



UNIVERSITÀ DEGLI STUDI DI PALERMO

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| DEPARTMENT | Ingegneria |
| ACADEMIC YEAR | 2023/2024 |
| MASTER'S DEGREE (MSC) | CIVIL ENGINEERING |
| SUBJECT | SANITARY AND ENVIRONMENTAL ENGINEERING |
| TYPE OF EDUCATIONAL ACTIVITY | C |
| AMBIT | 20913-Attività formative affini o integrative |
| CODE | 21866 |
| SCIENTIFIC SECTOR(S) | ICAR/03 |
| HEAD PROFESSOR(S) | MANNINA GIORGIO Professore Ordinario Univ. di PALERMO |
| OTHER PROFESSOR(S) | |
| CREDITS | 9 |
| INDIVIDUAL STUDY (Hrs) | 145 |
| COURSE ACTIVITY (Hrs) | 80 |
| PROPAEDEUTICAL SUBJECTS | |
| MUTUALIZATION | |
| YEAR | 1 |
| TERM (SEMESTER) | 2° semester |
| ATTENDANCE | Not mandatory |
| EVALUATION | Out of 30 |
| TEACHER OFFICE HOURS | MANNINA GIORGIO Tuesday 09:00 11:00 Dipartimento di Ingegneria - Area Idraulica e Ambientale piano 2° ed. 8 Wednesday 9:00 11:00 Dipartimento di Ingegneria - Area Idraulica e Ambientale piano 2° ed. 8 - Ufficio no. SO8P2130 |

DOCENTE: Prof. GIORGIO MANNINA

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| PREREQUISITES | Basic knowledge of: physics and chemistry, mathematics |
| LEARNING OUTCOMES | <p>Knowledge and ability to understand</p> <p>Features of water and wastewater; main unit and processes operations for water treatment; receiving water body pollution phenomena and mitigation measure strategies; waste management cycle.</p> <p>Ability to apply knowledge and understanding</p> <p>Communication skills</p> <p>Ability to pin down the best mitigation measures strategies and intervention for receiving water body safeguard with regards to treatment of the waters waste and water treatment of primary waters. Discuss the phases constitute the integrated waste cycle and to define the necessary technical operations.</p> <p>Learning ability</p> <p>Updating in the sanitary and environmental engineering, with particular reference to the treatment of the waters, the improvement of the bodies receptors and waste management. Access to the master's degree and participation in top-level master and master classes on topics specific environmental engineering</p> <p>Definition of schemes of installations for the purification and the purifying of water; interpretation of data quality of primary and wastewater; interpretation of data on the state of quality of water bodies; detection of suitable technologies for waste management.</p> <p>Making judgments</p> <p>Preparation of the general scheme of wastewater treatment plants and water purification; preparation of monitoring plans of primary water waste; analysis of the state of quality of water bodies and identification of possible recovery operations; setting the schematic diagram of a system of management of municipal solid waste.</p> |
| ASSESSMENT METHODS | The final exam, aimed at verifying the knowledge of the course content, consists of an oral test. The candidate during that test, first of all, will have to present the project of a sewage treatment plant object of the exercise. The evaluation will consist of a numerical rating scale, which provides, in the case of passing the exam, a minimum grade of pass (enough - 18) and a maximum rating (excellent 30 cum laude). In case of not passing the exam (insufficient) the applicant does not possess acceptable knowledge of the course content. |
| EDUCATIONAL OBJECTIVES | Topics covered in the course are directed to complete the preparation of engineering students who intend to carry out their professional activity in the fields environmental engineering, planning and management of territory, hydraulic engineering, chemical and mechanical plant. The course includes the conducting lectures and tutorials, the latter dedicated primarily the design of a wastewater treatment plant for urban waste water. |
| TEACHING METHODS | Lessons and exercises - Course given in english |
| SUGGESTED BIBLIOGRAPHY | <p>Dispense e materiale bibliografico sono distribuiti durante il corso. Per maggiori approfondimenti, si suggerisce la consultazione dei seguenti testi:</p> <p>C. Collivignarelli, G. Bertanza: "Ingegneria sanitaria-ambientale". Citta' Studi Edizioni, 2012</p> <p>L. Bonomo: "Trattamenti delle acque reflue". Ed. McGraw-Hill, 2008 Degremont: "Memento Technique de l'Eau" - ed. Degremont, Paris, 1989</p> <p>G. d'Antonio: "Trattamento dei rifiuti solidi urbani", ed. Maggioli, 1997 Metcalf & Eddy: "Ingegneria delle acque reflue: trattamento e riuso", ed. McGraw-Hill, 2006</p> <p>G. Tchobanoglous, H. Theisen, S.A. Vigil: "Integrated solid waste management", ed. McGraw-Hill, 1993</p> <p>Giorgio Mannina, George Ekama, Hallvard Ødegaard, Gustaf Olsson, 2018 Advances in Wastewater Treatment, International Water Association - IWA, ISBN13: 9781780409702.</p> <p>Giorgio Mannina, Ashok Pandey, Christian Larroche, How Yong Ng, Huu Hao Ngo 2020 current Developments in Biotechnology and Bioengineering Advanced Membrane Separation Processes for Sustainable Water and Wastewater Management - Case Studies and Sustainability Analysis ISBN 978-0-12-819854-4</p> |

SYLLABUS

| Hrs | Frontal teaching |
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| 1 | Course presentation |
| 2 | The water cycle and wastewater treatment scheme cycle |

SYLLABUS

| Hrs | Frontal teaching |
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| 5 | Wastewater treatment - Definitions. Sampling. Wastewater characteristics. setting of the treatment cycle. Grilling. Sieving. Sand separation. Oiling. Sedimentation: theory; types and design criteria. Biological treatments: principles of microbiology and biochemistry; aerobic processes and anaerobic; bacterial growth and removal of the substrate; hydrodynamics of reactors; biological reactors with and without cell recirculation. Processes Activated sludge: sludge load and load volume, age of the mud; calculation of volume of the reactor, the recirculation flow rate and the oxygen demand; ventilation systems; calculation of capacity of oxygenation. biological ponds. trickling filters. RBC. Sludge treatment: aerobic digestion and anaerobic; types and design criteria; production and recovery of biogas. Thickening. Sludge dewatering: drying beds; mechanical dehydration; conditioning. final disposal of sludge. biological nitrogen removal. phosphorus chemical removal. Disinfection. Imhoff tanks. Legislation/ law. |
| 3 | Treatment of water supply - Characteristics of natural waters. Water requirements depending on uses. Setting of the treatment cycle for surface water. clear signs and flocculationfiltration. Disinfection. Sludge treatment. Legislation. |
| 10 | Pollution of the receiving bodies - Characteristics of receiving bodies in respect of the pollution: surface receiving water bosies; docks at weak parts; ground water; sea; soil. Discharges to sea with pipeline sunderwater: calculation methods and construction techniques. Eutrophic lake: general,trophic status indicators, forecasting methods of the trophic state, rehabilitation techniques. self-purification ofwaterways. |
| 16 | Management of waste - Classification of solid waste. Composition, sampling and analysis. production ofRSU. Contribution. Collection. Recycling. Transport. transfer stations. landfillcontrolled: biochemical processes; leachate; biogas. Heat treatment: incineration; types of plant;energy recovery; characterization and control of solid and gaseous waste effluents; hints of pyrolysis andgasification. selection and retrieval systems: production of compost and waste-derived fuel(CDR); Quantity, quality and possibility of use of recycled products. Legislation. |
| 7 | Fundamentals of mathematical modeling; model classifications, Control Scheme: proportional, derivative, integral |
| Hrs | Practice |
| 16 | Preparation of the project of a sewage treatment plant of the waste water from a village:identification of the treatment regimen, water line and sludge line, sizing and designmain units, assembly of Units, hydraulic profiles.Technical visit to a sewage treatment plant of urban waste water. |
| 8 | Contaminated sites. Definitions. Soil quality criteria. Characterization of contaminated sites. Conceptual models. Risk analysis. Interventions for the reclamation and safety of soils and groundwater. Landfill remediation. The remediation of asbestos. legislation. |
| 12 | Software application for environmentl modelling: GPS-X Hrdomantics |