



WASTE ENERGY RECOVERY	
Enrollment year	2019/2020
Academic year	2020/2021
Regulations	DM270
Academic discipline	ICAR/03 (ENVIRONMENTAL AND HEALTH ENGINEERING)
Department	DEPARTMENT OF CIVIL ENGINEERING AND ARCHITECTURE
Course	ENVIRONMENTAL ENGINEERING
Curriculum	Energie rinnovabili
Year of study	2°
Period	2nd semester (08/03/2021 - 14/06/2021)
ECTS	3
Lesson hours	25 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	COLLIVIGNARELLI MARIA CRISTINA (titolare) - 3 ECTS
Prerequisites	Waste and wastewater treatment plant design. Waste treatment and contaminated sites remediation.
Learning outcomes	This course deals with the design and the management of waste treatment/disposal plant for energy recovery.
Course contents	<p>REGULATORY ASPECTS</p> <p>Overview.</p> <p>Municipal solid waste production and energy recovery situation in Europe and in Italy.</p> <p>Regulatory aspects concerning energy recovery.</p> <p>BIOCHEMICAL PROCESSES</p> <p>General aspects.</p> <p>Influence of parameters on biochemical processes.</p> <p>Biochemical processes with attached and suspended biomass, hybrid and multi-stage processes.</p>

	<p>Design criteria.</p> <p>THERMOCHEMICAL PROCESSES</p> <p>Overview.</p> <p>Gasification.</p> <p>Pyrolysis.</p> <p>The use of pyrolysis/gasification products.</p> <p>RECOVERY OF MATTER AND ENERGY FROM SEWAGE SLUDGE</p> <p>Sludge management issues.</p> <p>Main technologies for minimization of sludge production.</p> <p>Recovery of matter and energy from sewage sludge.</p> <p>Biogas production assessment from anaerobic digester.</p> <p>Characteristics and use of biogas.</p> <p>Thermal drying of sewage sludge: theoretical principles and design criteria.</p> <p>RENEWABLE ENERGY</p> <p>Overview.</p> <p>Renewable energy sources: definition, regulatory aspects.</p> <p>Biomass energy: definition, classification, legislation.</p> <p>Environmental impact of biomass energy plants.</p> <p>A visit to a waste recovery facility is scheduled.</p>
Teaching methods	<p>Lectures (hours/year in lecture theatre): 21</p> <p>Practical class (hours/year in lecture theatre): 5</p> <p>Practicals / Workshops (hours/year in lecture theatre): 3</p>
Reccomended or required readings	<p>A copy of the course slides will be distributed.</p> <p>De Fraja Frangipane E., Vismara R.. Recupero di materia ed energia da rifiuti solidi - Collana Ambiente Volume 19. Cipa Editore.</p> <p>Bertanza Giorgio, Foladori Paola, Guglielmi Lorena (2018). Recupero di materia e di energia negli impianti di depurazione. Maggioli Editore - Ambiente & Territorio.</p>
Assessment methods	<p>The exam consists of an oral test.</p>
Further information	<p>Experimental theses are available on the topics explained in the course. For further information, please contact the Professor via email.</p>
Sustainable development goals - Agenda 2030	<p>\$lbl legenda sviluppo sostenibile</p>