Universitat de Lleida

DEGREE CURRICULUM

FOREST HYDRAULIC ENGINEERING

Coordination: LOPEZ ALONSO, RAUL

Academic year 2020-21

Subject's general information

Subject name	FOREST HYDRAULIC ENGINEERING
Code	102420
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Forest Engineering	2	COMPULSORY	Attendance-based
Double degree: Bachelor's degree in Forest Engineering and Bachelor's degree in Nature Conservation	2	COMPULSORY	Attendance-based
Master's Degree in Forestry Engineering		COMPLEMENTARY TRAINING	Attendance-based

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRALAB	PRAULA	TEORIA
Number of credits	0.2	1	4.8
Number of groups	6	2	1

Coordination	LOPEZ ALONSO, RAUL
Department	AGRICULTURAL AND FOREST ENGINEERING
Important information on data processing	Consult this link for more information.
Language	Spanish

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COTS RUBIÓ, LLUÍS	lluis.cots@udl.cat	1,2	
LOPEZ ALONSO, RAUL	raul.lopez@udl.cat	6,8	

Subject's extra information

For reasons derived from the health crisis caused by Covid-19, activities in face-to-face mode may be replaced by other equivalent activities in distance mode.

Learning objectives

The student, when passing the subject, must be able to:

Know and know how to use the basic principles of hydraulics, both in pipes systems and in open channels.

Design pipe systems (including hydraulic machines such as pumps and turbines).

Be able to simulate numerically the steady and gradually varied flow in rivers and artificial channels.

Calculate the threshold of motion of the sediment particles in open cannel flow. Application in the design of channel revetments and in the analysis of the stability of the bed channel in gravel and mountain rivers.

Calculate the bedload sediment transport in gravel and mountain rivers.

Subject contents

Introduction to hydraulics

Properties of liquids: mass density, specific weight, compressibility, viscosity.

Pressure. Absolute and relative pressure. Distribution of hydrostatic pressure in a liquid.

Definition of flow discharge.

Classification of flow of water in a conduit: pipe flow and open channel flow.

Flow of incompressible fluids in pipes

Application of the fundamental equations of hydraulics in pipe flow: equations of continuity, energy and momentum.

Energy losses by friction in steady and uniform flow in pipes. Formula of Darcy-Weisbach.

Flow classification regimes according of viscosity effects: laminar and turbulent flow. Reynolds number.

Estimation of the Darcy–Weisbach friction factor. Laminar flow: Poiseuille formula. Turbulent flow: formulas of

Colebrook-White, Swamee and Jain and Haaland.

Determination of energy losses caused by singularities in pipes (local losses).

Hydraulic Pumps. Characteristic curves: system and pump curves. Determination of the pump operating point. Multiple pump systems: series and parallel operation.

Hydraulic turbines. Use of hydropower: hydroelectric power plants. Determination of the net head and the power of the plant.

Forces in pipe sections subjected to changes of direction or cross section.

Introduction to open channel flow

Basic concepts. Hydraulic geometry.

Classification of open channel flow (spatial and temporal variation).

Application of the fundamental equations to the open channel flow hydraulics: equations of continuity, energy and momentum.

Open channel flow: steady and uniform flow

Flow resistance equations: Chezy, Manning and Darcy-Weisbach.

Estimation of flow resistance coefficient: Manning and Darcy-Weisbach coefficients.

Open channel flow: critical regime

Specific energy concept.

Froude number.

Critical regime. Subcritical and supercritical regimes.

Open channel flow: steady and gradually varied flow

General equation of the gradually varied flow.

Classification of gradually varied flow profiles in a prismatic channel.

Numerical integration of the gradually varied flow equation: direct step method.

Properties of fluvial sediments

Classification. Characteristics: specific weight, size, shape.

Distribution of particle sizes (grain size distribution): particle size analysis, characteristic diameters.

Incipient sediment motion

Shear stress of the flow: uniform and gradually varied flow.

Critical shear stress of the granular material or non-cohesive sediment.

Critical discharge of the granular material or non-cohesive sediment.

Stability analysis of channel revetments (granular material).

Bedload sediment transport

Forms and components of fluvial sediment transport.

Bedload discharge calculation (non-cohesive sediment). Classification of formulas.

Formulas based on the threshold of motion: critical shear stress, critical unit flow discharge, critical particle Froude number.

Formulas based on stream power.

Computation of sediment transport for hyperconcentrated flow.

Bibliography

Basic bibliography

Lencastre, A.C. (1998). Manual de Ingeniería Hidráulica. Universidad Pública de Navarra, Pamplona.

López, L. (1997). Manual de Hidráulica. Publicaciones de la Universidad de Alicante. Alicante

López, R. (2004). Problemas Resueltos de Ingeniería Hidráulica Forestal. Edicions de la Universitat de Lleida, Lleida.

López, R. (2020). Problemas Resueltos de Hidráulica de Canales Abiertos. Universitat de Lleida, Lleida.

Martín-Vide, J.P. (2002). Ingeniería de Ríos. Edicions UPC.

Sánchez-Juny, M., Bladé, E., Puertas, J. (2005). Hidràulica. Edicions UPC.