UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
BACHELOR'S DEGREE (BSC)	ENVIRONMENTAL ENGINEERING
SUBJECT	ENVIRONMENTAL SANITARY ENGINEERING
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50278-Ingegneria ambientale e del territorio
CODE	03979
SCIENTIFIC SECTOR(S)	ICAR/03
HEAD PROFESSOR(S)	VIVIANI GASPARE Professore a contratto in quiescenza Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**VIVIANI GASPARE** Monday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Tuesday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Wednesday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Thursday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Friday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria

DOCENTE: Prof. GASPARE VIVIANI

PREREQUISITES	Basic knowledge of mathematics, physics, chemistry and hydraulics, allowing to understand the principles and processes analyzed in the course.
LEARNING OUTCOMES	Knowledge and understanding The student at the end of the course will have knowledge of the problems concerning the characteristics of water and wastewater, the main unit operations and processes for water and wastewater treatments, the pollution of water bodies and evaluation of restoring techniques, the waste management cycle. Applying knowledge and understanding The student will be able to define the layouts of plants for water and wastewater treatment, understand quality data of primary and sewage water, understand data regarding the quality of water bodies, identify appropriate technologies for waste management. Making judgments The student will be able to prepare the layouts of water and wastewater treatment plants, prepare monitoring plans of water and wastewater, evaluate quality status of water bodies and identify possible interventions of recovery, set the general scheme of a municipal solid waste management system. Communication skills The student will acquire the ability to communicate and express issues concerning the object of the course, such as the protection of water quality, with reference to interventions for the treatment of waste and wastewater. He will also be able to discuss the steps that constitute the integrated waste cycle and to define the necessary technical operations. Learning ability The student will learn ability in environmental engineering, with particular reference to water and wastewater treatment, restoring of receiving bodies and management of waste. Then he can access the master degree and attend master first level and advanced courses on specific environmental engineering issues.
ASSESSMENT METHODS	The exam will be oral with single test. The candidate has to answer at least three questions posed orally, on the elaborate developed during practical classes and on all topics included in the program and during the course. Final assessment aims to evaluate whether the student has knowledge and understanding of the topics, has acquired jurisdiction to interpret and independent judgment of concrete cases. The pass mark will be reached when the student shows knowledge and understanding of the subjects at least in general terms, and has domain expertise in order to solve concrete cases; It will also have presentation skills and argumentative as to allow the transmission of his knowledge to the examiner. Below this threshold, the examination will be insufficient. The more, however, the examinee with its argumentative and presentation skills can interact with the examiner, and the more his knowledge and application capabilities go into detail on the subject of discipline occurs, the more the assessment is positive. The assessment is carried out of thirty. Details of the valuation methods: Excellent - 30-30 cum laude Outcome: excellent knowledge of the topics, excellent properties of language, good analytical ability, the student is able to apply knowledge to solve problems proposed Very good - 26-29 Outcome: good control of the subjects, full ownership of the language, the student is able to apply knowledge to solve problems proposed Good - 24-25 Outcome: basic knowledge of the main topics, discrete properties of language, with limited ability to independently apply the knowledge to the solution of the proposed problems Satisfactory - 21-23 Outcome: the candidate does not have full command of the main teaching subjects but it has the knowledge, satisfactory property language, poor ability to independently apply the knowledge acquired Enough - 18-20 Outcome: minimum basic understanding of the main teaching and technical language issues, very little or no ability to independently apply the knowledge acquired Insufficient Outcome: the candidate does not have an acceptable knowledge of the contents of the topics covered in the teaching
EDUCATIONAL OBJECTIVES	Topics covered in the course are directed to provide the necessary training of students who intend to carry out their professional activities in the field of

	environmental engineering, with particular reference to the study of environmental pollution causes and design and management of intervention instruments for environment protection, such as water and wastewater treatment plants and systems for waste management.
TEACHING METHODS	The teaching will be organized by conducting lectures, exercises for the preparation of a project, in groups, and consequent revision of the topics, organization of technical visits.
SUGGESTED BIBLIOGRAPHY	Dispense e materiale bibliografico sono distribuiti durante il corso. Per maggiori approfondimenti, si suggerisce la consultazione dei seguenti testi: L. Bonomo: “Trattamenti delle acque reflue”. Ed. McGraw-Hill, 2008 C. Collivignarelli, S. Sorlini: “Potabilizzazione delle acque”. Ed. D. Flaccovio, 2009 L. Masotti: "Depurazione delle acque", ed. Calderini, Bologna, 2011 Metcalf & Eddy: "Ingegneria delle acque reflue: trattamento e riuso", ed. McGraw-Hill, 2006 G. Tchobanoglous, H. Theisen, S.A. Vigil: "Integrated solid waste management", ed. McGraw Hill, 1993

SYLLABUS

Hrs	Frontal teaching
9	Introduction to the course. The water cycle; supply systems; water transport, distribution and collection; transport systems of wastewater. Characteristics of water and wastewater. Sampling. Quality standards. Laws.
8	Treatment of supply water - Layout of water treatment plant for surface water. Coagulation, flocculation, sedimentation. Filtration. Disinfection. Sludge treatment.
20	Wastewater treatment – Layout of wastewater treatment plants. Screens. Grit removal. Oil removal. Clarification: theory; tanks typologies and project criteria. Biological treatments: principles of microbiology and biochemistry; aerobic and anaerobic processes; bacterial growth and substrate removal; hydrodynamics of reactors; biological reactors with and without waste return. Activated sludge processes: F/M ratio and volumetric load, sludge age; sizing of reactors volume, waste return flow rate and aeration systems. Biological ponds. Trickling filters. RBC. Sludge treatment: aerobic and anaerobic digestion; reactors typologies and design criteria; biogas production and recovery. Thickening. Sludge drying: drying beds; mechanical drying; sludge conditioning. final disposal of sludge. Disinfection. Imhoff tanks.
10	Pollution of the receiving bodies - Characteristics of receiving bodies with reference of pollution phenomena: rivers, lakes, groundwater, sea, soil. Discharges to the sea with marine outfalls: calculation methods and construction techniques. Eutrophication of lakes: basic, trophic status indicators, forecasting methods of the trophic state, rehabilitation techniques. Self-purification of rivers.
10	Management of waste - Classification of solid waste. Composition, sampling and analysis. Production of MSW. Collection. Transport. Recycling. Transfer stations. Landfill disposal: biochemical processes; leachate; biogas. Heat treatments: incineration; types of plant; energy recovery; characterization and control of solid and gaseous waste effluents; pyrolysis and gasification. Recycling plants. Production of compost and secondary solid fuel (SSF); quantity, quality and uses of recycled waste. Laws.

Hrs	Practice
24	Project of a municipal wastewater treatment plant: identification of the treatment layout, water line and sludge line, sizing of the main units, units assembly, hydraulic profiles. Visit of a wastewater treatment plant and a waste treatment / disposal plant.