# MATH705

## Research Topics in Mathematics 2

S2 Day 2018

*Dept of Mathematics*

## Contents

# General Information

Unit convenor and teaching staff
Lecturer in Applied Mathematics
Dr Christopher Green
christopher.c.green@mq.edu.au
Contact via email
725 E7A
by appointment, or drop by

Credit points
4

Prerequisites
Admission to MRes

Corequisites

Co-badged status

Unit description
This unit is study of a current topic of Mathematical research. As a preparation for life as a researcher, part of the assessment in this unit will be based on oral presentations by the student. The unit will be based around a mixture of standard lectures and student seminars.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

# Learning Outcomes

On successful completion of this unit, you will be able to:

At the end of the course, students will have an understanding of the introductory concepts in vortex dynamics and will be equipped with the mathematical tools to solve problems involving three types of vortex in different domains.
By completing all course assessment tasks (three assignments and final examination), students will develop their ability to write clearly and precisely about concepts introduced in the lectures.
In two of the course assignments, students will develop their programming skills by undertaking some numerical computations using a mathematical software package such

as MATLAB.

# Assessment Tasks

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| Asgn1: Vorticity & circulation | 10% | No | Week 5 |
| Asgn2: Point vortex dynamics | 15% | No | Week 9 |
| Asgn3: Distributed vorticity | 15% | No | Week 13 |
| Take home final examination | 60% | No | Examination period |

## Asgn1: Vorticity & circulation

Due: **Week 5**
Weighting: **10%**

Some problems will be set on concepts covered in lectures during Weeks 1-3.

On successful completion you will be able to:

- At the end of the course, students will have an understanding of the introductory concepts in vortex dynamics and will be equipped with the mathematical tools to solve problems involving three types of vortex in different domains.
- By completing all course assessment tasks (three assignments and final examination), students will develop their ability to write clearly and precisely about concepts introduced in the lectures.
- In two of the course assignments, students will develop their programming skills by undertaking some numerical computations using a mathematical software package such as MATLAB.

## Asgn2: Point vortex dynamics

Due: **Week 9**
Weighting: **15%**

Some problems will be set on concepts covered in lectures during Weeks 4-8.

On successful completion you will be able to:

- At the end of the course, students will have an understanding of the introductory concepts in vortex dynamics and will be equipped with the mathematical tools to solve problems involving three types of vortex in different domains.

- By completing all course assessment tasks (three assignments and final examination), students will develop their ability to write clearly and precisely about concepts introduced in the lectures.
- In two of the course assignments, students will develop their programming skills by undertaking some numerical computations using a mathematical software package such as MATLAB.

## Asgn3: Distributed vorticity

Due: **Week 13**
Weighting: **15%**

Some problems will be set on concepts covered in lectures during Weeks 9-12.

On successful completion you will be able to:

- At the end of the course, students will have an understanding of the introductory concepts in vortex dynamics and will be equipped with the mathematical tools to solve problems involving three types of vortex in different domains.
- By completing all course assessment tasks (three assignments and final examination), students will develop their ability to write clearly and precisely about concepts introduced in the lectures.
- In two of the course assignments, students will develop their programming skills by undertaking some numerical computations using a mathematical software package such as MATLAB.

## Take home final examination

Due: **Examination period**
Weighting: **60%**

Questions will be based on lecture material in Weeks 1-12, and will test overall understanding of the concepts in vortex dynamics presented during the course.

On successful completion you will be able to:

- At the end of the course, students will have an understanding of the introductory concepts in vortex dynamics and will be equipped with the mathematical tools to solve problems involving three types of vortex in different domains.
- By completing all course assessment tasks (three assignments and final examination), students will develop their ability to write clearly and precisely about concepts introduced in the lectures.
- In two of the course assignments, students will develop their programming skills by

undertaking some numerical computations using a mathematical software package such as MATLAB.

# Delivery and Resources

There will be 2 hours of lectures per week in 146 E7B (ACE room).

The course will be self-contained, although students are expected to enhance their understanding of the lectures by independent reading (recommended texts will be suggested).

All lecture notes will be made available for students and uploaded to the unit website.

# Unit Schedule

The course consists of three parts.

Weeks 1-3: Vorticity and circulation

- Euler and vorticity equations
- Biot-Savart law
- Kelvin's circulation theorem
- Helmholtz laws

Weeks 4-8: Point vortex dynamics

- Equilibria, stability and dynamics
- Point vortex motion in different domains
- Kirchhoff-Routh theory
- Point vortex motion on a sphere

Weeks 9-12: Distributed vorticity models

- Vortex patches
- Hollow vortices

# Learning and Teaching Activities

## Lectures

There will be 2 hours of lectures per week in 146 E7B (ACE room).

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy

- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/student-conduct

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

# Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

## Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

# Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

## IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

# Graduate Capabilities

## PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

### Learning outcomes

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### Assessment tasks

- Asgn1: Vorticity & circulation
- Asgn2: Point vortex dynamics
- Asgn3: Distributed vorticity
- Take home final examination

### Learning and teaching activities

- There will be 2 hours of lectures per week in 146 E7B (ACE room).

## PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience,

of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

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# PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

## Learning outcomes

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# PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

## Learning outcomes

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# Changes from Previous Offering

This is the first time this course has been offered in the Department of Mathematics at Macquarie University.