Autumn –International Civil & Environmental Engineering Semester–

July 2, 2018

Available Courses 2018-19

1 Land Planning and Management (3.0 ECTS)

1.1 Course Data

- Name: Land Planning and Management
- Course area: Transportation, Urbanism and Land Planning
- Code:213101027

- Degree programme (and number of semester): MSc Civil Engineering (3rd semester)
- Center: School of Civil & Mining Engineering
- Type: Elective course
- Semester: Autumn
- Language: English
- ECTS: 3.0

1.2 Lecturer data

- Lecturer in charge: Salvador García-Ayllón Veintimilla
- Department: Civil Engineering
- Knowledge area: Land Planning, Transportation and coastal engineering
- Office location: School of Civil & Mining Engineering
- Telephone: +34639778537
- Email: salvador.ayllon@upct.es
- URL/Web:

1.3 Course description

1.3.1 Summary

The course is oritented to deal with urban and land planning tools which the students can use during their proffesional career. During the course, the main techniques to analyze the demography, service levels of equipments, land uses and transportation networks will be studied and applied to a real region.

1. Relationship with other courses and/or prior recommendations (sólo si necesario, borrar si no) It is recommended but not strictly necessary to have coursed the subject Urbanism in the 2nd semester of the Master.

1.3.2 Theory syllabus

I – TERRITORIAL PLANNING LARGE-SCALE

1. GENERAL PLANNING
2. GENERAL PLANNING WORKSHOP
3. TERRITORIAL MANAGEMENT TOOLS

II – URBAN MANAGEMENT

1. FOUNDATIONS OF URBAN MANAGEMENT
2. MANAGEMENT URBAN SYSTEMS
3. INTEGRATED URBAN ACTIONS
4. PUBLIC INTERVENTION IN THE LAND MARKET

III – INTRODUCTION TO LAND APPRAISALS AND VALUATIONS

1. ANALYSIS OF THE LAND AND HOUSING MARKET
2. LEGISLATION APPLICABLE TO LAND APPRAISALS AND VALUATIONS
3. CADASTRAL AND MORTGAGE EVALUATION
4. THE PROPERTY VALUATION
5. THE URBANISTIC VALUATION

1.3.3 Practice syllabus

- Analysis on demography (PC)
- Analysis on service level of equipments (PC)
- Analysis on transportation networks (PC)
- Analysis on protected natural spaces (PC)
- Analysis on land resources and risks (PC)
- Analysis on land uses (PC)
- Analysis on urban planning (PC)

1.3.4 Assesment method

Test at the end of the semester (25%)
Report of the practices conducted during the course (60%)
Oral presentation of the practices conducted during the course (15%)

1.4 Bibliography and resources

1.4.1 Basic bibliography

- C.A.R.M. Texto refundido del Ley del Suelo de la Región de Murcia. BORM nº 282, 2005.
- Taberner Pastor Francisco et Al., Gestión urbanística Ed. UPV 2010.
- Sánchez Ramos De Castro, Francisco Manuel, valoraciones Inmobiliarias, Tasaciones Y Peritaciones Para Ingeniero De La Edificación Ed. Munilla-Leira, 2009.
- AA.VV., La práctica del planeamiento urbanístico, Luis Moya (editor), Madrid: Síntesis, 1994.
- Juli Esteban Noguera "La ordenación urbanística: conceptos, herramientas y prácticas", Barcelona, Electa. Diputación de Barcelona, 2003.
- Jaume Font Romà Pujadas, Ordenación y planificación territorial, Madrid: Síntesis, 1998.

1.4.2 Supplementary bibliography and/or on-line resouces and others

- P. Dericke. "Economía urbana" I.E.A.L., 1971.
- J. Esteban. "Elements d'urbanització" ,Colegi d'arquitectes 1984.
- M.Herce i F.Magrinya "La ingeniería en la evolución de la urbanística", UPC , 2001.
- M.Herce y J. Miró "El soporte infrestructural de la ciudad", UPC, 2001.
- Fernando de Terán. "Planeamiento Urbano en la España Contemporánea (1900-1980)".

Alianza Universidad Textos, Madrid, 1982.

- Juli Esteban i Noguera. “Elementos de Ordenación Urbana”, Colegio de Arquitectos de

Cataluña. Barcelona, 1981.

- Comunidad de Madrid “Madrid. Región Metropolitana. Estrategia Territorial y

Actuaciones”. Madrid, 1991.

- Rubio Requena, P.M. “Instalaciones Urbanas, Control Ambiental”. Madrid, 1.979.

- Foster, W. “Ingeniería Urbana y Servicios técnicos Municipales”. IEAL, Madrid, 1.979.

2 Finite Element Procedures for Structural Design (3.0 ECTS)

2.1 Course Data

- Name: Finite Element Procedures for Structural Design
- Course area: Construction Engineering
- Code: 213101024
- Degree programme (and number of semester): MSc Civil Engineering (3rd semester)
- Center: School of Civil & Mining Engineering
- Type: Elective course
- Semester: Autumn
- Language: English
- ECTS: 3.0

2.2 Lecturer data

- Lecturer in charge: Gregorio Sánchez Olivares
- Department: Department of Civil Engineering
- Knowledge area: Construction Engineering
- Office location: "Anexo de la Escuela Técnica Superior de Caminos, Canales y Puertos y de Ingeniería de Minas. Primera planta - Despacho A.1.13"
- Telephone: +34 968 32 5927
- Email: gregorio.sanchez@upct.es
- URL/Web:

2.3 Course description

2.3.1 Summary

The purpose of this course is to present the possibilities of applying the Finite Element Method in problems associated with the design of structures in civil engineering.

2.3.2 Theory syllabus

UNIT I. INTRODUCTION.
LESSON 1. PRELIMINARIES.
LESSON 2. STANDARD DISCRETE SYSTEMS.
LESSON 3. WEIGHTED RESIDUAL AN VARIATIONAL APPROACHES.
UNIT II. BASIC FORMULATION.
LESSON 4. DISPLACEMENT APPROACH.
LESSON 5. PLANE STRESS AND PLANE STRAIN.
LESSON 6. THREE-DIMENSIONAL STRESS ANALYSIS.
LESSON 7. ELEMENT SHAPE FUNCTIONS.
UNIT III. MAPPED ELEMENTS AND NUMERICAL INTEGRATION.
LESSON 8. TRANSFORMED ELEMENTS.
LESSON 9. NUMERICAL INTEGRATION.
UNIT IV. COMPUTER PROCEDURES.
LESSON 10. GEOMETRY, MATERIAL, LOADS AND MESH SPECIFICATION.

LESSON 11. ASSEMBLY AND SOLUTION.
LESSON 12. RESULTS PROCESSING.

2.3.3 Practice syllabus

2D and 3D discrete modelling (PC)
Linear analysis of a plane stress structure or a plane strain structure (PC)
Non-linear analysis of a retaining wall structure (PC)
Elastic second-order analysis of a 2D structure (PC)
Elastic-plastic second-order analysis of a 2D structure (PC)
Dynamic analysis of a 2D structure (PC)

2.3.4 Assesment method

Short questions on theory(about 20) 50%
Exercises and practice report 50%

2.4 Bibliography and resources

2.4.1 Basic bibliography

- BATHE K.J. Finite Element Procedures, 2nd ed., Prentice Hall, Upple Saddle River, NJ, 1996.
- NAFEMS. A Finite Element Primer. NEL, Hamilton, UK, 2003.
- OÑATE E. Cálculo de Estructuras por el Método de Elementos Finitos. Análisis Estático Lineal. CIMNE, Barcelona, 1995.
- ZIENKIEWICZ O.C., TAYLOR R.L., ZHU J.Z. y NITHIARASU P. El Método de los Elementos Finitos. Volumen 1. Las Bases. CIMNE, Barcelona, 2010.
- ZIENKIEWICZ O.C., TAYLOR R.L., ZHU J.Z. y NITHIARASU P. El Método de los Elementos Finitos. Volumen 2. Mecánica de Sólidos. CIMNE, Barcelona, 2010.

2.4.2 Supplementary bibliography and/or on-line resouces and others

- ARRIETA J.M., MADRID A.J. y MIRA P. Un programa de elementos finitos: SAP-90. CEDEX, Madrid, 1992.

- BELTZER A.I. Variational and Finite Elements Methods: Symbolic Computation Approach. Springer-Verlag, Berlín, 1990.
- CRISFIELD M.A. Non-Linear Finite Element Analysis of Solids and Structures. Volume 1. Essentials. John Wiley & Sons, Chichester, UK, 2003.
- CRISFIELD M.A. Non-Linear Finite Element Analysis of Solids and Structures. Volume 2. Advanced Topics. John Wiley & Sons, Chichester, UK, 2001.
- FERREIRA A.J.M. MATLAB Codes for Finite Element Analysis. Solids and Structures. Springer, 2008.
- HUEBNER K.H., DEWHIRST D.L., SMITH D.E. and BYROM T.G. The Finite Element Method for Engineers. 4ª ed., John Wiley & Sons, New York, 2001.
- HOFSTETTER G. and MANG H.A. Computational Mechanics of Reinforced Concrete Structures. Vieweg, Weisbaden, 1995.
- JURADO J.A., DIAZ J., NIETO F., FONTAN A.N. y HERNANDEZ S. Ejemplos resueltos de cálculo de estructuras con el programa SAP 2000. Tórculo Edicións, Santiago de Compostela, 2008.
- MADENCI E. and GUVEN I. The Finite Element Method and Applications in Engineering Using ANSYS. Springer, NY, 2006.
- http://www.nafems.org/
- http://www.csiamerica.com/products/sap2000
- http://www.nist.gov/itl/math/
- http://www.autodesk.com/products/autodesk-simulation-family/features/robot-structural-analysis/all/gallery-view
- http://www.ansys.com/
- http://www.solidworks.com/sw/products/simulation/finite-element-analysis.htm
- http://www.comp-engineering.com/
- http://www.cimne.com/cdl1/ctrhome/2#
- https://aulavirtual.upct.es/

3 Modelling and Simulation in Hydraulic Structures (4.5 ECTS)

3.1 Course Data

- Name: Modelling and Simulation in Hydraulic Structures
- Course area: Hydraulic Engineering
- Code: 213101019
- Degree programme (and number of semester): MSc Civil Engineering (3rd semester)
- Centre: School of Civil & Mining Engineering
- Type: Elective course
- Semester: Autumn
- Language: Partially in English
- ECTS: 4.5

3.2 Course description

3.2.1 Summary

In this subject, the student will learn several tools to solve advance hydraulic engineering problems. The students will know how to design and analyse reduced physical models and how to measure and understand the main hydraulic variables. Computational Fluid Dynamic programs are shown as a complement of the physical modelling.

3.2.2 Theory syllabus

I. Physical Hydraulic Modelling:

Pi theorem. Dimensional analysis and physical semblance. Non-dimensional numbers. Universal equation of the Hydraulic. Inspectional analysis. Rigid and bed movable models. Distorted models.

II. Numerical Simulation and Analysis of Hydraulic Structures through specialized software:

- HEC-RAS. One dimensional open channel flows in steady state and transient (rules of gates, dam breaking).

- Iber. Two dimensional open channel flows in transient.
- CFD.

3.2.3 Practice syllabus

Laboratory measurement techniques:

- Design and measurement of reduced physical models.
- Free falling jets.
- Intake systems.

Study cases in informatics room.

3.2.4 Assessment method

Exercises / Project expositions 70%
Exercises and practice reports 30%

3.3 Bibliography and resources

3.3.1 Basic bibliography

- Anderson, J.D. (1995). Computational Fluid Dynamics: The Basics with Applications. Mac Graw Hill. USA.
- ASCE (2000). Hydraulic Modeling. Concepts and Prectice. ASCE Manuals and Reports on engineering Practice No. 97. USA.
- Kobus, H. (1980). Hydraulic Modelling. Pitman Books. London, UK.
- Novak, P. and Cabelka, J. (1981). Models in Hydraulic Engineering (1981). Pitmam Publishing Inc., Massachusetts. USA.
- Sharp, J.J. (1981). Hydraulic Modelling. Butterworths and Co. London, UK.
- US Army Corps of Engineers (2010). HEC-RAS 4.1 Users Manual. Institute for Water Resources Hydrologic Engineer Center, Davis California.

3.3.2 Supplementary bibliography and/or on-line resources

- Castillo Elsitdié, Luís G. (2011). Apuntes de análisis de flujo en lámina libre. Reprografía de la UPCT. Spain.
- White, Frank M. (1986). Fluid mechanics. Ed. McGraw-Hill. EEUU
- Batchelor G. K. (1973). An introduction to fluid dynamics. Cambridge University Press. Reino Unido
- Hinze, J. O. (1975). Turbulence. Ed. McGra-Hill. USA.
- Abbot, M.B.. and Basco, D.R. (1989). Computational fluid dynamics. Ed. John Wile & Sons. New York.
- US Army Corps of Engineers. HEC-RAS. Hydraulic Reference Manual. Institute for Water Resources Hydrologic Engineer Center, Davis California.
- US Army Corps of Engineers. HEC-RAS Applications Guide. Institute for Water Resources Hydrologic Engineer Center, Davis California.
- Vreugdenhil, C.B. (1994). Numerical methods for shallow-water flow. Ed. Kluwer Academic Publishers. The Netherlands.
- OpenFoam User Guide (2012). The Open Foam Foundation.
- Modelización bidimensional del flujo en lamina libre en aguas poco profundas (2012), Manual de referencia hidráulico y Manual básico de usuario. Iber, Spain.
- Vera Coello M. et al. (2012). Ingeniería fluidodinámica. Paraninfo. Spain.

3.4 Lecturer data

Lecturer in charge: José M. Carrillo Sánchez

Department: Department of Civil Engineering

Knowledge area: Hydraulic Engineering

Office location: "Anexo de la Escuela Técnica Superior de Caminos, Canales y Puertos y de Ingeniería de Minas. Primera planta - Despacho A.1.07"

Telephone: +34 868 071 289

Email: jose.carrillo@upct.es

URL/Web:

4 Analysis of Hydraulic and Hydrologic Systems (3.0 ECTS)

4.1 Course Data

- Name: Analysis of Hydraulic and Hydrologic Systems
- Course area: Hydraulic Engineering
- Code: 213101018
- Degree programme (and number of semester): MSc Civil Engineering (3rd semester)
- Centre: School of Civil & Mining Engineering
- Type: Elective course
- Semester: Autumn
- Language: English
- ECTS: 3.0

4.2 Course description

4.2.1 Summary

The objective is to obtain the knowledge to use hydraulic software, to analyze the results and to optimize the system. Several open source programs are used:

1. EPANET for modelling Hydraulic pressure systems.
2. HEC-RAS for modelling open channel flows and river systems.
3. SWMM for modelling open channel flows in sewage systems.

4.2.2 Theory syllabus

UNIT I.

LESSON 1. INTRODUCTION TO THE HYDRAULIC PRESSURE SYSTEMS

LESSON 2. INPUT DATA TO BUILD A HYDRAULIC PRESSURE MODEL

LESSON 3. EPANET. CALCULATION BASES, USE AND MODELLING

LESSON 4. PRACTICAL CASES. ANALYSIS OF RESULTS OF THE MODEL AND SYSTEM OPTIMIZATION.

UNIT II.

LESSON 5. INTRODUCTION TO THE HYDRAULIC OPEN CHANNEL FLOW SYSTEMS

LESSON 6. INPUT DATA TO BUILD AN OPEN CHANNEL FLOW MODEL

LESSON 7. HEC-RAS. CALCULATION BASES, USE AND MODELLING

LESSON 8. SWMM. CALCULATION BASES, USE AND MODELLING

LESSON 9. PRACTICAL CASES. ANALYSIS OF RESULTS OF THE MODEL

4.2.3 Practice syllabus

P1. MODELLING HYDRAULIC PRESSURE SYSTEMS (PC)

Analysis of Study Case 1.

Hydropower plant regulation (LAB/PC)

P2. MODELLING HYDRAULIC PRESSURE SYSTEMS (PC)

Analysis of Study Case 2.

P3. MODELLING HYDRAULIC PRESSURE SYSTEMS (PC)

Analysis of Study Case 3.

P4. MODELLING HYDRAULIC OPEN CHANNEL FLOW SYSTEMS (PC)

Analysis of Study Case 4.

P5. MODELLING HYDRAULIC OPEN CHANNEL FLOW SYSTEMS (PC)

Analysis of Study Case 5.

P6. MODELLING HYDRAULIC OPEN CHANNEL FLOW SYSTEMS (PC)

Analysis of Study Case 6.

4.2.4 Assessment method

Exercises / Project expositions 70%

Exercises and practice reports 30%

4.3 Bibliography and resources

4.3.1 Basic bibliography

- Castillo Elsitdié, Luis G. (2002). Apuntes de obras y aprovechamientos hidráulicos. (2 Volúmenes). Reprografía de la UPCT. España.
- Rossman, L.A. et al. (2000). EPANET 2 Users Manual. NATIONAL RISK MANAGEMENT RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OH 45268
- US Army Corps of Engineers. (2010) HEC-RAS 4.1 Users Manual. Institute for Water Resources Hydrologic Engineer Center, Davis California.
- US Army Corps of Engineers. HEC-RAS. Hydraulic Reference Manual. Institute for Water Resources Hydrologic Engineer Center, Davis California.
- US Army Corps of Engineers. HEC-RAS Applications Guide. Institute for Water Resources Hydrologic Engineer Center, Davis California.

4.3.2 Supplementary bibliography and/or on-line resources

- Bladé, E. et al. (2009). Modelación numérica en ríos en régimen permanente y variable. Ediciones UPC, España.
- Cabrera, E. et al. (2009). Ingeniería Hidráulica aplicada a los sistemas de distribución de agua. ITA - Universidad Politécnica Valencia, España.
- Cabrera, E. et al. (2012). Transitorios Hidráulicos. Del régimen estacionario al golpe de ariete. . ITA - Universidad Politécnica Valencia, España.

4.4 Lecturer data

Lecturer in charge: José M. Carrillo Sánchez

Department: Department of Civil Engineering

Knowledge area: Hydraulic Engineering

Office location: "Anexo de la Escuela Técnica Superior de Caminos, Canales y Puertos y de Ingeniería de Minas. Primera planta - Despacho A.1.07"

Telephone: +34 868 071 289
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URL/Web:

5 Special foundations (4.5 ECTS)

5.1 Course Data

- Name: Special foundations
- Course area:Geotechnical engineering
- Code:2131010232011
- Degree programme (and number of semester):MSc Civil Engineering (3th semester)
- Center:School of Civil & Mining Engineering
- Type:Elective course
- Semester: Autumn
- Language: English
- ECTS:4.5

5.2 Lecturer data

- Lecturer in charge:Gonzalo García Ros and Iván Alhama Manteca
- Department:Department of Civil Engineering
- Knowledge area:Ground engineering
- Office location: Escuela de Caminos y Minas, planta baja, despacho 0.28
- Telephone:0034 968325743
- Email:gonzalo.garcia@upct.es
- URL/Web:`http://www.upct.es/caminosyminas/MasterCaminos.html`

5.3 Course description

5.3.1 Summary

The subject presents different topics related to the design and construction of foundations, as well as methods of ground improvement for the case of foundations in difficult soils.

1. Relationship with other courses and/or prior recommendations: Geotechnic and foundations

5.3.2 Theory syllabus

Teaching unit Lesson

1. Foundations in difficult soils

   1.1: Collapsible soils

   1.2: Expansible soils

   1.3: Waste landfills

   1.4: Bearing capacity improvementaste

   1.5: Consolidation by means of vertical drains2. Constructions of retaining walls

   2.1: Construction and geotechnical monitoring. Scope examples

   2.2: Practical case study

2. Construction of earth dams

   3.1: Core and shoulder characteristics

   3.2: Geotechincal monitoring

   3.3: Stability of dams4. Some methods to control reinforcement and strain

   4.1: Micropiles

   4.2: Anchors

   4.3: Prefabricated piles

3. Dynamic geotechnical problems

   5.1: Dynamic soil behavior

   5.2: Vibration of foundations on elastic media

5.3.3 Practice syllabus

Edometric and Rowe cell laboratory testing. Simulation of consolidation problems with prefabricated vertical drains

5.3.4 Assesment method

Exam 40%
Exercise / Project report unit 1 10%
Exercise / Project report unit 2 10%
Exercise / Project report unit 3 10%
Exercises and practice report 20%
Seminar / technical visit and assistance 10%

5.4 Bibliography and resources

5.4.1 Basic bibliography

- Soil Mechanics. Berry, P.L., Reid, D. McGraw-Hill
- Soil Mechanics. A one-dimensional introduction. David Muir Wood. Cambridge University Press
- Geotechnical engineering", R. Lancellotta. Editorial Rotterdam: A.A. Balkema, 1995
- Geotechnical engineering", González de Vallejo. Prentice Hall.

6 Flow and transport simulation in groundwater processes. Applications to engineering and environmental problems (4 ECTS)

6.1 Course Data

- Name: Flow and transport simulation in groundwater processes. Applications to engineering and environmental problems
- Course area: geotechnical engineering
- Code: 228101017
- Degree programme (and number of semester): MSc in Water and Ground Science & Technology, (1st semester)

- Center: School of civil and mining engineering (UPCT)
- Type:optative (Module II: weater resources speciality)
- Semester: Autumn
- Language: English
- ECTS:4

6.2 Lecturer data

- Lecturer in charge: Iván Alhama Manteca
- Department:Department of Civil Engineering
- Knowledge area:Ground engineering
- Office location: Escuela de CAminos y Minas, planta baja, despacho 0.31
- Telephone:0034 868071278
- Email:ivan.alhama@upct.es
- URL/Web: `http://www.upct.es/caminosyminas/MasterCaminos.html`

6.3 Course description

6.3.1 Summary

During the course of the subject, the coupled processes of groundwater flow and salt transport in porous media are studied, with transitory and stationary conditions. These problems define the dynamics of groundwater in aquifers, including problems of saline intrusion (coastal aquifers) and others of a similar nature. A total of 10 practical cases in which the student will put progressively into practice and the concepts developed in each of the sessions, are solved. The computer applications are carried out with the Modflow program.

1. Relationship with other courses and/or prior recommendations: Surface and groundwater hydrology

6.3.2 Theory syllabus

Teaching unit 1: Free and confined aquifers. Piezometry-groundwater flow relationship. Flow and transport equations in porous media. Hydrogeological parameters. Intrusion in coastal aquifers. Characterization of scenarios. Deposits and balances. Surface water-groundwater relations.

Teaching unit 2: Introduction to the numerical modeling of groundwaer flow and transport of salt in porous media. The Modflow program through the Visual Modflow interface: Operation and resolution of 10 practical cases.

6.3.3 Practice syllabus:

Field trip to the coastal aquifer of Agua amarga (El altet, Alicante).

Measures on the piezometric network are taken by means of a probe.

6.3.4 Assesment method

Exam 20%

Exercise / Project report 70%

Assistence 10%

6.4 Bibliography and resources

6.4.1 Basic bibliography

- Physical and Chemical Hydrogeology. Patrick A. Domenico, Franklin W. Schwartz. Wiley; 2 edition (September 22, 1997).
- Visual MODFLOW v.4.2. User’s Manual.- Schlumberger Water Services.
- Mar Menor: Una laguna singular y sensible. Evaluación científica de su estado.

6.4.2 Supplementary bibliography and/or on-line resouces and others

- SEAWAT, ver Langevin, Barclay y Guo (2003).
- Custodio E. y Llamas R.M. (1983). Hidrología Subterránea. (2ª ed.) Ediciones Omega. Barcelona.

7 River Hydraulics (4 ECTS)

7.1 Course Data

- Name: River Hydraulics
- Course area: Hydraulic Engineering
- Code:
- Degree programme (and number of semester): MSc OF SCIENCE AND TECHNOLOGY IN WATER AND SOIL
- Center: School of Civil & Mining Engineering
- Type: Elective course
- Semester: Autumn
- Language: English
- ECTS: 4.0

7.2 Lecturer data

- Lecturer in charge: Juan Tomás García Bermejo
- Department: Civil Engineering
- Knowledge area: Hydraulic Engineering
- Office location: (sin traducir)
- Telephone: 968 32 70 26
- Email: juan.gbermejo@upct.es
- URL/Web: www.upct.es/~ingcivil/

7.3 Course description:

The course is based on the hydrodynamic processes in rivers that result in river formation like erosion and sedimentation processes. So, the theoretical and applied Hydrodynamics of fluid-particle systems is reviewd. The resistance to flow and river formation and the sediment transport is also studied. The hydraulic processes are also reviewed in closed pipes.

7.3.1 Theory syllabus

Module I

Unit 1. Fundamentals in Rivers. Fluvial morphology. Preponderant flows in rivers. River ecosystems.

Module II

Unit 2. Hydrodynamics of fluid-particle systems. River Hydraulics. Principles of movement. Hydraulic characterization of river channels. Module III

Unit 3. Equations of Sediment Transport Mechanics.

Unit 4. Sediment characteristics in a river

Unit 5. Application of Sediment Transport equations in rivers and closed pipes

Unit 6. Erosion and sedimentation phenomenons.

7.4 Bibliography and resources

7.4.1 Basic bibliography

- Castillo Elsitdié, Luis G. (2002). Apuntes de obras y aprovechamientos hidráulicos. (2 Volúmenes). Reprografía de la UPCT. España.

- Martín Vide, J.P. (2002). Ingeniería de ríos. Ediciones de la Universidad Politécnica de Cataluña, España

- Martín Vide, J.P. (2003). Ingeniería Fluvial. Ediciones de la Universidad Politécnica de Cataluña, España.

7.4.2 Supplementary bibliography and/or on-line resouces and others

- Chang, H.H. (1988). Fluvial Processes in River Engineering. John Wiley, Nueva York

- Simons, Daryl B. y Sentürk, Fuat. (1992). Sediment Transport Technology. Water Resources Publications, Colorado- USA.

- Erosion and Sedimentation Manual. (2006) U.S. Department of the Interior Bureau of Reclamation Technical Service Center Sedimentation and River Hydraulics Group, Denver-Colorado-USA

- Vanoni, V. (1975). Sedimentation Engineering. ASCE, Nueva York

- Henderson, F.M. (1966). Open Channel Flow. Macmillan, Nueva York.
- Garcia, M.H. (2004) Hydraulic Desing Handbook, Chapter 6 Sedimentation and Erosion Hydraulics. McGraw-Hill
- Jansen, P. et al. (1979). Principles of River Engineering. Pitman, London
- Petersen, M. (1986). River Engineering. Pretince-Hall, Englewoods Clifford-

8 Hydraulic Models –Epanet & HEC-RAS– (4.0 ECTS)

8.0.1 Course Data

- Name: Analysis of Hydraulic and Hydrologic Systems
- Course area: Hydraulic Engineering
- Code: 228101010
- Degree programme (and number of semester): MSc in Water and Ground Science & Technology (2nd semester)
- Centre: School of Civil & Mining Engineering
- Type: Elective course
- Semester: Spring
- Language: English
- ECTS: 4.0

8.0.2 Lecturer data

Lecturer in charge: José M. Carrillo Sánchez

Department: Department of Civil Engineering

Knowledge area: Hydraulic Engineering

Office location: "Anexo de la Escuela Técnica Superior de Caminos, Canales y Puertos y de Ingeniería de Minas. Primera planta - Despacho A.1.07"

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URL/Web:

8.0.3 Course description

1. Summary The objective is to obtain the knowledge to use hydraulic software, to analyze the results and to optimize the system. Several open source programs are used:

   (a) EPANET for modelling Hydraulic pressure systems.

   (b) HEC-RAS for modelling open channel flows and river systems.

2. Theory syllabus UNIT I.

   LESSON 1. INTRODUCTION TO THE HYDRAULIC PRESSURE SYSTEMS

   LESSON 2. INPUT DATA TO BUILD A HYDRAULIC PRESSURE MODEL

   LESSON 3. EPANET. CALCULATION BASES, USE AND MODELLING

   LESSON 4. PRACTICAL CASES. ANALYSIS OF RESULTS OF THE MODEL AND SYSTEM OPTIMIZATION.

   UNIT II.

   LESSON 5. INTRODUCTION TO THE HYDRAULIC OPEN CHANNEL FLOW SYSTEMS

   LESSON 6. INPUT DATA TO BUILD AN OPEN CHANNEL FLOW MODEL

   LESSON 7. HEC-RAS. CALCULATION BASES, USE AND MODELLING

   LESSON 8. PRACTICAL CASES. ANALYSIS OF RESULTS OF THE MODEL

3. Practice syllabus P1. MODELLING HYDRAULIC PRESSURE SYSTEMS (PC)

   Analysis of Study Case 1.

   Hydropower plant regulation (LAB/PC)

   P2. MODELLING HYDRAULIC PRESSURE SYSTEMS (PC)

Analysis of Study Case 2.

P3. MODELLING HYDRAULIC PRESSURE SYSTEMS (PC)

Analysis of Study Case 3.

P4. MODELLING HYDRAULIC OPEN CHANNEL FLOW SYSTEMS (PC)

Analysis of Study Case 4.

P5. MODELLING HYDRAULIC OPEN CHANNEL FLOW SYSTEMS (PC)

Analysis of Study Case 5.

P6. MODELLING HYDRAULIC OPEN CHANNEL FLOW SYSTEMS (PC)

Analysis of Study Case 6.

4. Assessment method

   Exercises / Project expositions 70%

   Exercises and practice reports 30%

8.0.4 Bibliography and resources

1. Basic bibliography

   - Rossman, L.A. et al. (2000). EPANET 2 Users Manual. NATIONAL RISK MANAGEMENT RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OH 45268
   - US Army Corps of Engineers. (2010) HEC-RAS 4.1 Users Manual. Institute for Water Resources Hydrologic Engineer Center, Davis California.
   - US Army Corps of Engineers. HEC-RAS. Hydraulic Reference Manual. Institute for Water Resources Hydrologic Engineer Center, Davis California.
   - US Army Corps of Engineers. HEC-RAS Applications Guide. Institute for Water Resources Hydrologic Engineer Center, Davis California.
   - Castillo Elsitdié, Luis G. (2002). Apuntes de obras y aprovechamientos hidráulicos. (2 Volúmenes). Reprografía de la UPCT. España.

- ASCE (2000). Hydraulic Modeling. Concepts and Prectice. ASCE Manuals and Reports on engineering Practice No. 97. USA.

2. Supplementary bibliography and/or on-line resources

   - Bladé, E. et al. (2009). Modelación numérica en ríos en régimen permanente y variable. Ediciones UPC, España.
   - Cabrera, E. et al. (2009). Ingeniería Hidráulica aplicada a los sistemas de distribución de agua. ITA - Universidad Politécnica Valencia, España.
   - Cabrera, E. et al. (2012). Transitorios Hidráulicos. Del régimen estacionario al golpe de ariete. . ITA - Universidad Politécnica Valencia, España.

9 Spanish Courses (1.5 ECTS each)

- ECTS: 1,5
- Code:
- Number of hours: 3 hours per week (two sessions of 1,5h) .
- Start date: October and February.
- Levels: A1.1, A1.2, A2.2, B1.1, B2.1

10 Master's Thesis (9 ECTS)

- Name: Master's Thesis
- Course area: Electable
- Code: 210701053
- Center: School of Civil & Mining Engineering
- Semester: Autumn / Spring
- Language: English
- ECTS: 9