2301 (Fluid Mechanics)

Year:	2016–2017
Code:	MATH2301
Level:	Intermediate
Value:	Half unit (= 7.5 ECTS credits)
Term:	1
Structure:	3 hour lectures and 1 hour problem class per week. Assessed weekly coursework.
Assessment:	90% examination, 10% coursework. In order to pass the module you must have at least 40% for both the examination mark and the final weighted mark.
Normal Pre-requisites:	MATH1402, (MATH1302 recommended)
Lecturer:	Prof E R Johnson
Problem class teacher:	Prof N R McDonald

Course Description and Objectives

How does a plane fly? How fast do waves move on the surface of water? What is the Severn Bore? With applied mathematics it is possible to give quantitative answers to such questions: this course deals with the simplest cases of fluid motion and is the foundation for more advanced study.

Recommended Text

A recommended book is A R Paterson, *A first course in fluid dynamics* (CUP). There are some excellent and informative photographs in *An Album of Fluid Motion* by M. Van Dyke (Parabolic Press). A detailed discusion of fundamentals can be found in the comprehensive textbook *An Introduction to Fluid Dynamics* by G.K. Batchelor (CUP).

Detailed Syllabus

- Specification and kinematics
  - Definition of a fluid; Specification of the motion; Convected derivatives; Conservation of mass; Sources and sinks; Motion of a fluid element in two dimensions; Irrotational motion
- Two-dimensional motion;
  - The vorticity equation and circulation; Irrotational motion in singly- and doubly-connected regions; Flow past a cylinder with circulation; Complex potential
- Dynamics
  - Static and dynamic forces; Euler's equations of motion; Bernoulli's equation; Dynamics of currents; Hydraulic jumps
- Surface waves
  - Small-amplitude gravity waves; Particle paths and group velocity; Standing waves; Two-dimensional waves; Surface tension