ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA AGRONÓMICA Y DE MONTES

# GRADO DE INGENIERÍA AGROALIMENTARIA Y DEL MEDIO RURAL

2024/25 YEAR

# HIDROLOGÍA Y EROSIÓN

## Course details

**Course name:** HIDROLOGÍA Y EROSIÓN
**Code:** 101011
**Degree/Master:** GRADO DE INGENIERÍA AGROALIMENTARIA Y DEL MEDIO RURAL **Year:** 3
**Field:** INGENIERÍA RURAL (II)
**Character:** OBLIGATORIA **Duration:** FIRST TERM
**ECTS Credits:** 6.0 **Classroom hours:** 60
**Face-to-face classroom percentage:** 40.0% **Study hours:** 90
**Online platform:** https://moodle.uco.es/

## Coordinating teacher

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## Brief description of the contents

The course is divided in the following blocks:
PART I. Introduction to hydrology
PART II. Hydrological processes
PART III. Hydrological models
PART IV. Erosion processes
PART V. Erosion types
PART VI. Erosion assessment
PART VII. Soil and water conservation
PART VIII. Erosion conservation and slope restoration

## Prerequisites

### Prerequisites established in the study plan

None

### Recommendations

None specified

## Study programme

### 1. Theory contents

*PART I. Introduction to hydrology*
Hydrological cycle: mass and energy fluxes. Assessment and evolution of water and soil resources
*PART II. Hydrological processes*
Atmospheric processes: condensation and evaporation. Formation of rain, snow and dew. Calculation of evaporation. Rainfall interception. Spatial and temporal distribution of processes: probability density functions, including the intensity, duration and frequency curves. Regionalized analysis. Soil processes: water retention and transmission. Infiltration and generation of rainfall excess. Redistribution, percolation and evaporation. Hydrogeological processes: aquifers, subsurface flow equations. Surface processes: catchment characterization, flow equations, unit hydrograph, flow circulation, urban hydrology.
*PART III. Hydrological models*
Description and use of models, hydrological indices for drought assessment. Global and distributed models. Ecohydrology
*PART IV. Erosion processes*
Weathering and soil formation. Erosion processes: particle movement, impact and rain splash, wind erosion, surface runoff. Sediment transport: bed load and suspended load. Transport capacity. Sediment deposition: reservoir sedimentation
*PART V. Erosion types*
Erosion by concentrated flow: rills and gullies. Mass movement: slope stability analysis and factor of safety, vegetation. Fluvial erosion: meander flow and bank erosion
*PART VI. Erosion assessment*
Erosion measurement: plots and tracers. Analysis and prediction, erosion models. USLE
*PART VII. Soil and water conservation*
Principles and strategy of conservation. Conservation agriculture: basis and methods. Agroforestry
*PART VIII. Erosion conservation and slope restoration*
Conservation methods: storm detention ponds, vegetation filters, gully control PART IX. Past and future of soil conservation Conservation or collapse: analysis of case-studies.

### 2. Practical contents

Calculate water balance at different spatial and temporal scales
Downloading and using hydrometeorological data.
Calculation of precipitable water amount in the atmosphere, residence time.
Calculation of evapotranspiration.
Adjusting of different probability density function to hydrological data.
IDF curves
Adjusting and use of soil water retention curves.
Calculation of runoff and infiltration.
Evaluation of the change in piezometric surface caused by pumping from a well. Calculating aquifer recharge.
Characterization of watersheds for hydrological analysis.
Calculating runoff from a watershed.

Flow routing.
Use of simple hydrological models.
Use of the general erosion equation.
Estimating productivity losses.
Developing and evaluating the Shields diagram to estimate particle movement.
Calculating bed, suspended and total load in rivers.
Evaluating the useful life of reservoirs.
Using the slope-area threshold by Montgomery and Deitrich to estimate rill and gully location.
Calculating the probability of gully occurrence.
Calculating the landslide risk on hillslopes. Influence of rainfall.
Estimating the intensity of river incision
Evaluating soil erosion with environmental tracers
Use and application of the RUSLE scheme to calculate soil erosion.
Calculating the sediment delivery ratio in a catchment
Dimensioning of soil conservation structures (terrace spacing)
Evaluating the benefit of soil conversation practices with simple models
Evaluating the use of retention ponds in soil and water conservation.

## Bibliography

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L. B. Leopold. 1994. A view of the river. Harvard Univ. Press, Cambridge.
W. Brutsaert. 2005. Hydrology. An introduction. Cambridge Univ. Press, Cambridge.
I.Rodríguez-Iturbe y A. Rinaldo. 1998. Fractal river basins. Cambridge University Press, Cambridge.
J.L. Monteith y M.H. Unsworth. 2008. Principles of environmental physics. 3ª edición, Academic Press, Londres.
R. Webster y M.A. Oliver. 2001. Geostatistics for environmental scientists. Wiley, Chichester.
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M. García, ed. 2008. Sedimentation engineering: processes, measurements, modeling, and practice. ASCE,Reston.
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A. Clark. ed., 2007. Managing cover crops profitably. 3ª ed., Sustainable Agriculture Network handbook series bk. 9, Sustainable Agriculture Network, Beltsville.

## Methodology

### General clarifications on the methodology (optional)

The theoretical lectures will be dynamical in order to stimulate student participation so that they analyze, resolve and discuss short exercises between themselves and with the professor. Exercises and problems are prepared to complete fundamental issues explained during the lectures, and it will be allowed to solve them in small groups, promoting team work and collective learning

### Methodological adaptations for part-time students and students with disabilities and special educational needs

Adapted material will be prepared ad hoc.

### Face-to-face activities

| Activity | Large group | Small group | Total |
|---|---|---|---|
| *Field trips* | 1 | - | 1 |
| *Information processing activities* | 3 | - | 3 |
| *Projects based on the course contents* | 44 | 10 | 54 |
| *Tutorial action activities* | 1 | - | 1 |
| *Written expression activities* | 1 | - | 1 |
| ***Total hours:*** | ***50*** | ***10*** | ***60*** |

### Off-site activities

| Activity | Total |
|---|---|
| *Exercise and problem solving activities* | 40 |
| *Information processing activities* | 40 |
| *Information search activities* | 10 |
| ***Total hours*** | ***90*** |

## Results of the training and learning process

### Knowledge, competencies and skills

CB2 Creative problem solving. Using initiative, methodology, and critial thinking.

CB4 Demonstrating the ability to research and use legislations related to your field of work

CU2 Improving user-level skills in ICT

CEHJ4 Demonstrating the ability to recognise, understand and use the principles of environmental and landscape engineering, hydrology and erosion

CEMC5 Demonstrating the ability to recognise, understand and use the principles of facility engineering, rural electrification, irrigation and drainage technology, hydraulic buildings and facilities, animal health and wellbeing facilities

## Assessment methods and instruments

| Intended learning outcomes | Examination | Means of practical execution | Oral means | Students assignments |
|---|---|---|---|---|
| *CB2* | X | X | X | X |
| *CB4* | | | X | |
| *CEHJ4* | | | X | |
| *CEMC5* | | | X | |
| *CU2* | X | X | X | |
| ***Total (100%)*** | ***65%*** | ***15%*** | ***10%*** | ***10%*** |
| ***Minimum grade (*)*** | ***5*** | ***5*** | ***5*** | ***5*** |

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

### General clarifications on instruments for evaluation:

We aim to evaluate the interest of the student for this course.

### Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

The evaluation procedures established in this course guide will be adapted to students with special educational needs, in accordance with and following the procedures outlined by the UCO Unit responsible for this (Unidad de Educación Inclusiva-UNEI. atencioninclusiva@uco.es)

### Clarifications on the evaluation of the extraordinary call and extra-ordinary call for completion studies:

An exam will be held

### Qualifying criteria for obtaining honors:

*EXCELLENCE*

## Sustainable development goals

Quality education

## Other Faculty

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*The methodological strategies and the evaluation system contemplated in this Teaching Guide will respond to the principles of equality and non-discrimination and must be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required. Students must be informed of the risks and measures that affect them, especially those that may have serious or very serious consequences (article 6 of the Safety, Health and Welfare Policy; BOUCO 23-02-23).*