

Course Syllabus for
Smart and Sustainable Industry PhD Program
 (years 2024-25 /2025-26)

Course title	Photonics for Industry 4.0
Scientific Discipline Sector	ING-INF/02
Hours of instruction	20 hours
CFU	2 CFU
Semester	First
Goal	<p>The course focuses on the different photonic technologies that are utilized in advanced manufacturing and high-performance communication within the Smart Industry. Participants will gain knowledge about recent photonic technologies for the Smart Industry and beyond, as well as the use of microcontrollers in creating basic lidar-type devices.</p> <p>The course will comprise theoretical lectures and hands-on workshops conducted in small groups, which will encourage active participation and collaborative problem-solving.</p>
Syllabus	<ul style="list-style-type: none"> • Introduction to Photonic applications in Industry 4.0 and beyond. • Light Detection and ranging principles and applications. • Light-based manufacturing: Laser additive and subtractive advanced fabrication. Semantic segmentation for automatic feature recognition in additive manufacturing. • Photonics for Automotive. Augmented reality principles. • Introduction to wireless optical communication, free-space optics and light fidelity (LiFi) • Arduino-like microcontrollers for smart industry • Hands-on workshops: practical realisation of a lidar-like prototype device employing Arduino microcontrollers and time-of-flight sensors for smart industry applications
Bibliography	<ul style="list-style-type: none"> • LiDAR technologies and systems, P. McManamon, SPIE, 2019. • T. Masood and J. Egger, "Augmented Reality: Focusing on Photonics in Industry 4.0," in IEEE Journal of Selected Topics in Quantum Electronics, vol. 27, no. 6, 2021, doi: 10.1109/JSTQE.2021.3093721. • Optical Wireless Communications - An Emerging Technology, M. Uysal, C. Capsoni, Z. Ghassemlooy, A. Boucouvalas, E. Udvary, Springer International Publishing, 2016
Examination method	The exam will consist of a project work, with the completion of a prototype, that enables students in small groups to actively experiment with some aspects of the contents learned during a course.