FACULTY OF ENGINEERING, SCIENCE AND THE BUILT ENVIRONMENT

Unit title:	Coastal Engineering	
Unit number:	BCE/M/433	
Unit Level:	M	
Unit value:	1.0	
Unit co-ordinator:	J T Douglas	
Contact time:	Lectures	36 hours
	Tutorials	14 hours
	Assessment	3 hours
Private study time:	97 hours	
Total study time:	150 hours	
Unit pre-requisites:	None	

SHORT DESCRIPTION

This unit considers both regular and random wave theories. The student is introduced to the theories of both linear and higher order wave theories. The theory of linear waves is then applied to the wave shoaling process and to the determination of wave forces. This is extended to cover the beach transport process and a study of beach control structures. There is an introduction to the theory of long waves including astronomical tides. The theory of random waves introduces wave forecasting methods and short-term wave statistics

AIMS

To introduce the theories of ocean waves and coastal hydraulics. To apply this knowledge to practical problems in coastal engineering. To analyse and design coastal structures and sea defence works. To provide an introduction to random waves and wave statistics. To introduce the process of sediment transport in the coastal zone.

LEARNING OUTCOMES

The student should be able to:

- Classify regular waves,
- Understand the principles of classical hydrodynamics and linear wave theory,
- Determine the transformation of a wave train as it approaches the shore,
- Determine wave forces on structures as part of the design process,
- Carry out wave forecasting measurements in order to determine the significant wave height and period,
- Apply statistical methods to random waves,
- Understand the origins and behaviour of long waves,
- Have an understanding of beach transport processes.

TEACHING AND LEARNING PATTERN

Lectures and tutorials supplemented by printed handouts and laboratory demonstrations. There will be an emphasis on problem-solving activities to develop further the principles and concepts of the theories of ocean waves. This will be used extensively in the lecture programme and will be further supported in regular tutorial sessions.

INDICATIVE CONTENT

<u>Classification of waves</u>
Free and forced waves. Gravity waves – sea and swell. Classification according to height and depth. First order and higher order wave theories.

<u>Hydrodynamics</u>
Equation of continuity for two-dimensional flow. Circulation and vorticity. Stream function. Potential flow. Euler's equation. Lagrangian flow.

Linear wave theory
Progressive and stationary waves. Particle velocities and displacements. Streamlines. Phase velocity. Frequency dispersion. Group velocity. Energy and energy flux.

Shoaling processes
Shoaling and breaking waves. Refraction, diffraction and reflection. Wave run-up and set-up.

Wave forces
Design wave conditions. Breaking and non-breaking waves. Wave overtopping. Sea walls on a rubble foundation. Forces on piles and pipelines.

Random waves
The relation of wind to pressure. Geostrophic and gradient wind. Wave prediction. Significant wave height. Fetch and duration. Wave forecasting. Wave statistics.

Long waves
Coriolis force and amphidromic systems. Tides, tsunamis, seiches and storm surges.

Coastal zone processes
Beach profiles. Nearshore circulation. Longshore sediment transport. Beach control structures.

ASSESSMENT

The unit is assessed by a combination of examination and coursework with the proportion of marks allocated to each component given below:

70% 3-hour end of unit written examination.

30% 1 No. coursework based on a coastal engineering problem involving both analysis and design.

INDICATIVE SOURCES

Core

Reeve, D., Chadwick, A. J., and Fleming, C., Coastal Engineering: Processes, Theory and Design, E & FN Spon, 2004.

Background

Department of the Navy Waterways Experiment Station, Corp of Engineers, Shore Protection Manual, Volumes 1 & 2, 4th edition, 1984.

Novak, P., et al, Hydraulic Structures, 3rd edition, E & F N Spon, 2001.