Lecturers:
David Ivers (Carslaw 623, david.ivers@sydney.edu.au) weeks 1–7
Chris Lustri (Carslaw 630, christopher.lustri@sydney.edu.au) weeks 7–13

Lectures:
Mon 10–11 Carslaw 350
Wed 10–11 & Thu 10–11 Carslaw 375

Tutorials (from week 2):
Tue 2–3 Carslaw 451
Wed 12–1 Carslaw 351
The tutorials are mostly run as example classes; most problems are solved interactively between the students and the lecturer.

Course Description:
A description of the course is to be found in the Third Year Maths Handbook (see the Mathematics web-pages www.maths.usyd.edu.au/u/UG/SM ).

Aims and Objectives:
By the end of the course students will have received an introduction to the following:

• The basic variables used to describe flows; the need for continuity, momentum and energy equations; simple forms of these equations; geometric and physical simplifying assumptions; streamlines and stream functions; incompressibility and irrotationality; simple examples of irrotational flows

• Bernoulli’s equation and some applications thereof; the importance of vorticity, Kelvin’s circulation theorem and Helmholtz’s theorem that vortex lines move with the fluid

• Cartesian tensors; the role of viscosity and the derivation of the Navier-Stokes equation; the significance of the Reynolds number; pipe flow and unidirectional viscous flows; flow between concentric cylinders; thin film flows

• Irrotational flows with added circulation; Laplace’s equation and the use of complex variable methods for its solution in two dimensions; airfoil theory and the derivation of the formula for lift; basic understanding of how aircraft fly

• The fundamental importance of boundary layers and the subtleties of the change of order when viscosity is omitted; the Blasius and Falkner-Skan boundary layer solutions

• The ideas of hydrodynamic stability together with examples of calculations; transitions to turbulence via a sequence of bifurcations; the turbulent closure problem and other difficulties; Kolmogorov’s theory for the spectrum of turbulent eddies
**Course Materials:**
A set of handwritten notes including the exercise sets is available for $24 from Kopystop, Mountain Street (off Broadway). The lectures will mostly follow the notes, though the presentation may vary somewhat for the sake of variety.

**Assessment:**
Three **assignments** worth 10% each (due at the ends of weeks 5, 9 and 13).
Two hour **examination** worth 70%.
The assignments are an integral part of the course and are mostly based on material which can be researched in books or discovered on the Web. Past experience has shown that there is an excellent correlation between those who do (or don’t do) the assignments and those who pass (or fail) the course. The assignments are for learning (not tests) and the lecturers will provide help to anyone struggling.

**Consultations:**
David Ivers: Mon 1–2
Chris Lustri: tba
We will normally be happy to see students at any time when available. Students are therefore encouraged to drop in, or preferably to book a specific time by e-mail.

**Reference Books:**
A list of books appears in the end of the notes.

**Web Pages:**
The course web pages can be accessed from outside the School via the School’s senior mathematics web page:
The web pages will include exercise sheets (which are also included with the notes), and solutions (which are not). There are four sheets which are treated in sequence in the tutorials, but with no week-by-week assignation of particular problems. Additional exercises may also be given.