# MATH 2065:
# Introduction to Partial Differential Equations
## *Summer School Jan-Feb, 2012*

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**Unit-of-study website:** `http://www.maths.usyd.edu.au/u/UG/SS/SS2065`
Or go to the School of Mathematics and Statistics front page and follow the links.

**Lecture Notes** These will be posted on the website.

**Reference Books** Advanced Engineering Mathematics, by Erwin Kreysig (Wiley)
Applied Partial differential Equations, by Richard Haberman (Prentice-Hall)

## Tutorials

Tutorial questions will be posted on the webpage. Solutions will be posted after each tutorial.

## Assessment

40% of the final mark will come from quizzes and assignments given during the course. The remaining 60% will come from a 2 hour exam at the end of the course.

## Syllabus

**1.** Ordinary Differential Equations (ODEs)

- **(a)** Second-order homogeneous (summary)
- **(b)** Second-order inhomogeneous; undetermined coefficients
- **(c)** Laplace transform solution method

**2.** Preliminaries on Partial Differential Equations (PDEs) $\oint 1$

- **(a)** Introduction
- **(b)** Heat (diffusion) equation derivation
- **(c)** Boundary conditions (BCs), initial conditions (ICs)
- **(c)** Equilibrium / steady-state temperature

**3.** Method of Separation of Variables

- **(a)** Example with zero BCs
- **(b)** Examples with other BCs
- **(c)** Examples with Laplace's equation

**4.** Fourier Series

- **(a)** Basic properties
- **(b)** Fourier sine and cosine series; PDE applications

(c) Manipulating Fourier series
(d) Complex Fourier series

5. More PDEs: Wave equation

(a) Wave equation derivation
(b) Solutions using separation of variables / Fourier series
(c) Wave/heat equation in two-dimensions
(d) Vibrating rectangular membrane

6. Fourier transforms

(a) PDEs on infinite domains
(b) Fourier transform definition and properties
(c) PDE solutions using Fourier transforms
(d) Fourier transforms in signal processing (discussion)