FACULTY OF ENGINEERING, SCIENCE AND THE BUILT ENVIRONMENT

Unit title:	Fluid Mechanics	
Unit number:	BCE/1/122	
Unit Level	1	
Unit value:	1.0	
Unit co-ordinator:	J T Douglas	
Contact time:	Lectures	36 hours
	Tutorials	14 hours
	Laboratory	8 hours
	Assessment	3 hours
Private study time:	89 hours	
Unit pre-requisites:	None	

SHORT DESCRIPTION

This unit develops the fundamental principles of fluid statics and dynamics and applies them to practical applications of analysis and design. The student will be able to evaluate hydrostatic forces, measure the pressure at point in a fluid, and establish the stability of floating bodies. The student will also be introduced to the fundamental laws of fluid motion and will apply these laws to flow measurement, flow in simple pipe systems and open channels. The student will perform simple laboratory tests and prepare a formal report.

AIMS

To provide an introduction to the fundamental laws governing the statics and dynamics of real and ideal fluids.

LEARNING OUTCOMES

The student should be able to:

- understand the principle of units and dimensions,
- understand the laws governing hydrostatics and pressure measurement,
- determine the stability of floating bodies,
- distinguish between real and ideal fluids,
- understand the equations of continuity, energy, and momentum,
- apply these fundamental principles to flow measurement,
- analyse and design simple pipe and channel systems,
- carry out laboratory experiments and prepare a technical report.

TEACHING AND LEARNING PATTERN

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

INDICATIVE CONTENT

Dimensional Analysis
Principles of dimensional analysis. Buckingham π theorem. Dimensionless numbers.

Fluid Properties
Density, relative density, viscosity, surface tension and capillarity, vapour pressure of liquids.
Fluid Statics

Pressure at point in a fluid. Hydrostatic pressure on plane and curved surfaces. Measurement of pressure. Manometers. Stability of floating bodies. Determination of metacentre.

Principles of Fluid Flow
Ideal and real fluids. Equations of continuity, energy, and momentum.

Impulse-momentum Principle
Effect of jets on plane and curved surfaces.

Flow Measurement
Venturi meter, pitot tube, orifices and orifice plate.

Pipe Flow
Minor losses. Laminar and turbulent flow. Reynolds number. Friction losses. Flow in single, series, and parallel pipes. Energy line and hydraulic gradient line. Pumps in pipelines.

Open Channel Flow
Steady uniform flow in prismatic channels.

ASSESSMENT METHOD

70%	3 hour end of unit examination
30%	An individual report describing fully the outcome of a number of short experiments carried out in small groups. Regular coursework examples.

HEALTH AND SAFETY

For laboratory work, students should read the Health and Safety rules. Before commencement of each laboratory session students should return the general risk form, signed and dated, to their supervisor for record purposes.

INDICATIVE SOURCES

Core

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

Douglas, J. F., Gasiorek, J. M., and Swaffield, J. A., Fluid Mechanics, 4th edition, Prentice Hall, 2001.

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

Hamill, L., Understanding Hydraulics, Palgrave, 2nd edition, 2001.