Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: Applied Hydraulics			
ACADEMIC YEAR: 2019/2020			
TYPE OF EDUCATIONAL ACTIVITY: F			
TEACHER: Domenica Mirauda			
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Language: Italian and, if needed, English.			
ECTS: (lessons e tutorials/practice) 6	n. of hours: 32 hours of theoretical lessons and 22 hours of classroom tutorials	Campus: Potenza Dept./School: School of Engineering Program: Civil Engineering	Semester: 1°

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course aims at providing know-how about: steady flow of free surface streams; laboratory experiments for the estimation of flow rate in free surface streams; unsteady flow of free surface streams; derivation of the forces soliciting the bridge peers in river beds; turbulence and related dispersion processes; bed and suspended load transport, and interactions with the engineering constructions along a stream; steady and unsteady groundwater flows; free surface and confined aquifers; filtration across soil dams. At end of the course, the student should have more knowledge of:

- the planimetric, altimetric and morphological evolution of rivers;
- the impacts caused by uncontrolled bed and suspended load transport;
- the effects of anthropic interventions and actions on rivers and groundwater flows;
- the propagation of a flood wave in mountain and valley areas and identification of flood-prone zones;
- the vulnerability evaluation of sites intended for strong-impact engineering works.

The student should demonstrate designing and planning skills of:

- monitoring activities in natural and artificial open channels and groundwater flows;
- prevention and defence works in natural and artificial open channels.

The student should be able to evaluate critically and autonomously:

- the dynamic and cinematic processes within free surface and groundwater flows ;
- the diffusion motions of pollutants and the bed and suspension sediment transport;
- the fluid-structure interactions.

The student should be able to explain the topics during the course using simple and correct scientific terminology and to discuss technical reports clearly and precisely even with non-experts in the field. The student should continuously update through the consultation of scientific texts and publications and acquire specific skills in order to attend specialist seminars and Master's courses in hydraulics and applied hydraulics.

PRE-REQUIREMENTS

Passing the exams of Mathematical Analysis I-II, Physics I-II and Fluid Mechanics before beginning with the Applied Hydraulics classes is highly recommended.

SYLLABUS

Steady flow of free surface streams (6h theoretical lessons + 8h classroom tutorials).

Definition of the geometrical, kinematic and dynamic variables; flow and continuity equations; empirical relationships for the calculation of the drag coefficient; rating curves; flow profiles; hydraulic jump. Exercises on flow profiles for real cases.

Measurement of the water discharge in open channel flows (6h theoretical lessons + 14h classroom tutorials).

Techniques and methods for the evaluation of the water discharge. Laboratory equipment and experiments for the estimation of water discharge in free surface streams. Practical lessons in an indoor environment with the virtual reality laboratory "StreamFlow" and in field on rivers.

Unsteady flow of free surface streams (4h theoretical lessons).

Definition of the geometrical, kinematic and dynamic variables. Flow and continuity equations. Analysis of the flood wave propagation by numerical and graphical methods.

Subsurface flows (6h theoretical lessons).
Definitions and general concepts. Filtrating tunnels, free surface and artesian wells. Potential flows: potential and stream functions, hydrodynamic grid. Assessment of filtrating flow rate and under-pressures in the presence of fluvial barrages. Aquifers: Dupuit hypothesis. Filtration across soil dams. Phenomenon of suspended source. Unsteady subsurface flows. Exhaustion of a free surface aquifer by a topographic sill. Water level and pressure oscillations in the coastal aquifers.
Sediment transport (8h theoretical lessons)
Condition of incipient sediment motion, theories and formulas for the evaluation of the bed load transport. Models for the calculation of the suspended load transport. Direct and indirect methods for the measurement of bed and suspended load transport. Direct and indirect equipment for the measurement of bed and suspended load transport.
Fluid -structure interaction phenomena (2h theoretical lessons)
Numerical modelling and laboratory experiments for the evaluation of the dynamic response (displacements and forces) of bodies immersed in a steady free surface flows.

TEACHING METHODS
The course includes 54 hours of teaching in and classroom tutorials. In particular 32 hours of theoretical lessons and 22 hours of classroom tutorials.

EVALUATION METHODS
The aim of the examination is to verify the achievement of the educational goals.
The student will give the teacher a report about the homework carried out during the course. This report must be delivered to the teacher during the exam.
The exam is oral and concerns the topics of the course. The test intends to evaluate the understanding of the different topics and the ability to link and compare them.
The homework will be discussed during the exam to assess the comprehension of methods and tools used by the student. The final score depends for 25% on the homework and for the remaining part on the oral examination.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL
Lecture notes provided by the teachers.
Specific topics can be explored on the following textbooks:
D. Citrini, G. Noseda, Idraulica, Casa Editrice Ambrosiana – Milano.
A. Ghetti, Idraulica, Edizioni Libreria Cortina - Padova.
E. Marchi - A. Rubatta, Meccanica dei Fluidi, UTET- Torino.

INTERACTION WITH STUDENTS
At the beginning of the course, after the presentation of objectives, program and methods of verification, the teacher collects the list of students who intend to follow the course. In this list the students write down their name, ID number and e-mail so that the teacher can send them by e-mail lecture notes and whatever is useful to prepare the exam.
Office hours: Wednesday 10:30 to 12:30 at Mirauda's office (5th floor School of Engineering).
Additionally, the teacher is available every time to keep in touch with the students by e-mail or business mobile.

EXAMINATION SESSIONS (FORECAST)[1]
12/02/20, 26/02/20, 15/04/20, 17/06/20, 08/07/20, 22/07/20, 23/09/20, 18/11/20

SEMINARS BY EXTERNAL EXPERTS YES ☐ NO ☒

FURTHER INFORMATION

[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.