



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
MASTER'S DEGREE (MSC)	CHEMICAL ENGINEERING
SUBJECT	APPLIED CHEMISTRY FOR ENVIRONMENTAL PROTECTION
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50352-Ingegneria chimica
CODE	01817
SCIENTIFIC SECTOR(S)	ING-IND/22
HEAD PROFESSOR(S)	SCAFFARO ROBERTO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	108
COURSE ACTIVITY (Hrs)	42
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	<p>SCAFFARO ROBERTO</p> <p>Monday 10:00 12:00 Viale delle Scienze Edificio 6DICAM (ex Dip. Ingegneria Chimica) III piano, stanza 323</p> <p>Tuesday 10:00 12:00 Viale delle Scienze Edificio 6DICAM (ex Dip. Ingegneria Chimica) III piano, stanza 323</p> <p>Wednesday 10:00 12:00 Viale delle Scienze Edificio 6DICAM (ex Dip. Ingegneria Chimica) III piano, stanza 323</p> <p>Thursday 10:00 12:00 Viale delle Scienze Edificio 6DICAM (ex Dip. Ingegneria Chimica) III piano, stanza 323</p> <p>Friday 10:00 12:00 Viale delle Scienze Edificio 6DICAM (ex Dip. Ingegneria Chimica) III piano, stanza 323</p>

PREREQUISITES	In order to understand the topics and to easily achieve the learning goals of the teaching course, the student must be confident with the following subjects: Chemistry, Organic Chemistry, Applied Chemistry, Physics I and Physics II.
LEARNING OUTCOMES	<p>Knowledge and understanding ability The student, at the end of the teaching class, will possess knowledge of the main questions regarding environmental chemistry, with particular reference to water, air and soil pollution. The student will also be confident with the main treatment methods of pollutants. Particular attention will be paid to engineering question (design and verification) connected with the chemical and biochemical processes described</p> <p>Ability to apply knowledge and understanding The student will be able to describe and use different chemical and biochemical processes in order to evaluate the efficiency of depollution treatments and the magnitude of pollution phenomena. The student will also be able to correlate and synergistically connect the different processes studied in order to optimize the treatments to reduce pollutants.</p> <p>Judging autonomy The student will be able to interpret the raw data to evaluate the entity of water, air and soil pollution. The student will also be able to set design and verification problems inherent to environmental questions.</p> <p>Communication ability The student will acquire the capability to communicate and express problems inherent the course topics. The student will be able to sustain conversation about environmental subjects, to put into evidence problem related to the managements of pollutants and to propose solution and critically evaluating their effectiveness.</p> <p>Learning ability The student will learn the interactions between the chemical - biochemical processes and the engineering questions-purposes. This will allow continuing the studies in the engineering areawith improved autonomy and dynamism.</p>
ASSESSMENT METHODS	<p>The evaluation will be based on two tasks: a preliminary written composition followed by an interview. The written composition consist in a test containing three question to be answered openly in a maximum time of 30 minutes. This first task aims to evaluate some basic competences and problem solving capability of the student. The stimuli, well defined, clear and univocally interpretable allow formulating the answer in full autonomy. Moreover, they are structured in order to allow the comparability.</p> <p>The interview consists in at least three questions on topics described during the teaching classes. It aims to assess the competences and the knowledge learnt during the course. The questions will verify: acquired knowledge; elaboration capability; talking capability; ability to build autonomous connections not bound to the referring textbooks; capability to produce autonomous evaluations inherent the course topics; capability to understand the applications connected with the discipline areas; capability to connect the discipline topics with the referring professional and technological context.</p> <p>The final assessment is on a 30 basis according to the criteria reported below: 30-30+: excellent knowledge of the topics, excellent language and vocabulary, good analytical capability, the student is able to apply knowledge to solve the proposed problems 26-29: Good management of the topics, nice language and vocabulary, the student is able to apply knowledge to solve the proposed problems 24-25: basic knowledge of the topics, fair language and vocabulary, limited capability to apply autonomously knowledge to solve the proposed problems 21-23: the student does not show full management of the main topics while possessing the knowledge, satisfactorily language and vocabulary, poor capability to apply autonomously the acquired knowledge 18-20: minimal basic knowledge of the main topics and of the technical language and vocabulary, poor or no capability to apply autonomously the acquired knowledge.</p> <p>The exam will be not passed if the student will show a not acceptable knowledge of the topics. The exam and the related evaluation will be the same for non-attending students.</p>
EDUCATIONAL OBJECTIVES	<p>Aims The course gives the basic knowledge to understand the chemical and biochemical phenomena of environmental interest. In particular, there are described the chemical and biochemical processes interesting water and atmosphere and their main organic and inorganic pollutants. Also, there are described the depollution processes, especially water treatments. A part is devoted to illustrate the main classes of solid urban waste and industrial waste and, moreover, toxic and harmful waste. The related treatments are focused too. Water – properties of water and solutions. Water treatments: recall. Algae, bacteria, fungi, protozoa. Biochemical Processes: bacterial transformation of nitrogen, phosphorus, sulfur, alogenated compounds; Hydrolysis, reductions, dealogenations, dealkylations. Harmful and pollutant substances. Treatments of</p>

	<p>civil and industrial waste water: physical treatments, chemical treatments, biological treatments. Desalinization of marine and brackish water.</p> <p>Atmosphere – Composition and characteristics. Atmosphere dynamics: general circulations, winds, fronts, thermal inversion. Chemical and biochemical processes. Oxygen cycle. Nitrogen cycle. Solid particles. Air pollutants. Main depollution systems. Photochemical smog. Acid rains. Global warming.</p> <p>Combustibles and combustion – Solid, liquid, gas combustibles. Complete and incomplete combustions. Defective combustions. Combustion smokes. Basics on combustibles treatments. Non oil based energies.</p> <p>Toxic and harmful waste – Classification and characteristics. Main physical and chemical disposal processes. Basics of toxicology.</p> <p>Solid urban waste. – Composition and main treatments. Reuse, recycle, inertization, energy recover, controlled landfills.</p>
TEACHING METHODS	class lessons
SUGGESTED BIBLIOGRAPHY	<ul style="list-style-type: none"> - C. Brisi, Chimica Applicata, Levrotto e Bella, ogni edizione a partire dal (any edition since) 1997, ISBN: 8882180166 - G. Polizzotti, L'acqua, dispense - S.E. Manahan, Chimica Ambientale, Piccin, ogni edizione a partire dal (any edition since) 2000, ISBN: 8829913871 - S.E. Manahan, Environmental Chemistry, CRC Press, ogni edizione a partire dal (any edition since) 2017, ISBN 9781498776936

SYLLABUS

Hrs	Frontal teaching
11	Water
13	Atmosphere
5	Combustibles and Combustion
7	Toxic and harmful waste
6	Solid urban waste