

## Subject Information Guide

### Partial Differential Equations in Mathematical Biology AMH5

**Semester 1, 2016**

#### Administration and contact details

Host Department	School of Mathematics and Statistics
Host Institution	University of Sydney
Name of lecturer	Dr. Peter Kim
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#### Subject details

Handbook entry URL	<a href="http://www.maths.usyd.edu.au/u/UG/HM/">http://www.maths.usyd.edu.au/u/UG/HM/</a>
Subject homepage URL	<a href="http://www.maths.usyd.edu.au/u/pkim/CourseWebsites/2016sem1_MathBioHonours/2016-sem1-mathbiohonours.html">http://www.maths.usyd.edu.au/u/pkim/CourseWebsites/2016sem1_MathBioHonours/2016-sem1-mathbiohonours.html</a>
Honours student hand-out URL	<a href="http://www.maths.usyd.edu.au/u/UG/HM/">http://www.maths.usyd.edu.au/u/UG/HM/</a>
Start date:	29/02/2014
End date:	27/04/2014 (??? If the course runs Mon to Wed for the first 8 weeks)
Contact hours per week:	3
Lecture day and time:	Monday-Tuesday-Wednesday 9.00-10.00am
Description of electronic access arrangements for students (for	Course website < <a href="http://www.maths.usyd.edu.au/u/pkim/CourseWebsites/2016sem1_MathBioHonours/2016-sem1-mathbiohonours.html">http://www.maths.usyd.edu.au/u/pkim/CourseWebsites/2016sem1_MathBioHonours/2016-sem1-mathbiohonours.html</a> >

example,  
WebCT)

## Subject content

### 1. Subject content description

The course focuses on partial differential equation (PDE) models in mathematical biology. PDE models capture a wide range of biological phenomena, including spatial and age-structured interactions. Particular topics will include age/maturity-structured models, diffusion and reaction-diffusion models (e.g., predator-prey systems and chemotaxis), and evolution (e.g., genetic drift). We will also discuss a recently developing area of mathematical modelling, that of bridging agent (or individual)-based models and PDEs. This particular topic is relatively new to the field, so the only prerequisite for this investigation is a creative outlook and a curiosity to compare and contrast some newly developed agent-based models with PDE systems. Assessment work will be evenly distributed throughout the semester rather than in the form of one or two big assignments and will include a reading assignment in the current research literature which will be presented as a talk to the class.

### 2. Week-by-week topic overview

Age-structured models  
 Diffusion and Turing patterns  
 Chemotaxis  
 Fisher's equation  
 Travelling waves/fronts  
 Connecting PDEs to agent-based models

### 3. Assumed prerequisite knowledge and capabilities

Undergraduate background in differential equations, including ordinary and partial differential equations. No background in biology is required.

### 4. Learning outcomes and objectives

Enter learning outcomes/objectives/capability development goals here

#### AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes addressed in this subject	Associated AQF Learning Outcome Descriptors for this subject
Understand a variety of PDE models in	K1

mathematical biology.	
Be able to analyse a range of simple models in mathematical biology discuss results in class.	S1, S5
Develop insight for programming discrete, agent-based models and linking them with continuous PDE formulations.	S3, A2
Be able to critically read and summarise current research papers in mathematical biology give a brief presentation.	S5, K2

#### Learning Outcome Descriptors at AQF Level 8

##### Knowledge

K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines

K2: knowledge of research principles and methods

##### Skills

S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence

S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas

S3: cognitive skills to exercise critical thinking and judgement in developing new understanding

S4: technical skills to design and use in a research project

S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences

##### Application of Knowledge and Skills

A1: with initiative and judgement in professional practice and/or scholarship

A2: to adapt knowledge and skills in diverse contexts

A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters

A4: to plan and execute project work and/or a piece of research and scholarship with some independence

## 5. Learning resources

Matlab software will be used to numerically solve PDEs and to simulate simple agent-based models.

## 6. Assessment

Exam/assignment/classwork breakdown					
<b>Exam</b>	50 %	<b>Assignment</b>	40 %	<b>Class work</b>	10 %
<b>Assignment due dates</b>	Week 4 (23-25 Mar)	Week 7 (20-22 Apr)	Week 8 (27-29 Apr)	Click here to enter a date.	
<b>Approximate exam date</b>	Week 13 (1-5 June)				

## Institution Honours program details

<b>Weight of subject in total honours assessment at host department</b>	10 %
<b>Thesis/subject split at host department</b>	40 % thesis, 60% course work (6 courses x 10%)
<b>Honours grade ranges at host department:</b>	
<b>H1</b>	80-100
<b>H2a</b>	75-79
<b>H2b</b>	70-74
<b>H3</b>	65-69