



UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

PHD PROGRAM IN INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

PHD PROGRAM IN INFORMATION AND COMMUNICATION TECHNOLOGY FOR HEALTH

PhD Course announcement**Title: Safety Critical Systems for Railway Traffic Management****Lecturer: Prof. Salvatore Barone**

University: Pegaso University

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Salvatore Barone is tenured assistant professor (RTT L. 240/2010, scientific area IINF-05/A - Information Processing Systems) at the Department of Computer Science and Technologies, Pegaso University. His research activities include the design of high-performance computing systems, embedded systems, and safety-critical systems. He participates to research activities of the Center for Artificial Intelligence and Extended Reality at Pegaso University. He is involved in many joint research activities between the Department of Electrical Engineering and Information Technology (DIETI), University of Naples Federico II and Rete Ferroviaria Italiana S.p.a. – Gruppo delle Ferrovie dello Stato (RFI).

Credits: 4**Overview**

This course provides a comprehensive introduction to railway signaling systems, safety standards, and software engineering practices for safety-critical domains. Through a blend of theory and hands-on laboratories, participants will gain both the conceptual understanding and practical skills needed to design, develop, and test fail-safe railway software in compliance with European standards.

By the end of the course, participants will be able to understand the fundamentals of railway signaling, including high-speed and high-capacity networks; analyze and design fail-safe computing architectures for railway applications; apply European safety standards (EN 50126, EN 50128, EN 50129) in software development processes; enforce coding standards such as MISRA-C in real-world projects; plan, execute, and evaluate software testing methodologies for safety-critical systems, from unit testing to hardware tracing. Doctoral Students are requested to bring their own notebook. Basic knowledge of high-level languages, such as C can facilitate the Doctoral Students, but are not strictly necessary.

There will be a final assessment.

Schedule

Lecture	Date	Time	Room	Topics	Lecturer
1	03/10/2025	14:30 – 17:00	Seminari DIETI	Railway signaling	Salvatore Barone
2	06/10/2025	09:00 – 12:00	Seminari DIETI D	Fail-safe computing architectures	Salvatore Barone
3	13/10/2025	9:00 – 12:00	Seminari DIETI	Safety Standards	Salvatore Barone
4	17/10/2025	13:00 – 16:00	Seminari DIETI D	Testing software in safety- critical domains	Salvatore Barone
5	27/10/2025	14:30 – 17:30	Seminari	Test on target machines	Salvatore Barone



DIETI				
	30/10/2025	9:00 – 12:00	Seminari DIETI	Assessment test Salvatore Barone

Content details

Lesson 1. Introduction: The railway system. Railway signaling, signaling on high-speed/high-capacity infrastructure. The European ERTMS/ETCS standard.

Lesson 2. Computing Architectures: Fail-safe computing architectures for railway applications: real-time system, redundant architectures, 2oo2 architectures, consensus managing, vital and fail-safe output. The Eulynx Initiative for the European interoperability of computer-based interlocking systems.

Lesson 3. Safety Standards: principles of EN 50126, EN 50128 and EN 50129 standards. Software artifacts and V model. Agile methodologies in the railway domain. The fundamental role of coding standards for programming languages. MISRA C at a glance. **Laboratory:** MISRA-C hands on.

Lesson 4. Testing software in safety-critical domains: the EN-50128 perspective (Part 1). Testing methodologies from the EN 50128 perspective. Defining tests for requirements coverage; test specifications; test implementation; coverage metrics. Automatic generation of unit tests. **Laboratory:** testing SIL-0/2 software: a case study (unit testing on Linux Systems).

Lesson 5. Testing software in safety-critical domains: the EN-50128 perspective (Part 2). Test on target machines. Non-invasive testing methodologies. Hardware tracing. The ARM tracing infrastructure. Tracing capabilities in Risc-V and Intel CPUs. **Laboratory:** The Lauterbach environment. Testing and tracing on ARM devices using the Lauterbach Trace-32.

Participants are requested to send an e-mail to salvatore.barone@unipegaso.it by 26/09/2025, with the following information: Student name and surname, name of the PhD course, PhD cycle. The course is conducted on-site. However, students pursuing their PhD period abroad (for research purposes) have the option to request remote attendance via MS Teams.

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