VNIVERSITAT DE VALÈNCIA

Course Guide
43811 Management of contaminated soils and sediments

COURSE DATA

Data Subject	
Code	43811
Name	Management of contaminated soils and sediments
Cycle	Master's degree
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
2227 - M.U. en Ingeniería Ambiental	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
2227 - M.U. en Ingeniería Ambiental	3 - Treatment of land, waste and air emissions	Obligatory

Coordination

Name	Department
RIBES BERTOMEU, JOSEP	245 - Chemical Engineering

SUMMARY

Professors UPV: Miguel Martín Monerris y María Pachés Giner

“Management of contaminated soils and sediments” is an obligatory subject which is imparted during the second semester of the Master in Environmental Engineering. This subject is divided in two main parts according to the media where pollutants are located: soils and sediments.

In the first part, about “contaminated soils management”, the student will acquire basic knowledge about contaminated soils concerns and the problems related to groundwater pollution. General aspects about contaminated soils formation, degradation, contamination and characterization are studied, including the establishment of quality criteria based on environmental risks assessment. Finally, the study of the treatment systems for contaminated soils and contaminated groundwater is studied in depth, carrying out practical cases of basic design of treatment facilities.

In the second part, about “sediments management” it is intended that the student acquires the basic knowledge about the problems of pollution of sediments in the natural environment and deepens in the

mathematical modelling of the processes in the sediments and the exchange with the water column.

This part of the subject is considered as an extension of the subject "Transport of pollutants in the environment", with which it shares an approach based on the development and application of mathematical models, being in this case water-sediment interaction.

When taking this subject, the student will use the basic knowledge acquired in the subjects "Assessment of environmental quality" and "Transport of pollutants in the environment", mainly in their part related to soil, groundwater and sediments.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no specified enrollment restrictions with other subjects of the curriculum.
It is advisable to have knowledge on the following subjects:
Assessment of environmental quality.
Transport of pollutants in the environment.

OUTCOMES

2172 - M.U. en Ingeniería Ambiental

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Identify and apply technologies, tools and techniques in the field of environmental engineering.
- Assume with responsibility and ethics the Environmental Engineer role in a professional context.

- Promote and apply the principles of sustainability.
- Adapt to changes, being able to apply the principles of Environmental Engineering to unknown cases and use new and advanced technologies and other relevant developments, with initiative and entrepreneurial spirit.
- Identify, declare and entirely analyze environmental problems.
- Assess the application of measures for the pollution prevention and the recovery, protection and improvement of environmental quality.
- Understand and apply environmental national and international legislation, adapting environmental solutions to these regulations.
- Apply standard methodologies for the analysis and evaluation of environmental risks.
- Evaluate the environmental quality of soils from a global point of view, especially when there is a risk to public health..
- Be able to characterize the emissions to soils, coming from the anthropogenic activity.
- Evaluate the treatment of soils to assess different alternatives and obtain the required information for the design of the selected treatment processes.
- Design and manage treatment systems for contaminated soils.

LEARNING OUTCOMES

1 Be aware of the problem of contamination of soil and groundwater.

2 Design, plan and analyse the results of studies about contaminated sites characterisation.

3 Know and identify possible problems of soil contamination based on a historical study of the site.

4 Implement the risk analysis in the decision making about the management of contaminated sites, know the scope of the problem and establish the degree of need for intervention.

5 Know the existing physical, chemical and biological methods for the recovery of contaminated soils and sediments.

6 Know the main alternatives of action in contaminated soils and apply the most used recovery technologies.

7 Select the most appropriate technological alternatives among the possible confinement and/or treatment systems of soils, groundwater and contaminated sediments.

8 Identify the emerging technological solutions in the field of treatment and recovery of contaminated soils.

9 Design, implement and operate at a conceptual level the most used systems for the treatment of contaminated soils.

10 Know the main alternatives of action in the management of contaminated sediments.

11 Study and analyse examples of actions carried out for the recovery of soils and the management of contaminated sediments.

DESCRIPTION OF CONTENTS

1. Action in contaminated soils: Investigation of soil contamination.

Unit 1. Introduction. Sources of contamination of soil and groundwater. Types of contaminants present in the soil. Pollution mechanisms. Ground contaminant interactions. Transformation of pollutants.
Unit 2. Legal framework. Potentially polluting activities of the soil. Establishment of quality criteria of a soil. Action protocols in contaminated soils.
Unit 3.- Exploration of contaminated soils: Sampling and characterization of the site
Unit 4.- Quantitative risk analysis. Application of predictive tools: modelling the contamination of soil and groundwater

2. Systems for the treatment and recovery of contaminated soils.

Unit 5.- Confinement and containment techniques: barriers; in-situ vitrification; stabilization-solidification.
Unit 6.- Thermal treatments: Thermal desorption.
Unit 7.- Pollution extraction techniques: steam extraction; soil washing in-situ and
Ex-situ; solvent extraction; pumping and treat systems for groundwater.
Unit 8.- Elimination of pollutants in the soil I: Chemical oxidation; dehalogenation; electrochemical treatments; permeable reactive barriers.
Unit 9.- Elimination of pollutants in the soil II: Biological treatments (bioremediation and phytoremediation). Natural attenuation of contaminated soil.
Unit 10.- Classification of treatment systems. Evaluation and selection of alternatives.
Combination of treatment technologies. Technical and economic considerations

3. Examples of recovery projects: Case studies.

Unit 11. Recovery of old landfills. Recovery of soils contaminated by accidental discharges.
Recovery of brownfields. Recovery in mining activities. Treatment of soils affected by oil slicks.

4. Introduction. Properties of sediments.
Sediment transport Equations of the mass balance. Dissemination processes.
Basic schemes of sediment modelling.

Unit 12.- Legislative framework in sediment contamination. Implications of sediments in water quality. Management problem. Sampling techniques and sample conservation.
Unit 13.- Characterization of the sediments: granulometry, humidity, density, porosity, organic matter. Transport and sedimentation of suspended solids.
Unit 14.- Approaches to the modelling of oxygen flow, nutrients: constant flow in steady state, two-layer models, approximations in transient states.

5. Oxygen: oxygen demand from sediments, sulphides and methane.

Unit 15.- Modelling of the transformation of organic matter in sediment. Aerobic and anoxic layer.
Unit 16.- Modelling of anoxic processes in the sediment. The role of sulphides. Methane production. Oxygen demand models.

6. Nutrients: ammonium, nitrates and phosphorus

Unit 17.- Modelling the flow of ammonia and nitrates.
Unit 18.- Phosphorus flow modelling.

7. Extraction and management of sediments

Unit 19.- Sediment extraction: usual techniques, advanced techniques. Subsequent management: applicable regulations.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	25,00	100
Classroom practices	16,00	100
Computer classroom practice	10,00	100
Group work	5,00	100
Theoretical and practical classes	4,00	100
Attendance at events and external activities	6,00	0
Development of group work	30,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	29,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The training activities will be developed according to the following distribution:

· Theoretical activities.

Description: In the theoretical classes the topics will be developed providing a global and integrating vision, analysing in greater detail the key aspects and of greater complexity, promoting, at all times, the participation of the student.

· Practical activities.

Description: They complement the theoretical activities in order to apply the basic concepts and expand them with the knowledge and experience that students acquire during the realization of the proposed works. They include the following types of classroom activities:

o Classes of problems and questions in the classroom.

o sessions for discussion and solving problems previously worked by the students.

o Computer practices for specific software management.

o Oral presentations

o Programmed tutoring (individualized or in groups)

· Student's personal work.

Description: Realization (outside the classroom) of monographic works, directed bibliographic search, issues and problems, as well as the preparation of classes and exams (study). This task will be carried out individually and tries to promote autonomous work.

· Work in small groups.

Description: Realization, by small groups of students (2-4), of work, issues, problems outside the classroom. This task complements the individual work and fosters the capacity for integration in work groups.

· Evaluation

Description: Realization of individual evaluation questionnaires in the classroom with the presence of the teacher.

The e-learning platform (Virtual Classroom of the Universitat de València and / or PoliformaT of the

Polytechnic University of Valencia) will be used as communication support with the students. Through it you will have access to the didactic material used in class, as well as the problems and exercises to solve.

EVALUATION

The evaluation is unique and consists of four parts:

A theoretical part: a test based on questions to be developed, test questions and practical questions. The duration is three hours. The assigned day is performed in the exam calendar. The weight on the final grade is 50%. The number of questions and their assessment are weighted to the credits of each of the two parts of the subject: 75% soil, 25% sediment.

A practical part based on the active participation of the students in the classroom activities and the problems made throughout the course. The weight on the final grade is 15%.

Monographic group work. The weight on the final grade is 22.5%.

Resolution of an individual exercise on flows from the sediment. The weight on the final grade is 12.5%.

REFERENCES

Basic

- - A) Suelos:
  Lagrega M.D., Buckingham P.L., Evans J.C. Gestión de residuos tóxicos. Tratamiento, eliminación y recuperación de suelos. McGraw-Hill/Interamericana de España Madrid (1996).
  Mirsal I.A. Soil Pollution. Origin, Monitoring & Remediation. Springer-Verlag. Berlin Heidelberg (2004).
  Nyer Evan K. In situ treatment technology. Lewis Publishers (2001)
  Porta J., Lopez-Acevedo M., Roquero C. Edafologia para la agricultura y el médio ambiente. Mundi-Prensa Madrid (2003).
  Suthersan Suthan S. Remediation engineering: design concepts. CRC-Lewis Publishers, (1997)
  Wong J., Lim C.H., Nolen G.L. Design of remediation systems. CRC/Lewis Publishers (1997)
  B) Sedimentos:
  EPA (2001). Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. Office of Water and Technology. U.S. Environmental Protection Agency, Washington D.C. EPA-823-B-01-002.
  Chapra, S.C. (1997). Surface Water Quality Modelling. Mc-Graw Hill. New York.
  Di Toro, D. (2001). Sediment Flux Modeling. John Wiley & Sons, Inc.,Wiley-Interscience. New York (USA).

Additional

- A) Suelos:
  Salomons W., Förstner U., Mader P. (Eds.). Heavy Metals. Problems and Solutions. Springer-Verlag Berlin Heidelberg (1995).
  Levin M., Gealt M.A. Biotratamiento de residuos tóxicos y peligrosos. McGraw-Hill/Interamericana de España Madrid (1997).
  Wise D.L., Trantolo D.J. Remediation of hazardous waste contaminated soils. Marcel Dekker, New York (1994).
  Kobus H., Barczewski B., Koschitzky H.P. (Eds). Groundwater and Subsurface Remediation. Research Strategies for In-situ Technologies. Springer-Verlag Berlin Heidelberg (1996).
  Barrettino D., Loredo J., Pendás F. (eds.) Acidificación de suelos y aguas: problemas y soluciones Instituto Geológico y Minero de España Madrid (2005).
  B) Sedimentos:
  EPA (2000). Bioacumulation testing and interpretation for the purpose of sediment quality assessment. Status and needs. Office of Water. Office of Solid Waste.. U.S. Environmental Protection Agency, Washington D.C. EPA-823-R-00-001.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Contenidos

Se mantienen los contenidos inicialmente programados

2. Volumen de trabajo y planificación temporal de la docencia

No se añaden ni se eliminan actividades distintas de las planificadas originalmente. Se ha facilitado al estudiante todo el material para que pueda seguir su propia programación horaria. Sin embargo, se mantienen las sesiones programadas en las mismas fechas y con la misma duración para resolución de dudas a través de la plataforma Teams de Office 365

3. Metodología docente

La docencia presencial se sustituye por videoconferencias síncronas mediante BBC o Teams en los mismos horarios ya establecidos.

Las tutorías se siguen realizando a demanda de los estudiantes, como está ya programado habitualmente, mediante preguntas/respuestas por correo electrónico y mediante videoconferencia.

Con anterioridad a las videoconferencias, se les envía a los estudiantes un documento con cuestiones previas para repasar conceptos y enlaces a vídeos en red que ilustran los contenidos que se van a desarrollar.

Los problemas resueltos en clase son transcritos y puestos a disposición en el repositorio de la asignatura.

4. Evaluación

Se mantiene la ponderación existente en la guía docente para las diferentes actividades de evaluación.

La Prueba escrita de respuesta abierta se mantiene en formato a distancia. Se les enviarán a los alumnos las preguntas el día y la hora señalados oficialmente para esta prueba y los alumnos deberán entregar las respuestas por correo electrónico al profesor responsable en el tiempo indicado. Durante el proceso se abrirá una sesión en Teams para el grupo mientras responden las preguntas de la parte de Sedimentos con el fin de resolver dudas.

Mientras respondan a las preguntas de suelos, las consultas las podrán realizar mediante el Aula Virtual de la UV. Por ello se establecerán claramente los horarios de cada una de las partes. La resolución de problemas prácticos se realizará también a distancia y se pedirá al alumnado que cuelgue la resolución en Aula Virtual, incluyendo un breve video o audio, explicando cómo ha resuelto el problema. Durante toda la prueba se mantendrá abierta una videoconferencia Blackboard Collaborate (BBC) para resolver posibles dudas del alumnado.

La evaluación mediante Observación se mantiene igual dado que se desarrolla durante la primera parte del curso y se ha completado durante la etapa docente presencial.

El trabajo monográfico de grupo se llevará a cabo tal como estaba previsto, habiendo uso de la herramienta de trabajo colaborativo Padlet para tutorías y seguimiento. La entrega y exposición del trabajo se mantiene en las fechas previstas (11 de mayo y 19 de mayo). La exposición oral se llevará a cabo, tal como estaba previsto en el horario del curso, mediante videoconferencia Blackboard Collaborate (BBC) con presencia de todos los equipos on-line y siguiendo las instrucciones inicialmente indicadas. En caso de ser necesario, se llevará a cabo en varias sesiones de videoconferencia.

La realización del caso práctico se mantiene con la estructura que se realiza de forma presencial: entrega del ejercicio el 24 de abril y tutorías a distancia, con Teams, para su resolución. Entrega en la memoria y hoja de cálculo con fecha límite el día del examen teórico.

5. Bibliografía

No hay cambios en la bibliografía recomendada.