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**COURSE: Applied Hydrogeology**

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**ACADEMIC YEAR: 2019-2020**

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**TYPE OF EDUCATIONAL ACTIVITY: Characterizing**

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**TEACHER: Filomena Canora**

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Language: English

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ECTS: **6** CFUn. of hours: **56**

Campus: Potenza

Semester: I

ECTS 4 CFU lessons

n. of hours 32 lessons

Departement of Science

**01 ottobre 2018 al**

ECTS 2 CFU tutorials

n. of hours 24 tutorials

**20 dicembre****2019/20 gennaio****2020**

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**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

Knowledge: Aquifer characterization. Hydrogeological balance. Hydrodynamic parameters, principles of groundwater flow. Darcy law. Bernoulli equation. Groundwater flow equations. Hydraulic of wells and piezometers. Pumping tests. Methods for the interpretation of pumping tests. Equation of pollutant transport. Processes of dispersion and diffusion. Coastal aquifers. Environmental and conservative tracers, multi - tracer approach. Numerical hydrogeological modeling. Karst aquifers. Groundwater quality: Pollutants and evaluation of the degree of water pollution. Aquifer pollution vulnerability and risk. Criteria and methods to define the intrinsic vulnerability. Analysis of the main hydrogeological structures of the Basilicata region.

Skills: Development and understanding of the ability to recognize classify and analyze the peculiar problems of hydrogeological and environmental applications, to make a quantitative parameter of the aquifer. Knowledge tools to address different stages of investigations in the context of hydrogeological studies. Ability to identify the criteria for the proper management and protection of groundwater. Acquisition of specific skills in order to interact with similar figures that operate within the different skills and phases related to the environmental hydrogeological problems and the risk of pollution of aquifers.

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**PRE-REQUIREMENTS** No requirement

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**SYLLABUS**

First block of lectures (14 hours of which 6 hours of exercises). Groundwater hydrodynamics. Hydrogeological water balance. Hydrodynamic parameters, principles of groundwater flow. Darcy law. Bernoulli's equation. Spring Classification. Springs' Hydrographs and Chemographs.

Second block of lectures (14 hours of which 6 hours of exercises). Groundwater flow equations. Hydraulics of wells. Pumping tests. Methods for the interpretation of pumping tests. Steady state and transient in unconfined and confined aquifers, determination of hydrodynamic parameters, Dupuit, Theis and Jacob solution.

Third block of lectures (16 hours of which 8 hours of exercises). Water quality Laws and groundwater protection policy. Groundwater quality: Pollutants and risk assessment. Solute transport equation. Advection dispersion processes, salinization of groundwater, coastal aquifers, limits of Ghyben-Herzberg relation. Environmental tracers, conservative tracers and process multi-tracer. Numerical hydrogeological modeling. Models of groundwater flow, solute transport models to differences and finite elements. Conceptual model and numerical model. Domain, initial conditions, boundary conditions, calibration, sensitivity analysis. Simulation and validation.

Fourth block of lectures (14 hours of which 6 hours of exercises). Karst hydrogeological systems; methods for the evaluation of the vulnerability in karst environment. Evaluation of the groundwater pollution risk. Criteria and methods for the definition of the groundwater intrinsic vulnerability to pollution. Hydrogeological analysis of the main hydro-structures of the Basilicata.

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**TEACHING METHODS**Theoretical lessons and Classroom tutorials.

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**EVALUATION METHODS**Oral examination. It will be evaluated the ability to link and compare different aspects covered during the course.

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**TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL**

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Lecture Notes and Teaching handouts.

Civita M. - Idrogeologia applicata ed ambientale - Casa editrice Ambrosiana

Celico P. - Prospezioni idrogeologiche I, II, Liguori Editore

Fetter C.W. - Applied Hydrogeology - McMillan.

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#### INTERACTION WITH STUDENTS

At the beginning of the course, the teacher describes the objectives, program and evaluation methods, provides students educational material. She collects a list of students who intend to enroll in the course, together with name and email. Office hours: Thursday 11.00 to 13.00 hours; Friday 11.00 to 13.00 at the Campus of Macchia Romana, School of Engineering, third floor, st. n. 36 – Via dell'Ateneo Lucano, 10 - Potenza. In addition to weekly reception, the teacher is available at all times for a contact with the students, through e- mail or by telephone.

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#### EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

24/01/2020; 7/02/2020; 21/02/2020; 14/03/2020; 11/04/2020; 16/05/2020; 20/06/2020; 11/07/2020; 12/09/2020; 17/10/2020; 14/11/2020; 12/12/2020

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SEMINARS BY EXTERNAL EXPERTS      YES

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#### FURTHER INFORMATION

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<sup>1</sup> Subject to possible changes: check the web site of the Teacher or the Department/School for updates.