FACULTY OF ENGINEERING, SCIENCE AND THE BUILT ENVIRONMENT

Unit title:	Open Channel Hydraulics	
Unit number:	BCE/3/130	
Unit Level	3	
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	
Unit pre-requisites:	BCE/2/121 or equivalent	

SHORT DESCRIPTION

This unit takes the principles of open channel hydraulics and applies them to practical applications of analysis and design. The student will learn to identify flow profiles in open channels and establish their length, analyse and design channel transition structures, and design appropriate energy dissipating devices. The student will be introduced to sediment transport formulae and will learn to design a canal in an erodible material. In addition, practical problems in non-steady open channel flow will be examined.

AIMS

To investigate fully both steady and non-steady varied flow in open channels. To analyse and design canal structures. To introduce the concept of sediment transport in open channels

LEARNING OUTCOMES

The student should be able to:

- design energy dissipating devices,
- analyse flow profiles for steady open channel flow,
- analyse and design channel transition structures,
- understand the principles of rapidly varied non-steady open channel flow,
- analyse and design unlined canals with or without bed movement.

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 open channel hydraulics. This will be used extensively in the lecture programme and will be further supported in regular tutorial sessions.

INDICATIVE CONTENT

<u>Review of Open Channel Flow</u>
Specific energy. Flow force. Section factor. Conveyance.

<u>Gradually Varied Flow</u>
Flow profiles. Numerical solution of the gradually varied flow equation by direct integration and step-by-step methods. Canal delivery problem for subcritical and supercritical flow.

<u>Energy Dissipaters</u>
Hydraulic jump. Stilling basins, drop structures, roller buckets, and ski jumps.

Changes in Channel Section and Alignment
Design of channel transitions and bends for subcritical and supercritical flow. Oblique hydraulic jump. Velocity of an elementary wave

Rapidly Varied Non-steady Flow
Positive and negative surges in horizontal and sloping channels. Surge interaction. Dam break problem.

Loose Boundary Hydraulics
Modes of sediment transport and bed formation. Threshold of movement. Tractive force method of canal design. Bed load, suspended load and total load formulae.

ASSESSMENT METHOD

70%	3 hour end of unit examination
30%	3 No. courseworks involving the analysis of problems in open channel hydraulics and the detailed design of hydraulic structures. A typical example would be the design of an energy dissipater.

INDICATIVE SOURCES

Core

Chow, V.T., Open Channel Hydraulics, McGraw Hill, 1959.

Featherstone, R. E., and Nalluri, C., Civil Engineering Hydraulics, 4th dition, Blackwell, 2001.

Henderson, F.M., Open Channel Flow, MacMillan, 1966.

Background

Chadwick, A., Morfett, J. and Borthwick, M, Hydraulics in Civil and Environmental Engineering, 4th edition, E & FN Spon, 2004.

Chanson, H., The Hydraulics of Open Channel Flow, Arnold, 1999.

French, R.H., Open Channel Hydraulics, McGraw Hill, 1986.

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