

DEPARTMENT OF MATHEMATICS, UAB
PDE MODELING
MA461-1B/561-1B, Spring 2022

Instructor: Dr Ian Knowles, Room 4024, University Hall.

Email: iknowles@uab.edu

Class Meeting Times and Location: MWF: 9:05-9:55am, HHB221.

Office Hours. After class; you may also email for a private Zoom appointment.

My Zoom Meeting Number: 367-980-5688

Textbook. None: we use my lecture notes; download these from Canvas.

Prerequisite Course. MA252 with a Minimum Grade of C.

Important Dates: First day of classes is Monday January 10, 2022, and the last day of classes is Friday April 22, 2022; Martin Luther King Holiday, Monday January 17, 2022; Spring Break, March 14–20, 2022.

Grading

The course grade is calculated solely from the (approximately) weekly written assignments. MA561 students will be required to prepare all assignment reports using the typesetting program \LaTeX .

Course Outline

- The classification of second order linear partial differential equations into the three types: elliptic, parabolic and hyperbolic equations.
- Practical examples of second order partial differential equations, including Poisson's equation, the heat/diffusion equation and the wave equation; discussion of initial and boundary conditions and their practical interpretation.
- Derivation of partial differential equations from physical laws.
- Introduction to MATLAB and its PDE Toolbox, and COMSOL.
- Introduction to finite difference and finite element numerical solution methods for PDE.
- Continuum mechanics and linear elasticity.
- Fluid flow and the Navier-Stokes equations; class boat race for the "Aussie Cup".
- Mathematical finance.
- Specialized modeling projects in topics including heat flow, epidemiology and in particular community transmission of the COVID-19 virus, structural failure, fluid mechanics, and mathematical finance applications.