

REAL 2014 - SUMMER PROGRAM AT IH CANTABRIA / UC

Title: CHALLENGES AND OPPORTUNITIES FOR ENGINEERING IN THE OCEAN

Instituto de Hidráulica Ambiental “IH Cantabria”

Universidad de Cantabria

Director: Prof. Iñigo Losada, IH Cantabria Research Director

Coordinator: Dr. Jose A. Juanes, IH Director of Capacity Building and Training

Objective: To provide students with a global overview of current and future engineering needs in the ocean and coastal areas.

Who should attend: Sophomores, juniors and seniors enrolled in engineering or applied sciences programs in US Universities.

Classes will be taught in English. Spanish is not a requirement.

Duration: June 2, 2014-June 26, 2014/ 3 hours/day

Schedule: 10:00-13:00 M, W + 1 Friday (week 3)

Location:

Instituto de Hidráulica Ambiental-IHCantabria.

Isabel Torres 15

39011-Santander

Optional: 4 additional weeks internship in July including research or practical activities.

Program Structure:

The program is organized in four independent weeks closely interrelated which allows a continuous learning. Every week will include theory, applications, a case study, experimental and field work taking advantage of the excellent facilities in the Institute.

WEEK 1: The Ocean and Coastal Environment (12 hours)

Sustainable management of human activities in the coastal and ocean environment requires an excellent understanding of the relevant processes associated with the natural and socioeconomic system. Human settlements, tourism, transportation, industry, energy harvesting or aquaculture co-exist with some of the most valuable ecosystem in the planet. During the first week of the course we will try to understand the main components of both the human and natural systems in order to know the most relevant drivers, pressures, vulnerabilities and needs. It is a general agreement that the ocean will be the new frontier for engineering in the near future.

Monday	Instructors
Course general structure and goals Visit to IH Cantabria	Prof. Íñigo Losada
The ocean and coastal area: introduction	Prof. José A. Juanes
Case study of the week: "Modeling the best nursery area for clams in the Bay of Santander"	Javier Bárcena

Tuesday	Instructors
Coastal ecosystems: goods and services Socioeconomic activities in the ocean and coastal areas. Conflicts and pressures	Prof. Jose Juanes Note: This class will take place during a boat visit to the Bay of Santander
Case study of the week: "Modeling the best nursery area for clams in the Bay of Santander"	Javier Bárcena

Wednesday	Instructor
Wind and waves. Generation. Wave propagation. Sea level. Astronomical tides. Storm surges. Currents in coastal areas	Prof. Fernando Méndez
Case study of the week: "Modeling the best nursery area for clams in the Bay of Santander". Students' presentations	Javier Bárcena

Thursday	Instructor
The surf zone Observing vs. modeling Principles of surf: how to choose a good surfing spot	Prof. César Vidal Dr. Antonio Espejo
Case study of the week: "Modeling the best nursery area for clams in the Bay of Santander".	Students' presentations

WEEK 2: Introduction to ocean and coastal engineering (12 hours)

Ocean and coastal engineering are the basic disciplines covering human needs in the marine environment. During the week we will cover the most relevant infrastructures associated to these disciplines as well as the specific techniques and tools to be considered in engineering design.

Monday	Instructor
General structure and goals What is coastal/ocean engineering: problems and methodologies	Prof. Iñigo Losada
Case study of the week: “Designing my first marina”	Prof. Gabriel Díaz

Tuesday	Instructor
Overview of coastal infrastructures (ports, coastal defences, marinas) Functionality Stability Construction procedures Environmental impacts	Prof. César Vidal Includes visit to the ocean lab

Wednesday	Instructor
Introduction to ocean engineering Stability of floating objects Offshore structures Foundations and moorings Construction procedures Environmental impacts	Prof. César Vidal
Case study of the week: “Designing my first marina”	Prof. Gabriel Díaz

Thursday	Instructor
Visit to Santander Port Authority	Prof. César Vidal
Case study of the week: “Designing my first marina”	Students’ presentations

WEEK 3: Coastal Risks: Assessment and mitigation (19 hours)

Engineering can play an important role in several stages associated with risks in the ocean and coastal environment, including risk assessment, prevention, management and post disaster recovery. In this part of the course we will review the fundamentals of natural and human-induced risks including: climate change, tsunamis and oil spills. All three share a common framework but differ in several aspects that need to be considered.

Monday	Instructor
General structure and goals Overview of extreme events related risks: impact assessment and mitigation (Katrina, Asian Tsunami, Flash rain etc.) Risk components: hazard, exposure, vulnerability	Prof. Fernando Méndez/Prof. Sonia Castanedo
Case study of the week: “Assessment of climate change risks in the Bay of Santander”	Dr. Cristina Izaguirre

Tuesday	Instructor
Climate change related risks in coastal areas. Climatic drivers: sea level rise, wind, wave, temperature, etc. Impact assessment: flooding, erosion, impacts on socioeconomic systems and ecosystems Adaptation options	Prof. Fernando Méndez/Prof. Sonia Castanedo

Wednesday	Instructor
Human-induced risks: spills Review of recent oil spills: Deep Horizon, Prestige Impact assessment Cleanup and prevention: techniques Recovery	Prof. Sonia Castanedo
Case study of the week: “Assessment of climate change risks in the Bay of Santander”	Dr. Cristina Izaguirre

Thursday	Instructor
Introduction to tsunami risks Review of recent tsunamis: Japan and Indonesia tsunami Tsunamigenic sources. Hazard Tsunami propagation: modelling and observations Impacts and mitigation options Early warning systems	Prof. Mauricio Gonzalez
Case study of the week: “Assessment of climate change risks in the Bay of Santander”	Students’ presentations

Friday	Instructor
From the theory to the practice: “Riding the correct wave”	Activity on the beach

WEEK 4: Harvesting ocean energy (16 hours)

The Ocean offers clean energy and contributes to reducing dependency on distant sources of fossil fuel. Wind, waves and strong tides are enormous potential resources that can be exploited in a sustainable manner contributing to reduce our carbon footprint and consequently mitigating climate change. Engineering knowledge is key in the development of ocean renewable energies. During this part of the course the student will be introduced to the key challenges and opportunities associated to this field of engineering which will be experiencing a strong development in the near future.

Monday	Instructor
General structure and goals Introduction to ocean energy Energy resources (wind, waves and currents) mapping: observations and modelling	Prof. Fernando Méndez
Case study of the week: “Designing an offshore wave/wind energy farm”	Adrián de Andrés

Tuesday	Instructor
Introduction to offshore wind energy: characteristics, technologies available, economic and environmental relevant aspects.	Prof. Iñigo Losada/ Dr. Raúl Guanche
Case study of the week: “Designing an offshore wave/wind energy farm”	Adrián de Andrés

Wednesday	Instructor
Introduction to wave energy: characteristics, technologies available, economic and environmental relevant aspects.	Prof. César Vidal
Case study of the week: “Designing an offshore wave/wind energy farm”	Adrián de Andrés

Thursday	Instructor
Case study of the week: “Designing an offshore wave/wind energy farm”	Adrián de Andrés
	Students’ presentations