1. **Training Title**: Doctoral Training in Electronics - Specialization: Embedded Systems Electronics
2. **Language of Instruction**: French / English
3. **General Overview of the Program**: The doctoral training in Embedded Systems Electronics aims to deepen knowledge in the design, modeling, and optimization of intelligent embedded systems. It prepares doctoral candidates for academic and industrial careers by providing advanced skills in embedded technologies, artificial intelligence, supervision, and integration of cutting-edge electronic systems.

The specific objectives include:

• Mastery of modern approaches to design and optimization of embedded systems.

• Development of innovative solutions for integrating intelligent sensors and actuators.

• Application of new communication technologies and artificial intelligence in embedded systems.

4. **Main Courses**:

• Research methodology course

• Introduction to didactics and pedagogy course

• ICT course

• Foreign language skills enhancement course

Remarks:

• The courses are taught by faculty members who are researchers.

• The weekly duration of the foreign language enhancement course is 2 hours.

• Some courses may be shared with other programs.

• The doctoral logbook is mandatory for validating achievements and will be integrated into the PROGRES platform.

5. **Admission Information**: Admission to the program is governed by Decree No. 991 of August 1, 2022. Eligibility criteria and the selection process are defined in Articles 4 to 8.

6. **Core Courses**:
   • Design and optimization of embedded systems
   • Embedded communication systems
   • Artificial Intelligence and machine learning
   • Advanced control and supervision techniques
7. **Advanced Topics**: The program allows for in-depth study in several areas, including:
   • Cyber-physical systems and the Internet of Things (IoT)
   • Optimization and control of embedded systems
   • Integration of bio-inspired algorithms for performance optimization
   • Design and development of intelligent embedded architectures
   • Integration of AI and machine learning algorithms in embedded systems
8. **Affiliated Laboratory**: Signal, System, and Artificial Intelligence Laboratory (2SAIL) https://www.univ-chlef.dz/labo/ssail/
9. **Research Teams**:

• Team 1: "Signal Processing and Advanced Communications"

The "Signal Processing and Advanced Communications" team focuses on developing advanced techniques for signal processing and digital data in telecommunications, information security, and detection. The main objective of this team is to push the boundaries of communication system performance by using theoretical information models to find optimal trade-offs between performance and complexity. This team works closely with industrial partners to apply the developed theories to real-world scenarios. Research topics include optical communications, next-generation wireless systems, speech and image processing, as well as wireless sensor networks. The team also seeks to integrate artificial intelligence methods to improve communication system performance in terms of signal processing and network optimization.

• Team 2: "Performance Optimization and Process Monitoring"

This team focuses on creating robust dynamic models and integrating intelligent sensors to minimize the use of costly and difficult-to-maintain sensors. Artificial

intelligence, through the use of learning algorithms and logical reasoning, helps improve anomaly detection and diagnosis without disrupting the normal operation of systems. Research in this field aims to develop solutions for system monitoring and diagnosis, using robust methods like observers to address measurement faults, modeling errors, and environmental disturbances. Intelligent control also enhances system reliability by using high-precision sensors and integrating fault-tolerant control (FTC) strategies and fault detection and isolation (FDI).

- **Team 3: "Control, Robotics, and Artificial Intelligence" (CORIA)**

The "Control, Robotics, and Artificial Intelligence" (CORIA) team's main mission is to develop hardware and software platforms to solve control problems of dynamic systems in various sectors such as industry, healthcare, the environment, and other socio-economic fields. The research aims to propose modern and effective solutions that address the specific challenges of complex dynamic systems, which are often nonlinear, under-actuated, multi-variable, and strongly coupled. In parallel, research also focuses on optimizing teleoperation, supervision, and robotics by integrating artificial intelligence and machine learning to improve system efficiency.