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**Environmental and Hydraulic Engineering**

**PhD:** Environmental and Hydraulic Engineering  
**Graduate School:** Civil Engineering and Architectrue  
**Department:** Civil, Construction and Environmental Engineering  
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**Places:** 10

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**Curricula:**  
a) ENVIRONMENTAL ENGINEERING  
b) HYDRAULIC ENGINEERING

**Objectives:**  
The Environmental Engineering PhD course is part of the PhD School of Civil Engineering and Architecture. There are two different curricula: Environmental Engineering Curriculum and Hydraulics Engineering Curriculum. The Environmental Engineering Curriculum aims at getting an improved understanding of the environment-related phenomena and processes. A theoretical description should be provided afterward in order to be used for the environmental impact assessment and the design of pollution remedial actions. The adopted approach integrates knowledge and methods from various disciplines (geophysics, geotechnics, hydraulic works as well as sanitary and environmental engineering). This allows an in-depth understanding and an appropriate analytical description of the environmental processes.

Where the bio-geochemical cycles equilibrium is not altered by anthropic processes, the main focus is to preserve the environmental compartments. In the presence of alterations as a result of human activities, the main focus is to find appropriate alternative remedies.

The PhD graduate in Environmental and Hydraulic Engineering might give an useful support to different local and national authorities by planning, designing and taking decisions concerned with the the environmental protection field and the reduction of environmental risks.

The research activities of the Environmental Engineering Curriculum PhD include several topics described below:  
-Geotechnical issues in land preservation;  
-Stability of slopes, surface deformations of natural soils;  
-Forecast and management of floods;  
-Wastewater treatment and reuse;  
-Remediation of contaminated sites;  
-Chemical and mechanical characterization of waste materials;  
-Treatment and disposal of municipal solid wastes;  
-Utilization and recycling of waste materials;  
-Atmospheric pollution;  
-Water pollution control.

Hydraulic engineering in Rome has a long historical tradition. Some of the main research objectives in this field have been: - design of aqueducts and sewage systems; - prediction of extreme events (i.e. related to Tevere River flood) - rational use of landscapes (drainage and reclamation).

Theoretical and experimental findings in the last two centuries, have allowed to revisit design criteria and to apply fluid mechanics in several fields different from civil engineering.

In this sense, hydrology, turbulence, wave propagation, dispersion processes and biological flows become among the most important topics in hydraulic research focused. Moreover new research approaches have been developed depending on the possibility offered by new technologies. This is the basic point of the Hydraulic Engineering Curriculum.

In particular, the activities related to this curriculum are organized into two phases: - the first year is mainly devoted to acquire theoretical basis and knowledge of methodologies; - second and third year will be devoted to the specific research project PhD thesis are based on numerical and/or experimental activity. In the first case the tutor provides suitable computing resources. Laboratory activity is focused on the development and application of techniques based on optical methods that allow the measurement of the velocity field with high space and time resolution (i.e. PIV-Particle Image velocimetry; PTV-Particle Tracking Velocimetry, Feature Tracking).

These methods allow the gain of Eulerian and Lagrangian high space and time resolution information on the flow filed. Important results concerning i.e. boundary layers, turbulence, convection and porous media have been obtained and published on refereed Journals.

Based on this experience, a system to analyze hyper spectral images has been set up; it is used to perform analysis of environmental concern as:  
-identification of land degradation phenomena;  
-identification on vegetation stress;  
-analysis of buildings of considerable historical and architectural concern;  
-identification of risk situations such as the presence of substances hazardous to health or illegal waste displacement;  
-water bodies characterization.