INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Environmental Engineering			Field of study	Environmental Technology		
Master in	Chemical Engineering			School	School of Technology and Management		
Academic Year	2019/2020	Year of study	2	Level	2-2	ECTS credits	6.0
Type	Semestral	Semester	1	Code	6362-354-2101-00-19		

Workload (hours)	162	Contact hours	T	TP	PL	TC	S	E	OT	O
			-	28	30	-	2	-	-	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tuturial; O - Other

Name(s) of lecturer(s): Ramiro José Espinheira Martins

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
To design and monitoring a plant for: drinking water production; domestic and industrial wastewater treatment; water quality control in leisure equipments (swimming pool, Spa).

Prerequisites

Before the course unit the learner is expected to be able to:
It doesn't have.

Course contents

Study of physical and chemical water parameters; natural water sources (superficial and underground waters). Sampling of waters. Physical and chemical treatments of drinkable and leisure waters, and liquid effluents. Design and implementation of autonomous treatment units and insert in a treatment layout employing biological processes (aerobic and anaerobic). Theoretical concepts and design of treatment facilities of domestic/industrial wastewaters by waste stabilization ponds technology.

Course contents (extended version)

1. Sampling of waters
   - Planning of sampling; types of samples.
   - Techniques for collecting and sampling of water (human consumption and wastewater).
   - Sampling material and cleaning. Conservation, transportation and preservation of samples.
   - Processes of sampling quality control.
2. Physical and chemical parameters of water.
   - Physical parameters: temperature, colour, turbidity, smell, taste, suspended and dissolved solids.
   - Settleable solids, conductivity and pH.
   - Organic chemical parameters: biochemical oxygen demand and chemical oxygen demand.
   - Oxidability to KMnO4, total organic carbon, total oxygen demand, oils and fats.
   - Detergents and volatile organic compounds.
   - Inorganic chemical parameters: alkalinity/acidity, hardness, iron and manganese and nitrogen.
   - Phosphorous, sulfates, chlorides, heavy metals, dissolved oxygen, redox potential and sulfurides.
3. Physico-chemical treatments of drinkable waters, of leisure and liquid effluents (design):
   - Waters to drink/leisure: aeration, removal of hardness, coagulation/flocculation and filtration.
   - Waters to drink/leisure: desinfection (chlorine, UV radiation and ozone).
   - Liquid effluents (domestic and industrial wastewaters). Pretreatment and primary treatment.
   - Design of treatment units : solids removal.
   - Equalization; neutralization.
   - Settling: discrete, flocculant and zonal; flotation; wastewater aeration.
4. Design of independent treatment units and insert in a biological treatment layout.
   - Microbial metabolism. Essential microorganisms in biological treatments
   - Microbial growth and kinetic.
   - Biological processes of wastewater treatment: aerobic (suspended and fixed biomass).
   - Biological processes of wastewater treatment: anaerobic (fixed biomass).
   - Removal of biological nutrients.
5. Theoretical concepts and design of wastewater treatment units by waste stabilization ponds.
   - Waste Stabilisation Ponds (WSPs). Anaerobic, facultative, maturation and aerated ponds.
   - Construction of WSPs. WSP costs.
   - Reuse of WSPs effluents. Operation and maintenance of WSPs. WSP effluent quality monitoring.

Recommended reading

1. Wastewater Engineering – treatment, disposal and reuse, (3rd Edition, revised by Tchobanoglous and Franklin Burton) Metcalf and Eddy, Inc. , McGraw-Hill (1991).
2. W. Wesley Eckenfelder, Jr. Industrial Water Pollution Control. McGraw-Hill International Editions, Environmental Engineering Series. Third Edition (2000).
3. Luiz Di Bernardo, Angela Di Bernardo Dantas. Métodos e Técnicas de Tratamento de Água, Editora Rima (2005).
4. Howard S Peavy, Donald R Rowe, George Tchobanoglous. Environmental Engineering. McGraw-Hill International Editions, Civil Engineering Series (1985).
5. R. Crites, G. Tchobanoglous. Small and Decentralized Wastewater Management Systems, WCB-Mcgraw Hill (1998).

Teaching and learning methods

Theoretical lessons: explanation of the theoretic concepts. Practice lessons: to analyse real or simulated problems and suggest a solution; discussion about the better solution. Not-presential period: Individual/group study and preparation of exercises and topics proposed.

Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final)
  - Practical Work - 20%
  - Intermediate Written Test - 20% (minimum mark of 7)
  - Final Written Exam - 60%

Language of instruction

English

Electronic validation

Ramiro José Espinheira Martins	Hélder Teixeira Gomes	Simão Pedro de Almeida Pinho	Paulo Alexandre Vara Alves
11-11-2019	12-11-2019	18-11-2019	13-12-2019