M2 PROGRAM DESCRIPTION
Master in Civil Engineering
Hydraulics and Civil Engineering

International Program

Prof : Gaël Combe
Program director
gael.combe@grenoble-inp.fr

http://master-hydraulic.grenoble-inp.fr/

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M2 PROGRAM DESCRIPTION

Semester 3

Sept. 2016 - Jan. 2017

5 compulsory modules
1 optional module (among 3)

Semester 4

Feb. 2017 - Jul. 2017

5 months internship (private companies, research lab., etc.)

- Job in a private company
- Ph. D.

SEMESTER 3
30 ECTS, 300 Teaching Hours

5 compulsory modules

1/ RIVER DYNAMICS
6 ETCS, 60h

2/ FLOOD PROPAGATION AND MITIGATION
4 ETCS, 40h

3/ MECHANICAL STRUCTURE DESIGN
6 ETCS, 60h

4/ ASSET MANAGEMENT FOR CIVIL ENGINEERING WORKS AND NETWORKS
6 ETCS, 60h

5/ FRENCH AS A FOREIGN LANGUAGE
2 ETCS, 20h

1 optional module (among 3)

1/ WATER QUALITY AND TREATMENT
6 ETCS, 60 h

2/ WATER MANAGEMENT IN A NON STATIONARY ENVIRONMENT
6 ETCS, 60 h

3/ NATURAL HAZARDS AND CLIMATE CHANGE
6 ETCS, 60 h

SEMESTER 3
Compulsory modules description

1/ RIVER DYNAMICS

6 ETCS, 60h

Module leader

Prof. Eric BARTHELEMY

Lecture courses	32h
Tutorial classes	12h
Engineering work	8h
Practicals	8h
Exams	*4h*
Optional learning support	*10h*

Objectives and content

First part : fluvial dynamics

- Understand the physics and the modeling of unsteady flows in the rivers and canals (propagation of the tide, floods and of rapidly varying flows in the rivers and canals)
- Saint Venant equation formulation
- Design the volume of retention dams for flood protection
- Understanding the links between the physical reality, its perception and its modeling
- Brief presentation of the market software properties dealing with this problem

Second part : sediment transport

- Students will become acquainted with the pluridisciplinary aspects of this topic
- Student will be asked to master: the concept and the quantitave determination of sediment mouvement inception, computation of sediment transport rates, the concept of sedimentary equilibrium (river bed slope, grain size distributions), engineering tools of the field

SEMESTER 3
Compulsory modules description

2/ FLOOD PROPAGATION AND MITIGATION

4 ETCS, 40 h

Lecture courses	8h
Engineering work	32h

Module leader

Dr. Isabella ZIN

Objectives and content

First part : Flood propagation

- Hydraulic modelling of rivers with HEC-RAS (Hydrologic Engineering Centers River Analysis System)

Second part : Hydraulic Structures

- Hydraulic design of structures

SEMESTER 3
Compulsory modules description

3/ MECHANICAL STRUCTURE DESIGN

6 ETCS, 60h

Lecture courses	52h
Engineering work	8h
Exams	*3h*
Optional learning support	*10h*

Module leader
Prof. Gaël COMBE

Objectives and content

- Understanding and modelling of mechanical behaviour of geomaterials
- Global understanding of the design phase of a structure
- Comprehension and modelling of a structure including its foundation.

SEMESTER 3
Compulsory modules description

4/ ASSET MANAGEMENT FOR CIVIL ENGINEERING WORKS AND NETWORKS

6 ETCS, 60h

Module leader

Prof. Frédéric DUFOUR

Lecture courses	20h
Tutorial classes	26h
Engineering work	14h
Exams	*3h*
Optional learning support	*10h*

Objectives and content

- Understanding of modeling tools used to describe the change over time of structures and their functioning
- Developing strategies for monitoring, assessment and diagnosis of civil engineering structures and networks (water and wastewater networks, dams, dikes, tunnels and railways)
- Knowledge of physical phenomena of degradation of materials and structures, knowledge of the main pathologies
- Being able to choose among the main techniques for structures rehabilitation and to know the respective impact on their serviceability and safety.

SEMESTER 3
Compulsory modules description

5/ FRENCH AS A FOREIGN LANGUAGE (FLE)

2 ETCS, 20h

Lecture courses	20h

Module leader

Ing. Antoine LE GRAND

Obectives and content

During 10 weeks, 2 hours of FLE per weeks
Grade level small group

SEMESTER 3
Optional modules description

1/ WATER QUALITY AND TREATMENT

6 ETCS, 60h

Lecture courses	20h
Tutorial classes	26h
Engineering work	6h
Exams	*3h*
Optional learning support	*10h*

Module leader
Dr. Philippe SECHET

Objectives and content

- Understand and model pollutions transfer processes on natural ponds & urbanized area
- Understand their impact on the natural and urban environment
- Develop strategies in terms of planning and pollution control to limit these impacts
- Ensure the production of water suitable for various uses (domestic, industrial,...).

SEMESTER 3
Optional modules description

2/ WATER MANAGEMENT IN A NON STATIONARY ENVIRONMENT

6 ETCS, 60 h

Module leader
Prof. Anne-Catherine FABRE

Lecture courses	48h
Engineering work	8h
Practicals	4h
Exams	*3h*
Optional learning support	*10h*

Objectives and content

- To be able to produce regionalized (spatial) data using several methods.
- To understand notions of meteorology and climatology required for hydrological forecasting.
- To be aware of the need to take into account non stationarities (climate or change in land use) in long-term hydrological forecasting and management of water resources.
- To be able to apply new methodologies for hydrological forecasting at several lags.

An approach linked with research is privileged in this in-depth module. It is divided into three parts :
1 - Meteorology and climatology
2 - Geostatistics and spatial data
3 - Forecast and management of water resources in a non stationary context.
A short-project in the module called "Engineering of hydraulic structure" III will allow to link the three areas teached in this module.

SEMESTER 3
Optional modules description

3/ NATURAL HAZARDS AND CLIMATE CHANGE

6 ETCS, 60 h

Module leader

Prof. Fabrice EMERIAULT

Lecture courses	30h
Tutorial session	8h
Engineering work	22h
Exams	*3h*
Optional learning support	*10h*

Objectives and content

- To understand the tools used for defining the regional and local seismic hazard
- Advanced knowledge of soil dynamics and the associated mechanical. phenomena (including liquefaction).
- To know how to design a structure considering the seismic hazard (including dams, natural slopes, retaining structures and foundations).
- Knowledge of physical and mechanical phenomena at the origin of gravity risk (landslide, rock fall, avalanche).
- To understand the behavior of unsaturated soils and the impact on the stability of structures or natural slopes.
- Knowledge of the main techniques used for improving soil and the design of protective structures.

This course provides an overview of the issues natural hazards and climate change on the stability of structures (especially related to the transition between unsaturated and saturated soil). It covers in particular the seismic risk and the slope stability. The physical and mechanical phenomena induced in the soil and structures are addressed. The consequences in terms of stability of structures and natural slopes are analyzed. Finally the techniques usually used for risk mitigation (including soil improvement or installation of protective structures) are identified and discussed in more depth in the context of a design project.