UNIVERSITÀ DI PAVIA

## Anno Accademico 2021/2022

# WATER-ENERGY SUSTAINABLE URBAN DEVELOPMENT

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| **Enrollment year** | 2017/2018 |
| **Academic year** | 2021/2022 |
| **Regulations** | DM270 |
| **Academic discipline** | ICAR/03 (ENVIRONMENTAL AND HEALTH ENGINEERING) |
| **Department** | DEPARTMENT OF CIVIL ENGINEERING AND ARCHITECTURE |
| **Course** | |
| **Curriculum** | PERCORSO COMUNE |
| **Year of study** | 5° |
| **Period** | 2nd semester (07/03/2022 - 17/06/2022) |
| **ECTS** | 6 |
| **Lesson hours** | 45 lesson hours |
| **Language** | English |
| **Activity type** | WRITTEN AND ORAL TEST |
| **Teacher** | CAPODAGLIO ANDREA GIUSEPPE (titolare) - 3 ECTS<br>CAPODAGLIO ANDREA GIUSEPPE (titolare) - 3 ECTS |
| **Prerequisites** | Fundamentals of Sanitary-Environmental Engineering |
| **Learning outcomes** | The students will learn the latest advancement in environmental planning and technology leading to fully sustainable built or retrofitted future water centric communities, focusing on saving water, achieving net zero carbon emisions by relying on water conservation and renewable energy, and recovering, in an integrated way, energy and resources from used (waste) water and solid waste. |
| **Course contents** | Topics covered:<br>Historic Paradigms of Water Management and Sewerage<br>Urban Metabolism and its Footprints<br>The Fifth Paradigm of the Cities of the Future<br>Definition of urban sustainability for water<br>Sustainable and Resilient Urban Drainage and Green Infrastructure |

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| | Traditional urban storm water drainage<br>Green, sustainable and resilient urban drainage<br>Water Demand, Conservation, Reclamation and Reuse<br>Closing the cycle – from linear water system to recycle and reuse<br>Water – sewage – water cycle – an old concept of safe reuse<br>Substitute and supplemental water sources<br>Rainwater harvesting, stormwater, grey water, desalination<br>Uses and required quality (fit for use) of reclaimed water<br>Recycle<br>Smart water community concepts of integrated reuse and recycle<br>Treatment and Resource Recovery Processes<br>The anaerobic bioprocesses as core technology<br>Nutrient recovery processes<br>Membrane filtration - Membrane bioreactors<br>Reverse Osmosis<br>Waste to energy<br>Co-digestion and pyrolysis<br>Water/Energy Nexus<br>GHGs and energy footprint<br>Renewable energy sources and savings in urban settings<br>Renewable sources of energy<br>Energy and other resources from used water and organic solids<br>Syngas and biofuels<br>Methane production in anaerobic process units (reactors and digesters)<br>Microbial fuel cells and electrochemically assisted microbial reactors BEAMR)<br>Hydrogen fuel cells<br>Phosphorus and ammonium recovery<br>Water and energy recovery in distributed systems<br>Integrated resource recovery facility |
| **Teaching methods** | Frontal Lectures |
| **Reccomended or required readings** | Lecturer's materials |
| **Assessment methods** | Oral examination |
| **Further information** | Course notes will be available on Kiro |
| **Sustainable development goals - Agenda 2030** | $lbl_legenda_sviluppo_sostenibile |