



## IDENTIFYING DATA

### Transport of Water and Solutes in Soil

Subject	Transport of Water and Solutes in Soil			
Code	O01M142V01114			
Study programme	Máster Universitario en Ciencia y Tecnología Agroalimentaria y Ambiental			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Pérez Rodríguez, Paula López Periago, José Eugenio			
Lecturers	López Periago, José Eugenio Pérez Rodríguez, Paula Soto Gómez, Diego			
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Web				
General description	The investigation on transport in the floors has like end know the laws that control the movement of substances in a three-dimensional system, complex and dynamic, subject to multiple interactions.			

The transport in the floor determines the efficiency of the \*fertilizantes, phytosanitary, amendments and waste applied to the floor, as well as the movement of these substances like potentials \*contaminantes of superficial waters and aquifers. Also it allows to evaluate the function \*filtrante of the floor like natural system of purification of the water. And \*inervienen in the global balance of the carbon.

The aim of this matter is to teach methods advanced to investigate the transport, schedule and make properly experiments that allow to identify the critical processes that control interaction between the movement of the water and processes of transformation of substances in the floor. The task of the future researcher consists in applying with scientific rigour methods of \*prospección geophysics, methods of instrumental chemistry, analysis of image 3D and computational modelling, to identify the processes that control significantly the transport of substances in the \*agrosistemas, with the end to evaluate the future of alternatives of handle of the floor..

## Training and Learning Results

Code	
A2	
B1	(*)Que os estudantes sexan capaces de desenvolver habilidades de análise, síntese e xestión da información para contribuir á organización e planificación de actividades de investigación no eido agroalimentario e do medio ambiente.
B4	(*)Que os estudantes sxean capaces de adaptarse a novas situacións, con grandes doses de creatividade e ideas para asumir o liderado de investigadores.
C2	
C8	
C11	
D1	
D2	
D3	
D4	
D5	

D6
D7
D8
D9
D10
D11 Motivación poa calidade con sensibilidade hacia temas medioambientais

### Expected results from this subject

Expected results from this subject	Training and Learning Results
Dominate the technicians of investigation of the phenomena of transport of matter in the floor: schedule experiments of transport in floors, select and apply of models of transport and reverse modelling to obtain the parameters that control the transport in floors.	C2 C8 C11
Investigate the movement of substances in the floor. Quantify the function debugger and protective of the floor in front of the pollution of the water *sub-superficial, and estimate distances of protection to focus of pollution	
That the students know to apply the knowledges purchased and his capacity of resolution of problems in new surroundings or little known inside contexts wider (or multidisciplinary) related with his area of study.	A2 B1 B4
That the students are able to develop skills of analysis, synthesis and management of the information to contribute to the organisation and planning of activities of investigation in the sector *agroalimentario and of the environment.	
That the students are able to adapt to new situations, with big dose of creativity and ideas to assume the leadership of researchers.	
Capacity of analysis, organisation and planning	D1 D2
Strengthen the capacity of leadership, initiative and spirit *emprededor	D3 D4
Improve the capacity of oral communication and written in the native and foreign tongue	D5 D6
Increase the capacity of autonomous learning and management of the information	D7 D8
Facilitate the resolution of problems and taking of decisions.	D9 D10
Improve the *capacidade of interpersonal communication.	D11
Generate situations that require the effort of adaptation to new situations with creativity and innovation.	
Stimulate the capacity of critical reasoning and *autocrítico	
Create some surroundings of work in team of character *interdisciplinar.	

### Contents

Topic	
Block 1: experimental Systems to study the transport in the floor.	Sampling and obtaining of witnesses structured. Space and temporary variability. Physical characterisation. Design of and execution of experiments of transport in laboratory and in the field.
Block 2: Analysis of the movement of substances in the floor.	Components of the hydraulic flow in the floor. Model of convection-diffusion. *Trazadores Of flow. Effect of the scale in the dispersion Retention no reactive: heterogeneity of the *porosidad, model of *porosidad mobile and motionless. Reactive transport: chemical retention, concept of *sumidero, time of residence. Numerical modelling, reverse modelling and estimate of parameters of transport.
Block 3: Architecture of the floor and transport.	Preferential flow and effects of scale in the transport. Hydraulic properties of the floors and architecture of the floor. Technicians of visualisation of the architecture by means of tomography.

Block 4: Transport of particles in the floor.

Movement of \*micropartículas: microorganisms, \*nanopartículas and transport of \*contaminantes facilitated by colloids. Hydrodynamic \*coloidal, leak and transport. Methods of study.

### Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	5	0	5
Mentored work	0	40	40
Laboratory practical	5	0	5
Seminars	5	0	5
Problem and/or exercise solving	0	20	20

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

### Methodologies

	Description
Lecturing	Exhibition of the most important appearances of the contents: theoretical bases and/or guidelines of the work, exercise or project to develop by the student.
Mentored work	Application of models of transport of *contaminantes to practical cases. Autonomous study of cases/analysis of situations with bibliographic support. Design of strategies of investigation and editorial of a project.
Laboratory practical	Experiences of field and in models to scale of laboratory.  Obtaining of data and determinations ""*in-*situ"" . Modelling of data and interpretation of results.
Seminars	Numerical modelling with computers. Exercises reverse modelling for the obtaining of parameters of models of transport.

### Personalized assistance

Methodologies	Description
Lecturing	Session *magistral: exhibition by part of the professor with help of audiovisual means of the most important appearances of the contents of the *temarioof the subject, theoretical bases and/or guidelines of the work, exercise or project to develop by the student (face-to-face).
Laboratory practical	Works of field and of laboratory. The students will schedule the corresponding practices with the with the contents of the matter. The student will have to apply the knowledges purchased in the other face-to-face sessions, so that it can complete and facilitate to complete and consolidate these knowledges and develop technical and skills *es específicas of the matter.
Mentored work	Autonomous study of cases/analysis of situations with bibliographic support. Analysis of a problem or real case, with the purpose to know it, interpret it, resolve it, generate hypothesis, diagnose it and *adentrarse in alternative procedures of solution, to see the application of the theoretical concepts in the reality. *Feedback Through the platform of *teledocencia *FAITC (no face-to-face).
Seminars	Seminars. Activities in which *s and will analyse fundamentally scientific articles, of divulging and concrete cases (face-to-face).

### Assessment

	Description	Qualification	Training and Learning Results
Mentored work	Continuous evaluation to *traves of the follow-up of the works, resolution of problems or practical cases. No face-to-face.	40	A2 B1 C2 B4 C8 C11
Laboratory practical	Participation and assistance to practices of laboratory. Face-to-face.	20	D1 D2 D6 D9 D10 D11
Seminars	Participation and assistance to seminars. Face-to-face.	20	D3 D4 D5 D6 D7 D8

Problem and/or exercise solving	(*)Achega dos resultados dos exercicios realizados de forma autónoma	20	A2	D4 D5
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### Other comments on the Evaluation

The students declaring professional activities coincident with the assistance to the lectures will have to accredit his situation, in which it states his labor schedule and place of work.

In these cases, the examination method will be established on an individual basis by the coordinator.

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### Sources of information

#### Basic Bibliography

Klute A., **Water retention: laboratory methods. in Methods of Soil Analysis**, 3<sup>a</sup>, SAS, CSSA and SSSA, 1986

#### Complementary Bibliography

U. S. SALINITY LABORATORY AGRICULTURAL RESEARCH SERVICE U. S. DEPARTMENT OF AGRICULTURE R, **The STANMOD Computer Software for Evaluating Solute Transport in Porous Media Using Analytical Solutions of Convection-Dispersion Equation**, 1.0 2.0,

DEPARTMENT OF ENVIRONMENTAL SCIENCES UNIVERSITY OF CALIFORNIA RIVERSIDE RIVERSIDE, CALIFOR, **The HYDRUS-1D Software Package for Simulating the One-Dimensional Movement of Water, Heat, and Multiple Solutes in Variably-Saturated Media**, 3.0,

Werner Kördel, Hans Egli, Michael Klein, **Significance of pesticide transport through Macropores**, Fraunhofer Institut, Molekularbiologie und Angewandte Oekologie, D-57392 Schmallenberg, koerd,

S. A. Bradford, J. Simunek, M. Bettahar, M. T. van Genuchten, and S. R. Yates, **Significance of straining in colloid deposition: Evidence and implications**, WATER RESOURCES RESEARCH, VOL. 42, W12S15, doi:10.1029/2005WR004791, 2006,

Beven K, Germann P., **Macropores and water flow in soils revisited**, Water Resour. Res. 49:3071-3092, 2013

van Genuchten MTh., Wierenga P.J., **Solute dispersion coefficients and retardation factors. in Methods of Soil Analysis. Part .1 Physical and Mineralogical Methods**, SAS, CSSA and SSSA, 1986

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### Recommendations

#### Subjects that continue the syllabus

Hot Springs: Innovation and Development/O01M142V01113

Global Climate Change and its Impact on Terrestrial Ecosystems/O01M142V01204

#### Subjects that are recommended to be taken simultaneously

Alteration of Biological Interfaces by Polluting Agents/O01M142V01212

Trace Elements in the Plant-Soil System/O01M142V01112

Transport of Water and Solutes in Soil/O01M142V01114

#### Subjects that it is recommended to have taken before

Evaluation of Atmospheric Pollutants Transfer to the Plant-Soil-Water System/O01M142V01205

Mathematical Methods for Modelling in Research/O01M142V01102

Documentation Techniques for Research/O01M142V01103

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### Other comments

Schedule and place of teaching of the one of the matter: for determining.