UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Coastal Risks and Dynamics

2425-2-F7502Q023

Aims

The aim of the course is to provide the knowledge concerning coastal processes and risks interacting on coastal dynamics and evolution under changing climate. The student at the end of the course will be able to understand and evaluate the physical coastal system, identify coastal vulnerability and risk and the possible defence policies according to the Integrated Coastal Zone Management (ICZM).

Contents

The course is intended to provide basic knowledge of hydrodynamic (wave genesis and transformation) and morphodynamic (sediment transport, beach-profile evolution and coastline dynamics) processes induced by natural and anthropogenic pressures, and to assess design tools to prevent and reduce coastal risks related to beach erosion, flooding and extreme events.

Detailed program

The coastal zone. Wind waves. Wave theories. Random waves Wave statistics. Wave transformation from offshore to onshore. Sea level. Astronomical tide. Wave set-down and wave set-up. Wave run-up. Longshore, rip and undertow currents. The beach. Sediment characteristics. Cross-shore beach profile. Equilibrium beach profile. Closure depth. The concept of physiographic region. Sediments balance. Coastal Dynamics and processes. Sediment transport. Long-shore and cross-shore sediment transport. Shoreline evolution. Prediction of shoreline evolution. Elements of beach-dune system morphodynamics. Coastal risk. Coastal erosion: natural and anthropogenic pressures. Resilience and resistance of coastal systems. Coastal vulnerability. Climate change and extreme events: storm surges, flooding, typhoons, tsunami. Sea level rise projections. Risk assessment. Uni-variate and multi-variate analysis. Coastal protection systems. Design wave height related to structure lifetime.

Breakwaters. Groynes. Wave-structure interactions. Nourishments. Coastal sand dune restoration with eco-friendly techniques. Elements of coastal management policies. Elements of marine renewable wind and wave energy.

Prerequisites

None

Teaching form

21 two-hour lectures, in person, Delivered Didactis

Textbook and teaching resource

The following textbooks are strongly suggested:

· Dean, R.G., Dalrymple, R.A. (1991). Water wave mechanics for engineers and scientists. Adv. Series on Ocean Engineering – vol. 2, World Scientific.

· Dean, R.G., Dalrymple, R.A. (2004). Coastal Processes with engineering applications. Cambridge University Press.

· Davidson-Arnott R., Bauer B., Houser, C. (2019) Introduction to coastal process and geomorphology. Cambridge University Press.

· Masselink, G., Hughes, M.G., Knight, J. (2011). Introduction to coastal process and geomorphology. Routledge.

· Ciavola, P., Coco, G. (2017). Coastal storms: processes and impacts. Wiley-Blackwell.

Semester

First semester

Assessment method

The examination will consist of an oral interview on the topics covered in class. Assessment will be made on the basis of the student's answers, which must demonstrate mastery of the topics covered. In addition, project work, problems or exercises as a check on disciplinary problem solving skills will be assessed. Interim assessments are not planned.

Office hours

Friday 12:30 pm – 1:30 pm at room U4-10.

Sustainable Development Goals

CLIMATE ACTION