

# Mathematical modelling of natural phenomena 2015

Course delivery: Andrew Fowler and Iain Moyles

Tutor: Josh Duley

~ 24 lectures, 11 tutorials; start 7/9/15, finish 27/11/15

Lecture Mon 1 ERB 008 [but 26 Oct is a holiday]

Tutorial Tue 1 CG 058 (start week 2: extra lecture in first week)

[Lab Wed 4 C2 062: not used; available for overflow/revision/office hour]

Lecture Fri 10 P1 005

Homework: hand in Mon 1 the day before tutorial at lecture (sharp deadline). In week 8 bring homework to tutorial on 27th.

Assessment:

final exam, 4 questions (one on each segment of course), 18% each.

(The exam questions will be easier than the homework.)

homework and attendance, 28%.

Syllabus: (depending on time, some of the material may not be covered, and would not then be examined)

Waves and inviscid flow

Surface waves; dispersion relation; group velocity

Capillary waves

Sound waves

Rotating flows; Poincaré, Rossby, Kelvin waves

Shallow water theory

Derivation by averaging; derivation by  $\epsilon/\delta$

Characteristics

Dam break problem; simple waves

Korteweg-de Vries equation

Groundwater flow

Darcy's law  
Dupuit approximation  
Dispersion

#### Instability

Saffman-Taylor instability  
Rayleigh-Bénard convection  
Double-diffusive convection

Course materials: problem sheets and printed lecture notes and old/mock exams are on sulis, also at <http://www3.ul.ie/fowlera/> or on demand from [andrew.fowler@ul.ie](mailto:andrew.fowler@ul.ie). These may undergo alteration/revision through the semester, so keep an eye on the latest edition (indicated by date).

#### Staff emails:

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ACF 5/9/15