Code: 1531 **Water and Wastewater Technology**
Degree: 2nd cycle – Environmental Engineering
Stream: all
Curricular Year: 1st **Semester Course: 2nd**
Credits: 6 ECTS **Optional**
Language: Portuguese/English
Responsible: Elizabeth da Costa Neves Fernandes d'Almeida Duarte
Other lecturer(s): Ana Cristina Ferreira da Cunha Queda
Web Site: http://www.isa.utl.pt/home/node/3788

1. Contact hours
Lecture/Praticals 35 **Practicals/Laboratory** 35 **Others** 14 **Total** 84

2. Objectives:

The main objectives are to provide a comprehensive coverage of the fundamental principles and current practices in water processing, water distribution, wastewater collection, and wastewater treatment. The objective is to transfer knowledge of these subjects to persons interested in continuing their study in sanitary technology and engineering, and to persons interested in operation and maintenance of water and wastewater facilities. The subjects of water quality and pollution are also introductory to understand the reasons for the selection of processes in water and wastewater treatment. The students should be able to understand the interrelationships between individual unit operation and integration of systems as a whole

3. Progamme

1. Water/Wastewater Quality
1.1 Introduction
1.2 Monitoring
1.3 Measurement of Quality Parameters
1.4 Parameter Types
1.5 Key Water Quality Parameters
2. Flowsheeting
2.1 Introduction
2.2 Flowsheeting
2.3 Unit Processes
2.4 Flowsheet
3. Physical Processes
3.1 Introduction
3.2 Sedimentation
3.3 Flotation
3.4 Screening
3.5 Comminution
3.6 Filtration
3.7 Centrifugal Separation.
4. Chemical Processes
4.1 Introduction
4.2 Chemical solution Dosing
4.3 pH Adjustment
4.4 Precipitation
4.5 Coagulation and Flocculation
4.6 Oxidation and Reduction
4.7 Disinfection
4.8 Scale and Corrosion Inhibition
5. Sorption Processes
5.1 Introduction
5.2 Sorption
5.3 Adsorption
5.4 Ion Exchange Softening
5.5 Ion Exchange Deionisation
5.6 Mixed Bed Polishing
5.7 Ion Exchange in Wastewater
6. Biological Processes
6.1 Introduction
6.2 Biological Processes
6.2.1 Microbiology
6.2.2 Aerobic and Anaerobic Processes
6.2.3 Reactor Types
6.2.4 Treatment Systems
6.3 Aerobic Fixed Film Processes
6.3.1 Biofilm Formation
6.3.2 Trickling Filters

6.3.3 Rotating Biological Contactors
6.3.4 Biological Aerated Filters
6.3.5 Fluidised Beds
6.4 Aerobic Suspended Growth Processes
6.4.1 Activated Sludge
6.4.2 Sequencing Batch Reactors
6.4.3 Biological Nutrient Removal
6.4.4 Membrane Bioreactors
6.5 Anaerobic Processes
6.5.1 Microbiology and Biochemistry
6.5.2 Anaerobic Systems
6.5.3 Anaerobic Reactors
7. Membrane Processes
7.1 Introduction
7.2 Membranes and Membrane Processes
7.3 Membrane Structure
7.4 Membrane Manufacture
7.5 Membrane Process Parameters
7.6 Membrane Configuration
7.7 Membrane Process Operation
7.8 Membrane Applications
7.8.1 Dead-end. Microfiltration
7.8.2 Crossflow Microfiltration
7.8.3 Ultrafiltration
7.8.4 Nanofiltration
7.8.5 Reverse Osmosis
7.8.6 Electrodialysis
8. Key Parameters to evaluate the Performance of the different Water/Wastewater Treatment Technologies studied. Selection of the Best Available Techniques (BAT)
9. Case Study
10. Project

4. Bibliography:

Main Bibliography

- Duarte, E. (2008). *Manual de Tratamento águas, efluentes e resíduos*. Serviço de Reprografia do ISA
- Hammer, M.J., Hammer Jr., Mark J. (2001). *Water and Wastewater Technology*. 4th Ed. Prentice-Hall Inc. New Jersey
Judd S. J. and Jefferson B. (2003) *Membranes for Industrial Wastewater Recovery and Re-use* Elsevier, Oxford..
- - Metcalf & Eddy, Inc. (2003). *Wastewater Engineering: Treatment, Disposal and Reuse*. 4th ed., McGraw-Hill, Inc, New York.
- Stuetz, R. (2009). *Principles of Water and Wastewater Treatment Processes*. Series Editor: Tom Stephenson. IWA Publishing. London-New York

Other Bibliography

Gray N. F. *Biology of Wastewater Treatment.* (2004). 2nd ed., Imperial College Press, London.
- Lens, P., Hamelers, B., Hoitink, H., Bidlingmaier, W. (2004). *Resource Recovery and Reuse in Organic Solid Waste Management.* Integrated Environmental Technology Series. IWA Publishing, UK.
Parsons S. A.. (2003). *Advanced Oxidation Processes for Water and Wastewater Treatment.* IWA Publishing, London.
- Sincero, A.P., Sincero, G.A. (2002). *Physical-Chemical Treatment of Water and Wastewater*. IWA Publishing, London.
Van der Roest H. F., Lawrence D. P. and van Benten A. G. N. (2002). *Membrane Bioreactors for Municipal Wastewater Treatment.* IWA Publishing, London.

5. Assessment:

Part one is concerned with laboratory classes where the students developed teamwork applied in the area of Water and Wastewater Technology - Written report of laboratory activities
Part two is a continuous assessment through laboratory exercises, field trips, and discussions of current events of real life Environmental Engineering problems aiming the evaluation of the students understanding capacity regarding the main topic lectures.
Part three consist in the elaboration of a teamwork project related with a case study which has to be written and oral presented.
Written final examination.

6. Estimated Workload:	168	Hours
7. Last Update:	20/7/2010	