



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Coastal Risk and Dynamics

2021-1-F7401Q118

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#### 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 off-shore to on-shore. 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. Historical shoreline evolution. Shoreline

evolution modelling. 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, typhoon and tsunami hazards. 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**

Lessons: 6 credits (42 hours). Some seminars with experts will be organized.

## **Textbook and teaching resource**

During the COVID-19 restrictions the lessons will be recorded and available on-line. Furthermore, 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**

Oral exam. Mark range: 18-30/30.

### **Office hours**

Friday 12:30 pm – 1:30 pm.

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