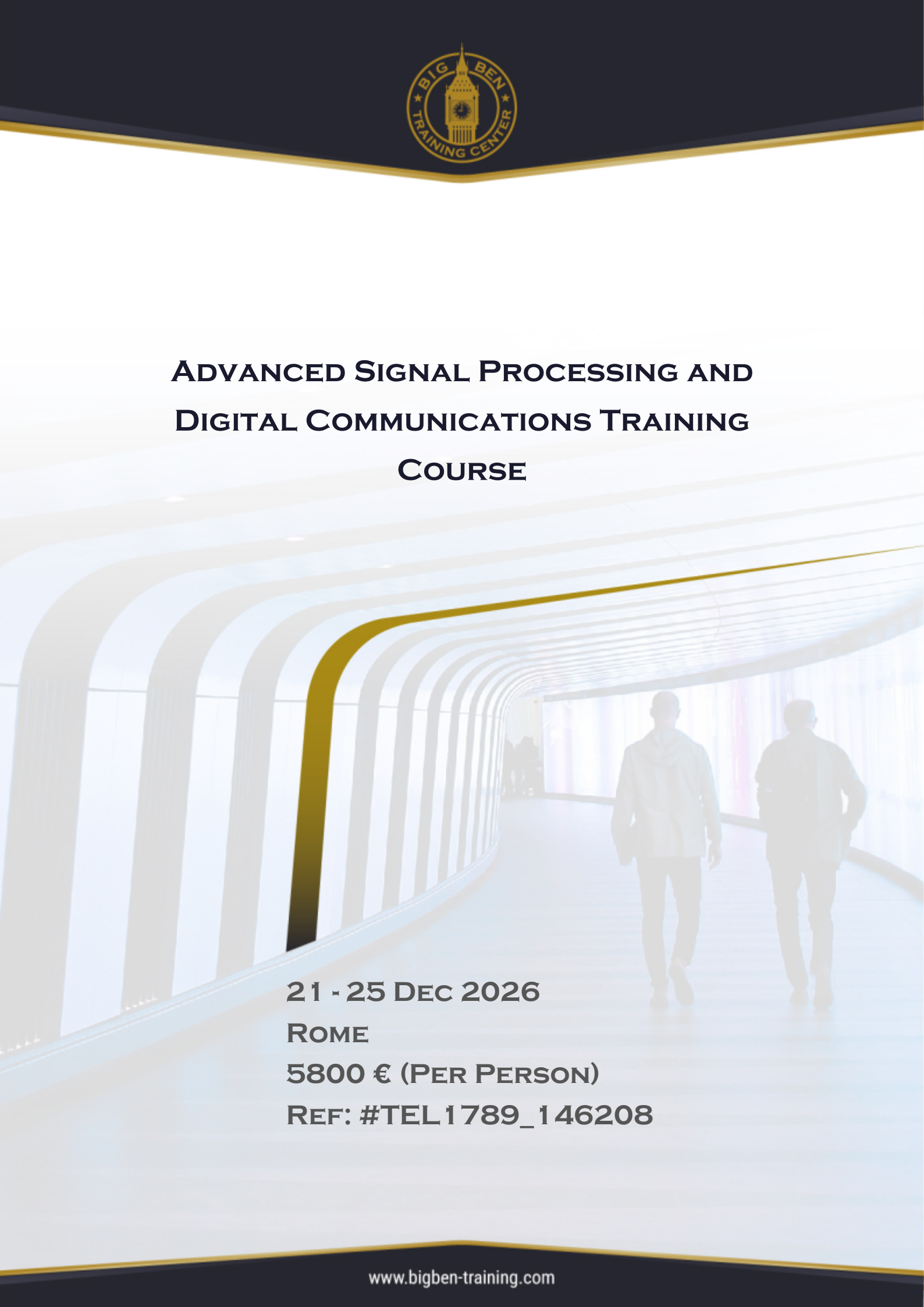
Advanced Signal Processing and Digital Communications Training Course



21 - 25 Dec 2026

Rome

5800 € (Per Person)

Ref: #TEL1789_146208

Course Introduction / Overview:

This comprehensive training course provides an in-depth exploration of the principles and practices of advanced signal processing and modern digital communication systems. In an era defined by ubiquitous connectivity and data-driven technologies, a profound understanding of how signals are processed, transmitted, and received is paramount. This program is meticulously designed to bridge the gap between fundamental theory and real-world application, drawing on established principles from seminal works like "Digital Communications" by John G. Proakis. Participants will delve into the mathematical foundations of signal analysis, explore sophisticated digital modulation and coding schemes, and examine the architecture of advanced communication technologies. BIG BEN Training Center has developed this course to empower professionals with the skills to design, analyze, and troubleshoot complex communication systems. The curriculum covers everything from Fourier analysis and filter design to cutting-edge topics like OFDM, MIMO systems, and the enabling technologies behind 5G and IoT networks, ensuring participants are well-equipped to tackle the challenges of next-generation wireless and wired communications.

Target Audience / This training course is suitable for:

- Telecommunications Engineers.
- Electrical Engineers.
- Systems Engineers.
- R&D Scientists and Researchers.
- Network Architects and Designers.
- Firmware and Embedded Systems Engineers.
- Signal Processing Specialists.
- Graduate students in engineering and computer science.
- Technical managers overseeing communication projects.
- RF Engineers.

Target Sectors and Industries:

- Telecommunications and Wireless Services.
- Aerospace and Defense.
- Consumer Electronics Manufacturing.
- Automotive and Autonomous Vehicle Technology.
- Semiconductor Industry.
- Information Technology and Networking.
- Governmental agencies and regulatory bodies.
- Satellite Communications.
- Medical Device Manufacturing.
- Research and Development Institutions.

Target Organizations Departments:

- Research and Development (R&D).
- Engineering and Design.
- Network Operations and Management.
- Product Development.
- Systems Integration and Testing.
- Quality Assurance.
- Technical Support and Field Engineering.
- Innovation and Technology Strategy.

Course Offerings:

By the end of this course, the participants will have able to:

- Analyze discrete-time signals and systems using Z-transforms and Fourier analysis.
- Design and implement digital filters for various signal processing applications.
- Evaluate the performance of different digital modulation schemes like QAM and PSK.
- Implement error detection and correction coding techniques to ensure data integrity.
- Understand the principles of channel modeling and equalization.
- Analyze advanced communication techniques such as OFDM and MIMO systems.
- Apply signal processing concepts to modern wireless standards like 5G and Wi-Fi 6.
- Develop models for communication systems to simulate and predict performance.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive, immersive, and practical, ensuring that participants gain both theoretical knowledge and hands-on competence. This course moves beyond traditional lectures by integrating a blended learning approach. Mornings will often focus on establishing a strong theoretical foundation through expert-led presentations and discussions, while afternoons are dedicated to practical application. Participants will engage in a series of guided problem-solving sessions, case studies of real-world communication system designs, and collaborative group exercises that simulate industry challenges. Interactive workshops will allow for the exploration of signal behavior, modulation performance, and the impact of channel impairments. The instructor will facilitate dynamic Q&A sessions and provide continuous, constructive feedback to foster a deep understanding of the material. This participant-centered approach ensures that theoretical concepts are immediately reinforced with practical context, enabling attendees to confidently apply their new skills in their professional roles upon completion of the course.

Course Agenda (Course Units):

Unit One: Fundamentals of Digital Signal Processing

- Introduction to signals and systems.
- Discrete-time signals and sampling theory.
- The Z-Transform and its applications.
- Fourier analysis for discrete-time signals.
- Digital filter design principles (FIR and IIR).
- Filter implementation structures and techniques.
- Introduction to random signals and noise.

Unit Two: Baseband Processing and Digital Modulation

- Pulse shaping and intersymbol interference (ISI).
- Baseband data transmission and equalization.
- Principles of digital modulation.
- Amplitude, Phase, and Frequency Shift Keying (ASK, PSK, FSK).
- Quadrature Amplitude Modulation (QAM).
- Signal constellations and bandwidth efficiency.
- Performance analysis of modulation schemes in noise.

Unit Three: Channel Coding and Information Theory

- Information theory fundamentals and channel capacity.
- Source coding techniques for data compression.
- Principles of error control coding.
- Linear block codes for error detection and correction.
- Cyclic codes and their properties.
- Convolutional codes and the Viterbi algorithm.
- Introduction to modern codes like Turbo and LDPC codes.

Unit Four: Advanced Wireless Communication Techniques

- Wireless channel modeling and characteristics.
- Spread spectrum and code division multiple access (CDMA).
- Orthogonal Frequency Division Multiplexing (OFDM).
- MIMO systems for spatial multiplexing and diversity.
- Synchronization techniques in communication systems.
- Carrier and timing recovery methods.
- Channel estimation and equalization in wireless systems.

Unit Five: Modern Communication Systems and Applications

- Architecture of 5G and beyond wireless networks.
- Signal processing for the Internet of Things (IoT).
- Communication protocols for low-power devices.
- Satellite communication system design principles.
- Optical communication systems overview.
- System-level design and performance trade-offs.
- Future trends in digital communications and signal processing.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

As we push towards 6G and beyond, how might the principles of quantum mechanics influence signal processing and secure communication, and what new trade-offs will emerge between data rate, security, and computational complexity?

What unique qualities does this course offer compared to other courses?

This training course distinguishes itself by providing a holistic and forward-looking perspective on signal processing and digital communications. Unlike programs that focus narrowly on either theoretical mathematics or specific vendor technologies, this course masterfully integrates both. It builds a robust foundation on timeless principles, ensuring participants understand the 'why' behind the formulas, before progressing to the most current and impactful applications in the industry, such as 5G, MIMO, and IoT. The curriculum is uniquely structured to demonstrate the direct lineage from fundamental concepts like Fourier analysis to the complex architecture of modern wireless systems. Furthermore, the course emphasizes system-level thinking, encouraging participants to analyze the intricate trade-offs between bandwidth, power, and reliability that define real-world engineering challenges. By focusing on practical problem-solving and strategic design considerations rather than just software proficiency, it equips attendees with a versatile and enduring skill set that transcends specific tools and prepares them for the next wave of innovation in communication technology.