

**Course Syllabus for  
Smart and Sustainable Industry PhD  
(2023-24)**

<b>Course title</b>	<b><i>Xtended Realities for Industry 4.0</i></b>
<b>Scientific Discipline Sector</b>	ING-IND-15
<b>Hours of instruction</b>	20 hours
<b>CFU</b>	2 CFU
<b>Semester</b>	First semester
<b>Goal</b>	Quickly introduce the researchers to the Augmented, Virtual, and Mixed technologies providing the key concepts and methods, and by a hands-on practical laboratory. The goal is to explore and envisions new and disruptive research domains and applications.
<b>Syllabus</b>	<p>Methods (1CFU)</p> <ol style="list-style-type: none"> <li><b>Next-Gen interfaces (4 h, 0.5 CFU):</b> Milgram continuum, AR vs. VR, trends, AR-enabling Technologies, Virtual-Digital combiner (Spatially Augmented Reality, Spatial see-through display, Head- up displays, Handheld Displays, Video see-through HMD, Optical see-through HMD, retinal), AR tracking, AR UI, AR applications.</li> <li><b>Mixed Reality experiences development (4 h, 0.5 CFU):</b> concepts, workflow, architecture, editor simulation and deployment, authoring, scenes, object hierarchy, assets, import process, rendering pipeline, object, components, scripts, Troubleshooting.</li> </ol> <p>Laboratory (1CFU)</p> <ol style="list-style-type: none"> <li><b>Unity 3D Basics (4 h, 0.5 CFU):</b> installation, configuration, start a new project, interface layout, play-mode, creation and navigation of the scene, graphics primitives, hierarchy, project folder explorer and asset store integration.</li> <li><b>AR authoring (4 h, 0.5 CFU):</b> Setting cameras, tracking and lights, import CAD files with materials, Physics Engine, Gravity, Colliders, Triggers, Rigid bodies, Build and deploy AR application.</li> </ol>
<b>Bibliography</b>	<ul style="list-style-type: none"> <li>Augmented Reality: Principles and Practice, by Dieter Schmalstieg, Tobias Höllerer Released June 2016 Publisher(s): Addison-Wesley Professional ISBN: 9780133153217</li> <li>Unity 3D online Documentation, <a href="https://docs.unity3d.com/Manual/index.html">https://docs.unity3d.com/Manual/index.html</a></li> </ul>
<b>Examination method</b>	Final project presentation and oral discussion.