Code: 1497 **Remediation**
Degree: 2nd cycle – Environmental Engineering
Stream: Environmental Management
Curricular Year: 1st **Semester Course: 2nd**
Credits: 6 ECTS **Optional**
Language: Portuguese/English
Responsible: Francisco Cardoso Pinto
Other lecturer(s): Maria Manuela Silva Nunes Reis Abreu, Maria Odete Pereira Torres and Nuno Renato da Silva Cortez
Web Site: http://www.isa.utl.pt/home/node/3791

1. Contact hours
Lectures 42 **Lecture/Practicals** 28 **Others** 14 **Total** 84

2. Objectives:

To assure fundamental formation in the field of remediation in what concerns scientific and technical aspects of soil and water cleanup technologies

3. Programme:

LECTURES

1. Fundamental definitions and concepts
2. Main environmental recovering and landscape planning interventions
Areas suffering desertification processes and forestry fires. Saline and alkali soils.
3. Role of the soil in the domain of remediation
Influence of soil characteristics on contamination, remediation and restoration of land and groundwater. The soil as a pollutant agent.
4. Groundwater
Hydrogeology. Basic concepts.
5. Pollutants of natural ecosystems
Origin and characteristics of the major groups of environmental pollutants. Fate and behaviour of pollutants in soil and surface and underground waters. Bioavailability. Biodegradability and biodegradation of pollutants.
6. Contaminated sites
Identification and evaluation of the level of degradation and contamination of contaminated sites.
7. Treatment of contaminated soils and waters
Treatment techniques exploiting physical and chemical processes. Application, strong points and drawbacks. Selection of remedial approaches and treatment techniques
8. Bioremediation
Technical and scientific basis. Advantages and disadvantages. Implementation
9. Phytoremediation
Advantages and disadvantages of phytoremediation. Implementation. Selection of type and species of plants.
10. Monitoring and evaluation of the efficiency of the remediation techniques in terms of environmental performance
General aspects. Soil and water monitoring.
11. Legislation and regulation

Lecture/practicals
Cases of study
Basic numeric applications concerning remediation techniques

Study visits

4. Bibliography:

Main Bibliography

- Eweis, J.B., Argas, S.J.,Chang, D.P.Y. e Schroeder, E.D (1999) - Principios de Biorrecuperación – Tratamientos para la descontaminación y regenaritión de suelos y aguas subterráneas mediante procesos biológicos y físico-químicose. McGraw- Hill.
- Lecomte, Paul - Les sites pollués - Traitement des sols & des eaux souterraines (2éme edition) (1998). Lavoisier Tec&Doc.
- McCutcheon, S.C, Schnoor J.L (Eds) (2003).- Phytoremediation – Transformation and control of contaminants. John Wiley&Sons Inc.

Other Bibliography

- Riviére, Jean-Louis (1997) - Évaluation du risque écologique des sols pollués. LavoisierTec&Doc.
- Nathanail, C.P.and Bardos, R.P (2004) – Reclamation of contaminated land,. John Wiley&Sons Inc.

5. Assessment:

Examination test

6. Estimated Workload: 168 Hours

7. Last Update: 20/7/2010