



ACE Network Subject Information Guide

Partial Differential Equations

Semester 2, 2023

Administration and contact details

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Host institution	Monash University
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Subject details

Handbook entry URL	https://handbook.monash.edu/2020/units/MTH5123
Subject homepage URL	
Honours student hand-out URL	
Teaching period (start and end date):	24/07/2023- 20/10/2023
Exam period (start and end date):	TBA
Contact hours per week:	
ACE enrolment closure date:	TBA
Lecture day(s) and time(s):	Tuesday 4:30-6pm Friday 8:00-9:30am Tutorial: Friday 10-11am
Description of electronic access arrangements for students (for example, LMS)	

Subject content

1. Subject content description

Partial Differential Equations are ubiquitous in the modelling of physical phenomena. This topic will introduce the modern tools for a class of dispersive partial differential equations, in particular the nonlinear Schrodinger equation. Fourier analysis, one of the most powerful tools of modern analysis, will also be covered. The following topics are covered in the unit: Fourier transform, distribution theory, Sobolev spaces theory, Littlewood-Paley dyadic decomposition, Bony's paraproduct decomposition, Strichartz estimates, well-posedness for nonlinear Schrödinger equations

2. Week-by-week topic overview

1 Lebesgue space and linear operators
2 Fourier transform: L1 theory
3 Fourier transform: L2 theory
4 Distribution theory
5 Fourier transform on Schwartz distribution
5 Application I: linear equations
6 Application II: nonlinear equations
7 Fourier multiplier and Littlewood-Paley dyadic decomposition
8 Sobolev space, Bony's paraproduct decomposition
9 Nonlinear Schrodinger equation: local well-posedness
10 Strichartz estimates for Schrodinger equation
11 Nonlinear Schrodinger equation: global well-posedness
12 Elliptic equation and nonlinear Schrodinger equation

3. Assumed prerequisite knowledge and capabilities

Real analysis

Functional analysis (Banach space, Hilbert space, linear operator),

Measure theory (Lebesgue integration)

4. Learning outcomes and objectives

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

- 6. Lecture notes for printout.

7. Assessment

Exam/assignment/classwork breakdown					
Exam	60%	Assignment	40%	Class work	Enter %
Assignment due dates		Click here to enter a date.	Click here to enter a date.	Click here to enter a date.	Click here to enter a date.
Approximate exam date				Click here to enter a date.	

Institution honours program details

Weight of subject in total honours assessment at host department	1/16
Thesis/subject split at host department	thesis is worth 1/4 of the whole Master
Honours grade ranges at host department	
H1	HD: 80% and above

H2a	D: 70-79%
H2b	C: 60-69%
H3	P: 50-59%

Institution masters program details

Weight of subject in total masters assessment at host department	1/16
Thesis/subject split at host department	thesis is worth 1/4 of the whole Master
Masters grade ranges at host department	
H1	HD: 80% and above
H2a	D: 70-79%
H2b	C: 60-69%
H3	P: 50-59%