CE 314 COASTAL ENGINEERING

Co-ordinator: Professor R.J. Sobey (Room 330), r.j.sobey@imperial.ac.uk

Status: Environmental Elective

Lecturers:	Professor R.J. Sobey (RJS) (Room 330) Dr. C. Swan (CS) (Room 329)
Structure:	50 contact hours (lectures and tutorials)
Links:	see below

Introduction

Coastal defences and the formulation of coastline management strategies are currently receiving a good deal of attention from central and local government. In attempting to tackle coastal problems we must be aware of the fact that the spatial and time scales of coastal processes are large, and the physical mechanisms that influence coastal zones are quite complex. The general principle that applies to Coastal Engineering is that if one takes a narrow view of a problem and provides a local solution to it, then the same problem will eventually materialise some distance away.

Aims

The module addresses the environmental forcing and the physical processes that impact the tidal and coastal regions, and the natural or man-built structures that protect them. The nearshore characteristics of waves, currents, tides, winds and storm surges are introduced, together with their combined effects on coastlines. Consideration extends to coastal structures and their behaviour in such a complex marine environment.

Links with other course modules

The module requires good analytical skills, but has a strong practical flavour. The theoretical aspects involve mathematical techniques taught during the first two years (CE102, CE201). It also relies on knowledge from the core classes in Fluid Mechanics (CE105, CE202 and CE302). The module is useful to those planning to take the Year IV modules, CE406 (Applied Hydrodynamics) and CE416 (Environmental Fluid Mechanics).

SYLLABUS

The Autumn Term lectures (CS) will cover the following topics:
1. Regular waves.
2. Irregular or random waves.
3. Wave statistics
4. Wave transformations, and
5. Fluid loading

The Spring Term lectures (RJS) will cover the following topics:
1. Wind Waves. (Physics, fetch graph, spectral models.)
2. Wave Climate. (Observations, probability summaries, intensity-duration-frequency.)
3. Tides. (Observations, harmonic analysis, propagation.)
4. Storm Tides. (Historical storms, evolution, frequencies.)

5. Wave Evolution. (Diffraction, combined refraction-diffraction.)
6. Nearshore Circulation. (Surf zone, undertow, longshore current, edge waves.)

Coursework
In the Autumn Term, there will be a single course work assignment due at the end of term. In the Spring Term, there will be four coursework assignments, distributed over the term. Topics will be Wind Waves, Wave Climate, Tides, and Storm Tides & Diffraction.

Assessment
The coursework assignments will be assessed for a coursework mark. The written examination at the end of Part III session will consist of six questions covering each half of the module, from which five are to be chosen.

Recommended Textbooks:
DEAN and DALRYMPLE, Water Wave Mechanics for Engineers and Scientists
GODA, Random Seas and Design of Maritime Structures
HORIKAWA (Editor), Nearshore Dynamics and Coastal Processes
HORIKAWA, Coastal Engineering
KAMPHUIS, Introduction to Coastal Engineering and Management
MUIR WOOD and FLEMING, Coastal Hydraulics
PUGH, Tides, Surges and Mean Sea-Level
WIEGEL, Oceanographical Engineering
COASTAL & HYDRAULICS LABORATORY, U.S. Army Waterways Experiment Station, Coastal Engineering Manual

Learning Outcomes
Appreciate the multi-faceted nature of coastal problems and the techniques of coastal engineering analysis. Understand the concept of the 'design wave', and its statistical synthesis. Use wave spectra and transfer functions to calculate important wave parameters. Calculate the transformations waves undergo as they propagate from deep to coastal waters. Predict tidal variations in coastal regions, and appreciate the impact of tides in the coastal environment. Calculate coastal mean water level changes and wave-induced nearshore currents.Appreciate the environmental impacts of coastal engineering works. [3]