HOW TO PARTICIPATE
In order to apply for this course please click the link below:

https://www.polimi.it/index.php?id=5782&uid=4852&L=1

and insert your application as requested.
The deadline for the application is **25 January 2021.**

Minimum number of participants: 10
Maximum number of participants: 30

Below 10 participants in presence the course will be switched online.

Admission to the course follows a first-come, first-served basis. Once the course is confirmed, the applicant receives a communication from the organization with all information on how to proceed with the payment by bank transfer and invoicing.

LOCATION
It will be held **in hybrid setting (both physical and virtual attendance is allowed)** at the Department of Energy - Politecnico di Milano, Campus Bovisa La Masa, 20156, Milano. If at the moment of the course opening Italian government or **institutional restrictions** related to the Covid Pandemic will not permit the physically attendance, the course will be held **just online** with the same schedule.

In compliance with the italian Law, as of October 2021, to maintain adequate health and safety protection, university staff and students accessing University premises must have a valid COVID-19 green certification (Green pass).
Instructions to obtain a Green Pass/EU Digital Covid Certificate can be found HERE (https://covid.ats-milano.it/?q=informativa_certificazione_verde_covid19)

DELIVERY STRUCTURE
Dipartimento di Energia – Politecnico di Milano

COURSE DIRECTORS
Prof. Enrico Zio - Department of Energy, Politecnico di Milano
Prof. Piero Baraldi – Department of Energy, Politecnico di Milano

DURATION
5 days, 7-11 February 2022

REGISTRATION FEE:
€ 2500 (full registration fee)
€ 1200 (PhD students)
PHD STUDENTS SHOULD ATTACH TO THE REGISTRATION FORM THE CERTIFICATE OF ENROLLMENT IN THE PHD PROGRAM OF THEIR UNIVERSITY.

SCHOLARSHIP
The European Safety and Reliability Association (ESRA, www.esrahomepage.eu) supports the course with two scholarships to be awarded to PhD students. Scholarships will be assigned considering the affinity of the research to the topics of the course, the quality of the CV and the number and impact of publications in the field.
IF YOU ARE INTERESTED, PLEASE ATTACH YOUR CV TO THE REGISTRATION FORM.

COURSE PROGRAM CHAIR
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POLITECNICO MILANO 1863
DIPARTIMENTO DI ENERGIA

RAM&PHM 4.0: Advanced methods for Reliability, Availability, Maintainability, Prognostics and Health Management of industrial equipment

XXIV Edition
7 - 11 February, 2022

Organizers:
Laboratory of Analysis of Signals and Analysis of Risk (LASAR) (www.lasar.polimi.it)
Energy Data and Information Lab (EDILAB)

Sponsorship:
ESRA (European Safety and Reliability Association)

Support:
ARAMIS Srl, Milano, Italy
IEEE – Reliability Society, Italian Chapter, Italy
MINES ParisTech, PSL Research University, CRC, Sophia Antipolis, France

COURSE PARTICIPANTS

The course is mainly dedicated to control, process, quality and maintenance engineers, asset managers, data scientists, data miners, researchers and PhD students in the areas of Reliability, Availability, Maintainability (RAM), and fault diagnostics and Prognostics and Health Management (PHM).

TRAINING FORMAT

A part of the course is devoted to lectures on advanced methods for the availability, reliability and maintainability (RAM) analysis of complex systems, and Prognostics and Health Management (PHM) for condition-based and predictive maintenance. Monte Carlo Simulation, nonlinear regression and data analytics (Principal Component Analysis, Auto-Associative Kernel Regression, Artificial Neural Networks, Ensemble Systems, Deep Learning, Convolutional Neural Networks, Reservoir Computing, Particle Filtering) are illustrated. Approaches for strategic maintenance planning (reliability-centered and prescriptive) are discussed. Another important part of the course consists of hands-on sessions in which the participants directly apply the methods explained in the lectures to practical case studies (MATLAB and/or PHYTON will be used).

Finally, in the last part of the course, real applications of the advanced methods illustrated in the course are presented. The applications range from Monte Carlo Simulation for system availability analysis to the use of regression and classification techniques for fault detection, to classification and prognostics for condition-based, predictive and prescriptive maintenance management.

Lectures are held in English. All participants will receive a complete set of the presentation slides with specific examples and case studies, selected reference lists and resources in electronic format.

CERTIFICATE OF ATTENDANCE

At the end of the course, the participants will receive a certificate of attendance, provided that they have attended at least 80% of the course lectures and that they have filled in the anonymous participant evaluation questionnaires.

MISSION AND GOAL

In recent years, the volume of data and information collected by the industry has been growing exponentially, and more sophisticated and performing analytics have been developed to exploit their content.
This offers great opportunities for optimized, safe and reliable productions and products, including optimal predictive maintenance for “zero-defect” production with reduced warehouse costs, and improved system availability, with “zero unexpected shutdowns”.
To grasp these opportunities, new system analysis capabilities and data analytics skills are needed. The goal of this course is to provide participants with advanced methodological competences, analytical skills and computational tools necessary to effectively operate in the areas of reliability, availability, maintainability, diagnostics and prognostics of modern industrial equipment and systems. The course presents advanced techniques and analytics to improve safety, increase efficiency, manage equipment aging and obsolescence by setting up condition-based, predictive and prescriptive maintenance and asset management strategies.

CONTENTS

Methods:
Statistical techniques for system reliability/availability estimation (Monte Carlo Simulation);
Machine learning techniques for PHM (Principal Component Analysis, Auto-Associative Kernel Regression, Artificial Neural Networks, Deep Learning, Ensemble Systems);
Bayesian filtering for prognostics (Particle Filtering);
Approaches for maintenance strategic planning (Reliability-centered and prescriptive maintenance).

Exercise sessions:
Monte Carlo simulation for system reliability/availability analysis;
Auto-Associative Kernel Regression for fault detection; Artificial Neural Networks for component fault diagnostics and prognostics; Particle Filter for failure time prediction;

Applications:
Monte Carlo Simulation for system reliability/availability analysis and condition-based maintenance management; Regression and classification techniques for fault detection, classification and prognosis in industrial equipment.

LECTURERS (to be confirmed)

Ibrahim Ahmed (PhD)
Assistant Professor
Department of Energy**,** Politecnico di Milano

Piero Baraldi (PhD)
Full Professor
Department of Energy**,** Politecnico di Milano

Michele Compare (PhD)
CEO
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