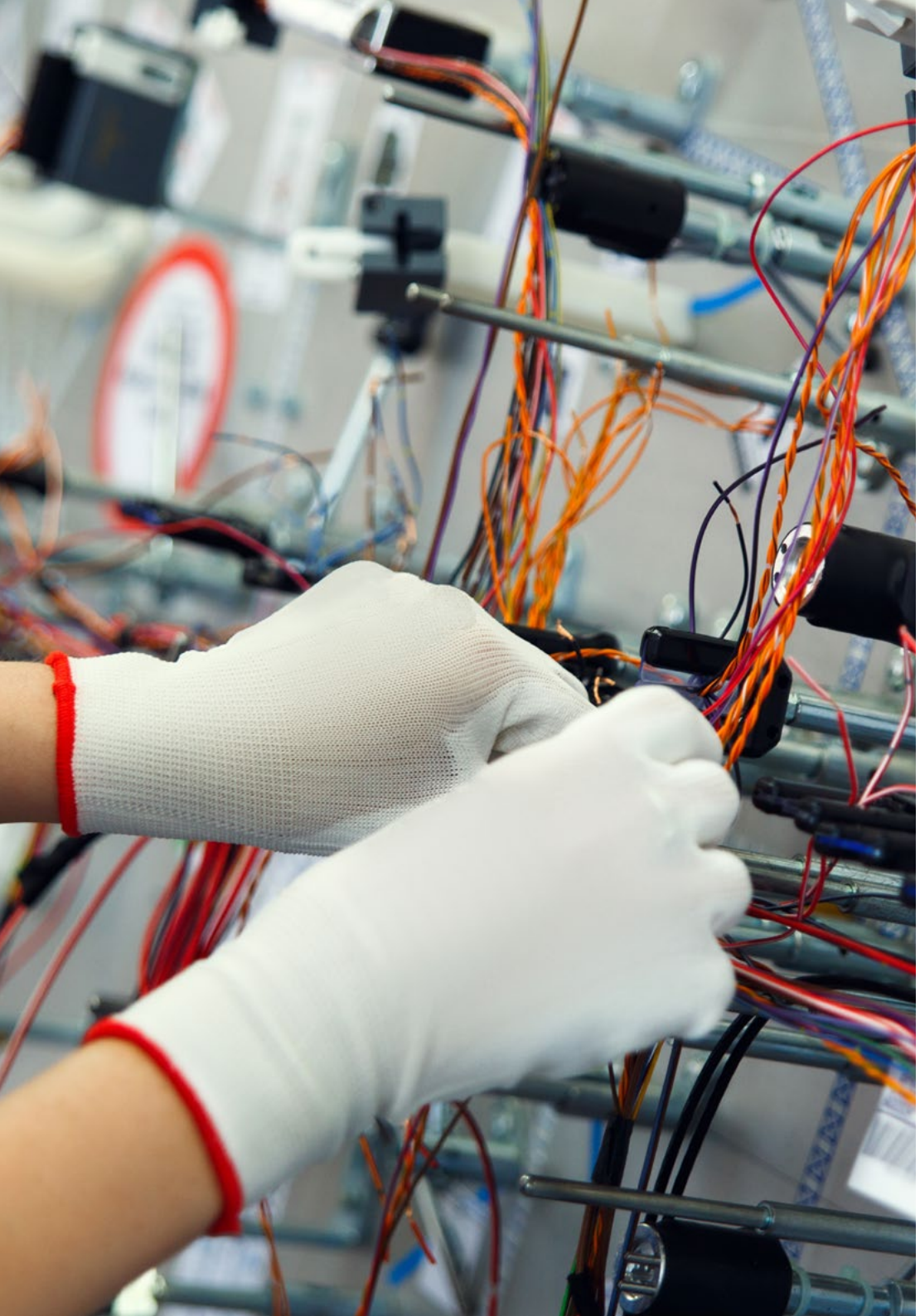
7.6. ATM: Asynchronous Transfer Mode
- 7.6.1. ATM Service
- 7.6.2. Protocol Architecture
- 7.6.3. Logical ATM Connections
- 7.6.4. ATM Cells
- 7.6.5. ATM Cell Transmission
- 7.6.6. Classes of ATM Services

7.7. MPLS: Multiprotocol Label Switching
- 7.7.1. Introduction MPLS
- 7.7.2. MPLS Operation
- 7.7.3. Labels
- 7.7.4. VPNs

7.8. Project for the Implementation of a Telematic Network
- 7.8.1. Obtaining the information
- 7.8.2. Plan
  - 7.8.2.1. System Sizing
  - 7.8.2.2. Installation Site Plans and Schematics
- 7.8.3. Technical Design Specifications
- 7.8.4. Technical Design Specifications

7.9. Structured Cabling Case Study
- 7.9.1. Introduction
- 7.9.2. Structured Cabling Organizations and Standards
- 7.9.3. Mediums of Transmission
- 7.9.4. Structured Cabling
- 7.9.5. Physical Interface
- 7.9.6. Parts of Structured Cabling (Horizontal and Vertical)
- 7.9.7. Identification System
- 7.9.8. Case Study

7.10. Planning of Common Telecommunication Infrastructures
- 7.10.1. Introduction to ICT
- 7.10.2. Enclosures and Conduits
  - 7.10.2.1. Outdoor Zone
  - 7.10.2.2. Common Zone
  - 7.10.2.3. Private Zone
- 7.10.3. ICT Distribution Networks
- 7.10.4. Technical Project



Module 8. Mobile Communications Networks

8.1. Introduction to Mobile Communications Networks
- 8.1.1. Communications Networks
- 8.1.2. Classification of Communications Networks
- 8.1.3. The Radio-Electric Spectrum
- 8.1.4. Radio Telephone Systems
- 8.1.5. Cellular Technology
- 8.1.6. Evolution of Mobile Telephone Systems

8.2. Protocols and Architecture
- 8.2.1. Review of the Concept of Protocol
- 8.2.2. Review of the Concept of Communication Architecture
- 8.2.3. Review of the OSI Model
- 8.2.4. Review of the Architecture of TCP/IP Protocol
- 8.2.5. Structure of a Mobile Telephone Network

8.3. Principles of Mobile Communications
- 8.3.1. Radiation and Types of Antennas
- 8.3.2. Radiation and Antenna Types
- 8.3.3. Signal Propagation
- 8.3.4. Roaming and Handover
- 8.3.5. Multiple Access Techniques
- 8.3.6. Analog and Digital Systems
- 8.3.7. Portability

8.4. GSM Networks Review: Technical Characteristics, Architecture and Interfaces
- 8.4.1. GSM System
- 8.4.2. Technical Features of GSM
- 8.4.3. GSM Network Architecture
- 8.4.4. GSM Channel Structure
- 8.4.5. GSM Interfaces

8.5. Review of GSM and GPRS Protocols
- 8.5.1. Introduction
- 8.5.2. GSM Protocols
- 8.5.3. Evolution of GSM
- 8.5.4. GPRS

8.6. UMTS System. Technical Characteristics, Architecture and HSPA
- 8.6.1. Introduction
- 8.6.2. UMTS System
- 8.6.3. Technical Features of UMTS
- 8.6.4. UMTS Network Architecture
- 8.6.5. HSPA

8.7. UMTS System. Protocols, Interface and VoIP
- 8.7.1. Introduction
- 8.7.2. UMTS Channel Structure
- 8.7.3. UMTS Protocols
- 8.7.4. UMTS Interfaces
- 8.7.5. VoIP and IMS

8.8. VoIP: Traffic Models for IP Telephony
- 8.8.1. VoIP Introduction
- 8.8.2. Protocols
- 8.8.3. VoIP Elements
- 8.8.4. Real Time VoIP Transport
- 8.8.5. Packaged Voice Traffic Models

8.9. LTE System. Technical Features and Architecture. CS Fallback
- 8.9.1. LTE System
- 8.9.2. Technical Features of LTE
- 8.9.3. LTE Network Architecture
- 8.9.4. LTE Channel Structure
- 8.9.5. LTE Calls: VoLGA, CS FB and VoLTE

8.10. LTE Systems: Interfaces, Protocols and Services
- 8.10.1. Introduction
- 8.10.2. LTE Interfaces
- 8.10.3. LTE Protocols
- 8.10.4. LTE Services

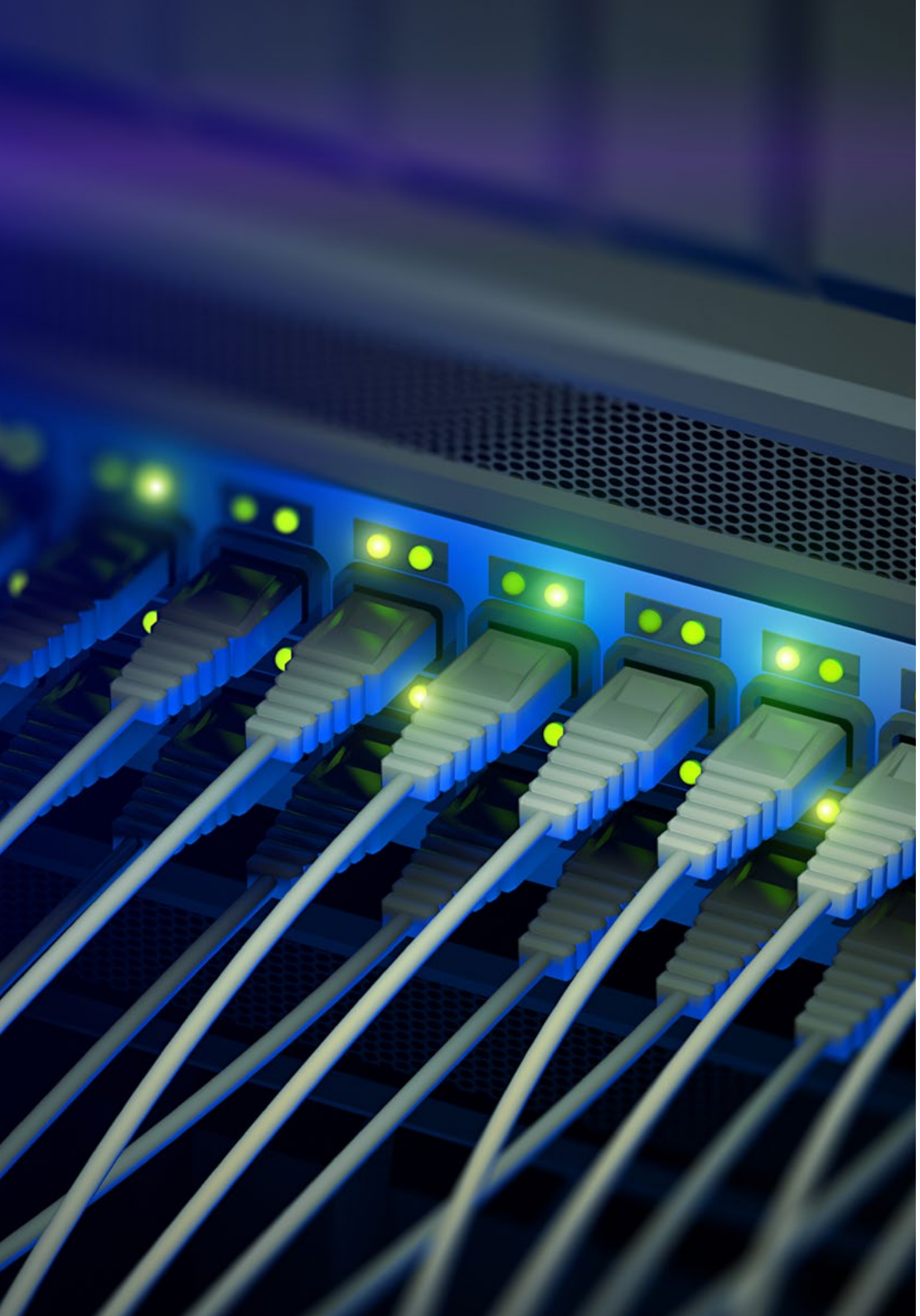
Module 9. Radio Networks and Services

9.1. Basic Techniques for Radio Networks
- 9.1.1. Introduction to Radio Networks
- 9.1.2. Basic Fundamentals
- 9.1.3. Multiple Access Communications (MAC) Techniques: Random Access (RA). MF-TDMA, CDMA, OFDMA
- 9.1.4. Radio Link Optimization: Fundamentals of Logical Link Control (LLC) Techniques HARQ MIMO

9.2. The Radio-Electric Spectrum
- 9.2.1. Definition
- 9.2.2. Nomenclature of Frequency Bands According to ITU-R
- 9.2.3. Other Nomenclatures for Frequency Bands
- 9.2.4. Division of the Radio-electric Spectrum
- 9.2.5. Types of Electromagnetic Radiation

9.3. Radio Communications Systems and Services
- 9.3.1. Signal Conversion and Processing: Analog and Digital Modulations
- 9.3.2. Digital Signal Transmission
- 9.3.3. DAB, IBOC, DRM and DRM+ Digital Radio System
- 9.3.4. Radio Frequency Communication Networks
- 9.3.5. Configuration of Fixed Installations and Mobile Units
- 9.3.6. Structure of a Fixed and Mobile Radiofrequency Transmitting Center
- 9.3.7. Installation of Radio and TV Signal Transmission Systems
- 9.3.8. Verification of the Operation of Emission and Transmission Systems
- 9.3.9. Maintenance of Transmission Systems

9.4. Multicast and End-to-End QoS
- 9.4.1. Introduction
- 9.4.2. IP Multicast in Radio Networks
- 9.4.3. Delay/Disruption Tolerant Networking (DTN). 6
- 9.4.4. E-to-E Quality of Service:
  - 9.4.4.1. Impact of Radio Networks on E-to-E QoS
  - 9.4.4.2 TCP on Radio Networks



9.5. Wireless Local Area Networks WLAN
- 9.5.1. Introduction to WLANs
  - 9.5.1.1. WLAN Principles
    - 9.5.1.1.1. How They Work
    - 9.5.1.1.2. Frequency Bands
    - 9.5.1.1.3. Security/Safety
  - 9.5.1.2. Applications
  - 9.5.1.3. Comparison between WLAN and wired LAN
  - 9.5.1.4. Health Effects of Radiation
  - 9.5.1.5. Standardization and Normalization of WLAN Technology
  - 9.5.1.6. Topology and Configurations
    - 9.5.1.6.1. Peer-to-Peer (Ad-Hoc) Configuration
    - 9.5.1.6.2. Configuration in Access Point Mode
    - 9.5.1.6.3. Other Configurations: Interconnection of Networks
- 9.5.2. The IEEE 802.11 Standard - WI-FI
  - 9.5.2.1. Architecture
  - 9.5.2.2. IEEE 802.11 Layers
    - 9.5.2.2.1. The Physical Layer
    - 9.5.2.2.2. The Link Layer (MAC)
  - 9.5.2.3. Basic WLAN Operation
  - 9.5.2.4. Assignment of the Radioelectric Spectrum
  - 9.5.2.5. IEEE 802.11 Variants
- 9.5.3. The HiperLAN Standard
  - 9.5.3.1. Reference Model
  - 9.5.3.2. HyperLAN/1
  - 9.5.3.3. HyperLAN/2
  - 9.5.3.4. Comparison of HiperLAN with 802.11a

9.6. Wireless Metropolitan Area Networks (WMAN) and Wireless Wide Area Networks (WWAN)
- 9.6.1. Introduction to WMAN. Features
- 9.6.2. WiMAX Features and Diagram
- 9.6.3. Wireless Wide Area Networks (WWAN) Introduction
- 9.6.4. Cellular Phone and Satellite Network

9.7. Wireless Personal Area Networks WPAN
- 9.7.1. Evolution and Technologies
- 9.7.2. Bluetooth
- 9.7.3. Personal and Sensor Networks
- 9.7.4. Profiles and Applications

9.8. Terrestrial Radio Access Networks
- 9.8.1. Evolution of Terrestrial Radio Access: WiMAX, 3GPP
- 9.8.2. 4th Generation Access Introduction
- 9.8.3. Radio Resources and Capacity
- 9.8.4. LTE Radio Carriers MAC, RLC and RRC

9.9. Satellite Communications
- 9.9.1. Introduction
- 9.9.2. History of Satellite Communications
- 9.9.3. Structure of a Satellite Communication System
  - 9.9.3.1. The Special Segment
  - 9.9.3.2. The Control Center
  - 9.9.3.3. The Ground Segment
- 9.9.4. Types of Satellite
  - 9.9.4.1. By Purpose
  - 9.9.4.2. According to its Orbit
- 9.9.5. Frequency Bands

9.10. Planning and Regulation of Radio Systems and Services
- 9.10.1. Terminology and Technical Characteristics
- 9.10.2. Frequencies
- 9.10.3. Coordination, Notification and Registration of Frequency Assignments and Plan Modifications
- 9.10.4. Interference
- 9.10.5. Administrative Provisions
- 9.10.6. Provisions Relating to Services and Stations

Module 10. Systems Engineering and Network Services

10.1. Introduction to Systems and Network Services Engineering
- 10.1.1. Concept of the IT System and Computer Engineering
- 10.1.2. The Software and its Features
  - 10.1.2.1. Software Features
- 10.1.3. Software Evolution
  - 10.1.3.1. The Dawn of Software Development
  - 10.1.3.2. The Software Crisis
  - 10.1.3.3. Software Engineering
  - 10.1.3.4. The Software Tragedy
  - 10.1.3.5. Software Updates
- 10.1.4. Software Myths
- 10.1.5. New Software Challenges
- 10.1.6. Software Engineering Professional Ethics
- 10.1.7. SWEBOK The Software Engineering Body of Knowledge

10.2. The Development Process
- 10.2.1. Problem Solving Process
- 10.2.2. The Software Development Process
- 10.2.3. Software Process vs. Life Cycle
- 10.2.4. Life Cycles (Traditional) Process Models
  - 10.2.4.1. Cascade Model
  - 10.2.4.2. Models Based on Prototypes
  - 10.2.4.3. Incremental Development Model
  - 10.2.4.4. Rapid Application Development (RAD)
  - 10.2.4.5. Spiral Model
  - 10.2.4.6. Unified Development Process or Rational Unified Process (RUP)
  - 10.2.4.7. Component-based Software Development

10.2.5. The Agile Manifesto Agile Methods
10.2.5.1. Extreme Programming (XP)
10.2.5.2. Scrum
10.2.5.3. Feature Driven Development (FDD)
10.2.6. Standards on Software Process
10.2.7. Definition of a Software Process
10.2.8. The Maturity of the Software Process
10.3. Agile Project Planning and Management
10.3.1. What is Agile?
10.3.1.1. History of Agile
10.3.1.2. Agile Manifesto
10.3.2. Agile Basics
10.3.2.1. The Agile Mindset
10.3.2.2. Alignment to Agile
10.3.2.3. Product Development Life Cycle
10.3.2.4. The "Iron Triangle"
10.3.2.5. Working with Uncertainty and Volatility
10.3.2.6. Defined Processes and Empirical Processes
10.3.2.7. The Myths about Agile
10.3.3. The Agile Environment
10.3.3.1. Operating Model
10.3.3.2. Agile Roles
10.3.3.3. Agile Techniques
10.3.3.4. Agile Practices
10.3.4. Agile Working Frameworks
10.3.4.1. eXtreme Programming (XP)
10.3.4.2. Scrum
10.3.4.3. Dynamic Systems Development Method (DSDM)
10.3.4.4. Agile Project Management
10.3.4.5. Kanban
10.3.4.6. Lean Software Development
10.3.4.7. Lean Start-up
10.3.4.8. Scaled Agile Framework (SAFe)
10.4. Configuration Management and Collective Repositories
10.4.1. Software Configuration Management Basics
10.4.1.1. What is Software Configuration Management?
10.4.1.2. Software Configuration and Software Configuration Elements
10.4.1.3. Baselines
10.4.1.4. Versions, Revisions, Variants and *Releases*
10.4.2. Configuration Management Activities
10.4.2.1. Configuration Identification
10.4.2.2. Control of Changes in Configuration
10.4.2.3. Generation of Status Reports
10.4.2.4. Configuration Audit
10.4.3. The Configuration Management Plan
10.4.4. Configuration Management Tools
10.4.5. Configuration Management in the Metrics v.3 Methodology
10.4.6. Configuration Management in SWEBOK
10.5. Systems and Services Testing
10.5.1. General Testing Concepts
10.5.1.1. Verify and Validate
10.5.1.2. Definition of Testing
10.5.1.3. Principles of Testing
10.5.2. Testing Approaches
10.5.2.1. White Box Testing
10.5.2.2. Black Box Testing
10.5.3. Static Testing or Reviews
10.5.3.1. Formal Technical Reviews
10.5.3.2. Walkthroughs
10.5.3.3. Code Inspections
10.5.4. Dynamic Tests
10.5.4.1. Unit or Unitary Tests
10.5.4.2. Integration Tests
10.5.4.3. System Tests
10.5.4.4. Acceptance Tests
10.5.4.5. Regression Tests

10.5.5. Alpha Tests and Beta Tests
10.5.6. The Test Process
10.5.7. Error, Defect and Failure
10.5.8. Automatic Testing Tools
10.5.8.1. Junit
10.5.8.2. LoadRunner
10.6. Modeling and Design of Network Architectures
10.6.1. Introduction
10.6.2. System Features
10.6.2.1. Description of Systems
10.6.2.2. Description and Features of Services 1.3: Performance Requirements
10.6.2.3. Operability Requirements
10.6.3. Requirements Analysis
10.6.3.1. User Requirements
10.6.3.2. Application Requirements
10.6.3.3. Network Requirements
10.6.4. Design of Network Architectures
10.6.4.1. Benchmark Architecture and Components
10.6.4.2. Architectural Models
10.6.4.3. System and Network Architectures
10.7. Modeling and Design of Distributed Systems
10.7.1. Introduction
10.7.2. Addressing and *Routing* Architecture
10.7.2.1. Addressing Strategy
10.7.2.2. Routing Strategy
10.7.2.3. Design Considerations
10.7.3. Network Design Concepts
10.7.4. Design Process
10.8. Platforms and Roll Out Environments
10.8.1. Introduction
10.8.2. Distributed Computer Systems
10.8.2.1. Basic Concepts
10.8.2.2. Computational Models
10.8.2.3. Advantages, Disadvantages and Challenges
10.8.2.4. Basic Concepts of Operating Systems
10.8.3. Virtualized Network Roll Outs
10.8.3.1. The Need for Change
10.8.3.2. Transformation of Networks: from " All-IP " to the cloud
10.8.3.3. Cloud Network Roll Out
10.8.4. Example: Network Architecture in Azure
10.9. E2E Performance: Delay and Bandwidth QoS
10.9.1. Introduction
10.9.2. Performance Analysis
10.9.3. QoS
10.9.4. Traffic Prioritization and Management
10.9.5. Service Level Agreements
10.9.6. Design Considerations
10.9.6.1. Performance Assessment
10.9.6.2. Relationships and Interactions
10.10. Network Automation and Optimization
10.10.1. Introduction
10.10.2. Network Management
10.10.2.1. Management and Configuration Protocols
10.10.2.2 Network Management Architectures
10.10.3. Orchestration and Automation
10.10.3.1. ONAP Architecture
10.10.3.2. Controllers and Functions
10.10.3.3. Politics
10.10.3.4. Network Inventory
10.10.4. Optimization

This program will allow you to advance in your career comfortably"

06

Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning.**

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"

You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.

The student will learn to solve complex situations in real business environments through collaborative activities and real cases.

A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

> *Our program prepares you to face new challenges in uncertain environments and achieve success in your career"*

The case method has been the most widely used learning system among the world's leading Information Technology schools for as long as they have existed. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the course, students will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

Relearning Methodology

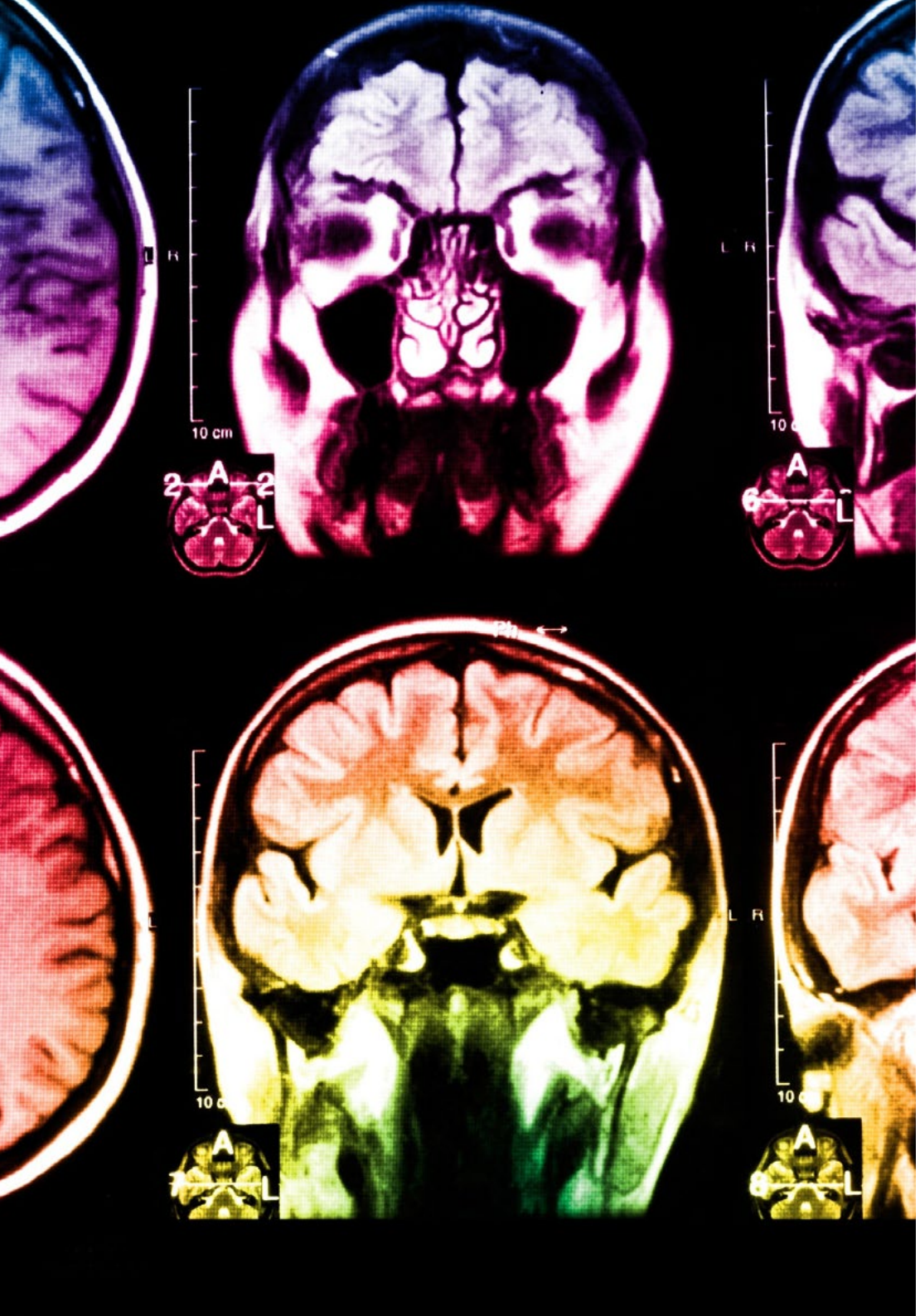
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

In 2019, we obtained the best learning results of all online universities in the world.

At TECH you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.

This program offers the best educational material, prepared with professionals in mind:

Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.

Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

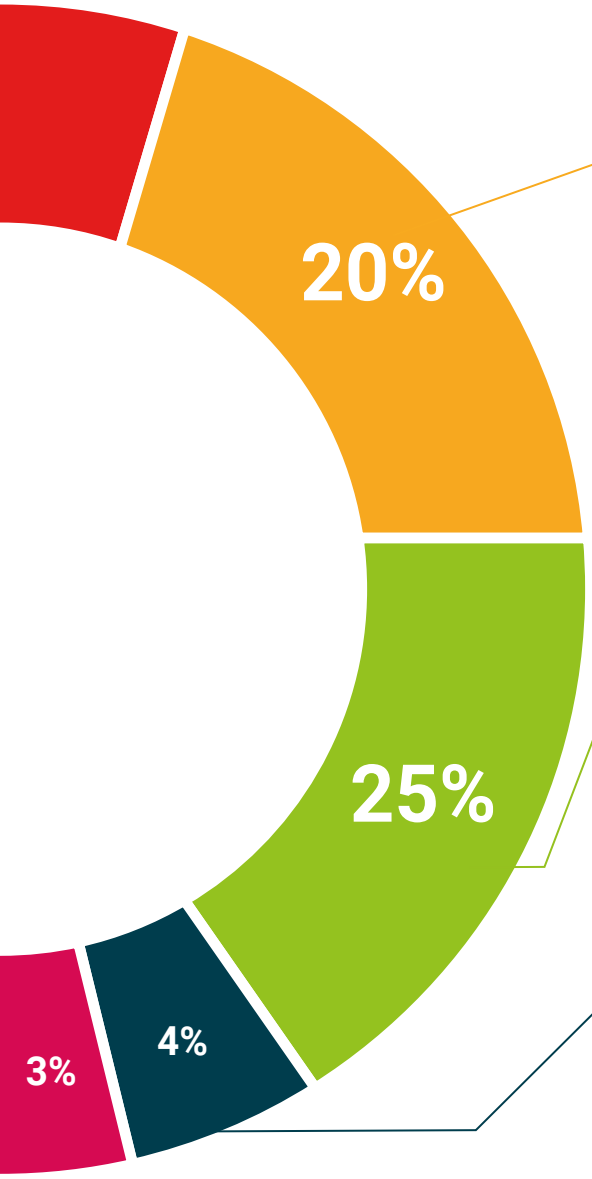
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

Practising Skills and Abilities

They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.

Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.



Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.

Interactive Summaries

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".

Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.

07

Certificate

The Professional Master's Degree in Telecommunications Engineering guarantees students, in addition to the most rigorous and up-to-date education, access to a Professional Master's Degree issued by TECH Global University.

Successfully complete this program and receive your Professional Master's Degree without having to travel or fill out laborious paperwork"

This program will allow you to obtain your **Professional Master's Degree diploma in Telecommunications Engineering** endorsed by **TECH Global University**, the world's largest online university.

TECH Global University is an official European University publicly recognized by the Government of Andorra (***official bulletin***). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Professional Master's Degree in Telecommunications Engineering**

Modality: **online**

Duration: **12 months**

Accreditation: **60 ECTS**


tech global university

Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

Professional Master's Degree in Telecommunications Engineering

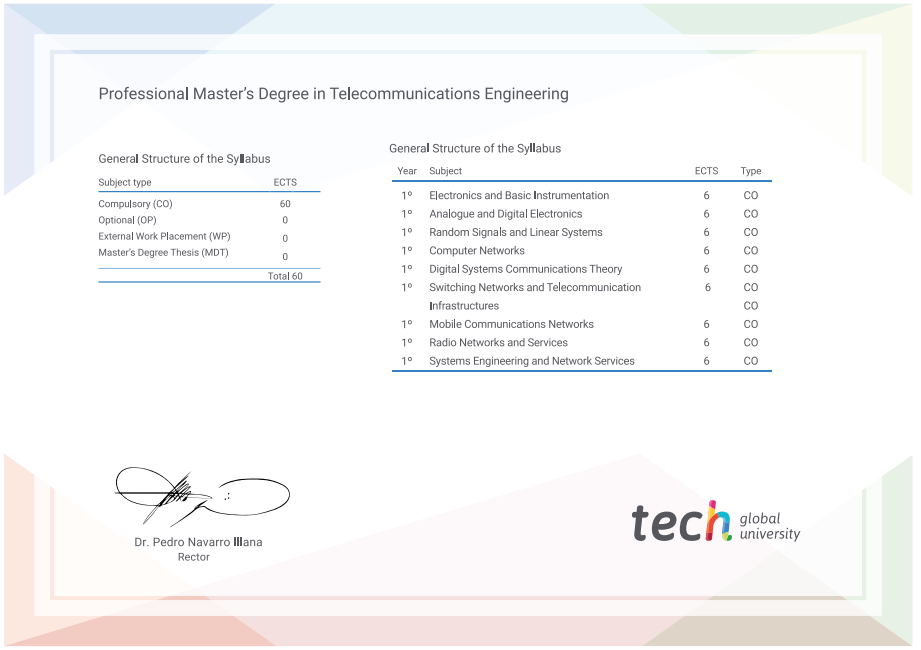
This is a program of 1,500 hours of duration equivalent to 60 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February of 2024

Dr. Pedro Navarro Illana
Rector

Unique TECH Code: AFWORD23S techtitute.com/certificates


Professional Master's Degree in Telecommunications Engineering

General Structure of the Syllabus

Subject type	ECTS
Compulsory (CO)	60
Optional (OP)	0
External Work Placement (WP)	0
Master's Degree Thesis (MDT)	0
	Total 60

General Structure of the Syllabus

Year	Subject	ECTS	Type
1º	Electronics and Basic Instrumentation	6	CO
1º	Analogue and Digital Electronics	6	CO
1º	Random Signals and Linear Systems	6	CO
1º	Computer Networks	6	CO
1º	Digital Systems Communications Theory	6	CO
1º	Switching Networks and Telecommunication Infrastructures	6	CO
1º	Mobile Communications Networks	6	CO
1º	Radio Networks and Services	6	CO
1º	Systems Engineering and Network Services	6	CO

Dr. Pedro Navarro Illana
Rector

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*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH Global University will make the necessary arrangements to obtain it, at an additional cost.

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Professional Master's Degree

Telecommunications Engineering

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Global University**
- Credits: **60 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Professional Master's Degree
Telecommunications Engineering

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