UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
MASTER'S DEGREE (MSC)	ENGINEERING AND INNOVATIVE TECHNOLOGIES FOR THE ENVIRONMENT
INTEGRATED COURSE	HYDROGEOLOGICAL RISK MITIGATION - INTEGRATED COURSE
CODE	20553
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	ICAR/02
HEAD PROFESSOR(S)	NOTO LEONARDO — Professore Ordinario — Univ. di PALERMO
OTHER PROFESSOR(S)	CANDELA ANGELA — Professore Associato — Univ. di PALERMO NOTO LEONARDO — Professore Ordinario — Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**CANDELA ANGELA** Monday 11:00 13:00 presso Sezione idraulica DICAM piano 2° Thursday 11:00 13:00 presso Sezione idraulica DICAM piano 2° **NOTO LEONARDO** Tuesday 10:30 13:00 DICAM - Area Idraulico-Ambientale II° piano Thursday 10:30 13:00 DICAM - Area Idraulico-Ambientale II° piano

DOCENTE: Prof. LEONARDO NOTO

PREREQUISITES	Skills concerning hydrology, statistics applied to hydrology and GIS spatial analysis techniques are required.
LEARNING OUTCOMES	Knowledge and understanding At the end of the course, the students will know the problems concerning the hydrological/geomorphological risk and soil conservation. In particular, they will be able to understand and analyze the processes leading to the risk and its dynamics. He will be able to formulate hypotheses about the interventions for the erosion defense and for risk mitigation, modelling the effect of such works on the territory, and assess its consequences in relation to flood exposure. Applying knowledge and understanding The students will be able to use mathematical, physical and computer based tools to evaluate the different types of hydrological/geomorphological risk; moreover they will be able to design and plan different methods aimed to prevent the hydrological/geomorphological risk. Making judgements The students will be able to understand the phenomena associated with risk and its formation; they will be also able to manage hydraulic and hydrological models for evaluating and handling different risks (e.g. hydrological, geomorphological, etc.). The student will also acquire a methodology for its analysis of the soil management and conservation that will allows himself to make appropriate design and planning decisions regarding risk erosion and flood risk. Communication The students will be able to communicate and discuss about issues concerning the main topics of the course. They will be capable to argue about issues related to the hydrological/geomorphological risk, to highlight problems inherent the forecasting and the prevention systems and to propose different solutions to the policymakers. Lifelong learning skills At the end of the course, the students will have learned the importance of all of the physical processes reliable for the hydrological/geomorphological risk prevention: this will allow them to deal with the design and the verification of principal systems for the forecast of the hydrological/geomorphological risk together with those aimed to its prevention. He will be also able to investigate complex issues such as the conception, design and maintenance of protection works and soil conservation.
ASSESSMENT METHODS	The final exam consists of an oral exam with mark expressed in thirties (xx/30). The exam will focus on course topics and the candidate will have to answer at least three questions. Moreover, a question about the programming skills developed during the course could be asked. The final exam aims to evaluate students' knowledges of the course topics and their capability in applying them to real cases. Evaluation: a) excellent 30 - 30 with laude. Excellent knowledge of the subjects of the course; the student is able in a very effective way to use the knowledge of the course to solve problems. b) Very good 26 – 29. Good knowledge of the course; the student is able to use the knowledge of the course to solve problems c) Good 24 – 25. Basic knowledge of the subjects of the course; the student is partially able to use the knowledge of the course to solve problems. d) Satisfactory 21-23. The students knows the more relevant subjects; the student uses the knowledge of the course to solve problem with difficulties. e) Sufficient 18 – 20. Minimal knowledge of the main subjects; not good ability to use the knowledge. f) Not sufficient. The student has not a sufficient knowledge of the subjects of the course
TEACHING METHODS	Lectures, Exercises, Field survey

MODULE
PREVISION AND PREVENTION OF HYDRO-GEOLOGICAL RISK

Prof. LEONARDO NOTO

SUGGESTED BIBLIOGRAPHY

Renzo Rosso: Manuale di protezione idraulica del territorio – CUSL – 2002
Noto L. – Appunti del corso di Previsione e Prevenzione del Rischio Idrogeologico
Noto L. – Dispense del corso di Idrologia
Becciu Paoletti – Fondamenti di costruzioni idrauliche, UTET, 2010
Chow V.T., Maidment D.R., Mays L.W. - Applied Hydrology – McGraw-Hill, 1988.
Dispense varie distribuite ai ragazzi durante il corso

AMBIT	50372-Ingegneria per l'ambiente e territorio
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide the students with tools for the understanding, forecasting and prevention of the hydrological/ geomorphological risk, with particular reference to hydrological extremes (floods and droughts).
The course will deal with the hydrological knowledges in the field of the climatology and the meteorology.
Particular attention will be paid to the probabilistic framework for the development of floods and droughts forecasting models. Students will learn to develop and implement stochastic models for the rainfall forecast and generation. With regard to the forecast phase, a number of methods, direct and indirect, designed to reduce the hydrogeological risk, will be mentioned and developed.

SYLLABUS

Hrs	Frontal teaching
3	Recall hydrology. Hydrological model calibration.
6	Definitions of risk and emergency. Risk classification according Italian law. Italian laws concerning risk and hazard. National Civil Protection Department. Hydraulic and geomorphological risk: definition and classification. PAI
4	Forecast of hydraulic and geomorphological risk. Structural and non structural actions for the prevention of hydraulic and geomorphological risk.
5	Meteorology. Weather models: forecasting and nowcasting. 5
5	Weather radar
4	4 Time series. Generation of synthetic rainfall series.
4	Flood wave propagation (De Saint Venant equations)
2	Rainfall thresholds for flood hazard/risk
5	Geomorphological risk. Landslide classification. Statistical methods for the derivation of susceptibility maps. Rainfall thresholds for the landslide triggering. Landslides survey.
4	Drought: definition, analysis and forecast.

Hrs	Practice
2	Generation of synthetic rainfall series.
2	Thunderstorm cell model
2	2-D Flood wave propagation (HEC-RAS 2D)
2	Rainfall thresholds for flood hazard/risk
2	Drought indices (SPI)
2	Creation of a landslide susceptibility map

MODULE
HYDRAULIC PROTECTION OF LAND

Prof.ssa ANGELA CANDELA

SUGGESTED BIBLIOGRAPHY

V. Ferro: La sistemazione dei bacini idrografici. Mc Graw Hill, Milano, 2002.
R. Rosso: Manuale di Protezione Idraulica del Territorio. CUSL, Milano, 2002.
APAT, Atlante delle opere di sistemazione fluviale, 2003
APAT, Atlante delle opere di sistemazione dei versanti, 2003
PODIS, La valutazione di impatto ambientale nella difesa del suolo, 2004
CIRF, Manuale di riqualificazione fluviale, 2006
Dispense relative a particolari contenuti del Corso

AMBIT	50372-Ingegneria per l'ambiente e territorio
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

The course of River Basin Management aims to provide the scientific foundations, procedures and regulations for soil protection in order to assess flood risks planning and management. In detail, the course aims to give the methodology for defining monitoring plans and the key scenarios aimed at the characterization of flood risk. The course aims, also, to provide the knowledge and tools needed to analyze the interaction of infrastructure and antrophic activities with the environment in order to define interventions for the territory protection and safeguarding in order to valorize natural resources with particular reference to water and soil.

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the course - the hydrograph catchment and the river environment. Rivers and streams. River basin management framework
2	Torrent control. River basin management framework. Flood risk management plans
8	The sediment transport. Sediment grain size and properties. Torrent control. Aggradation and degradation in natural streams. Equilibrium slope. The kinematic and dynamic formulations: Shield's diagram and Thiery method. Bed load estimation formulas. Crossing structures: check dams. Design and verification of structures. Types of check dams. Selective check dams: classification and types. Sills, coatings and block ramps. Outline of bioengineering techniques for river restoration
4	The solid mass transport - The debris flows, mud flows and landslides: generality and phenomenology. Elements of rheology of debris flows. Solid flow discharge assessment. The speed and volume of debris flows. Debris Flow Preventive Measures: passive measures (Definitionof hazard zones, Warning systems), active measures (Reforestation, Stabilization of debris sources using check dams and erosion sills Channel improvements, diversion, Open debris basins, Debris sheds)
5	Slope protection. Water erosion phenomena. The erosion risk. Mathematical models for estimating soil loss: The Wischmeier and Smith formula. Sediments yield and water erosion: the modified universal soil loss equation (Musle), istributed models for sediment yield estimation. The sediment delivery ratio SDR coefficient. The sediment yield in a river basin. Structural interventions for the erosion protection: surface drainage channels. Environmental engineering interventions for the defense from erosion on the slopes.
6	Slope protection. Water erosion phenomena. The erosion risk. Mathematical models for estimating soil loss: The Wischmeier and Smith formula. Sediments yield and water erosion: the modified universal soil loss equation (Musle), istributed models for sediment yield estimation. The sediment delivery ratio SDR coefficient. The sediment yield in a river basin. Structural interventions for the erosion protection: surface drainage channels. Environmental engineering interventions for the defense from erosion on the slopes.
12	The hydraulic protection from flood and river erosion. Distinctive morphological characters of valley watercourse. Riverbank protection purpose: measures to strengthen the banks other than using riprap. Different types of riverbank protection: Vegetation, Windrows and Trenches, Sacks and Blocks, Gabions and Mattresses, articulated concrete mattresses, Soil-Cement, Retaining Walls, brushes or repellents. Flood risk mitigation. Structural measures: river embankments, stream corrections, canal spillways, diversions, reservoirs, flood control reservoirs. Re-evaluation of safety control of safety conditions of large dams. The environmental impact assessment of hydraulic defences structures on downstream and upstream river.
5	Flood control and river flood management in urbanized areas - Flood control measures in urbanized areas: storage areas, diversions, centralised and distributed storm management practices.

Hrs	Practice
4	Torrent control. Check dams hydraulic and structural design
4	Design of an hydraulic protection structure from flood.