UNSW Course Outline

MATH3121 Mathematical Methods and Partial Differential Equations - 2024

Published on the 06 Feb 2024

General Course Information

Course Code : MATH3121
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Mathematics & Statistics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This is an applied mathematics course that builds on MATH2120 Mathematical Methods for

Differential Equations. The course will present ways of solving the (usually partial) differential equations that arise in physical, biological, and engineering applications. Many of the methods covered, such as Fourier Transforms, also have applications beyond the solution of differential equations.

The course begins by characterising different partial differential equations (PDEs), and exploring some methods of solution, such as similarity solutions and the method of characteristics. Integral transforms, including Fourier and Laplace transforms, are then investigated. These transforms are particularly useful for solving linear PDEs. Whilst complex contour integration is an intrinsic part of using these transforms, only brief references to complex variable methods will be made.

The success of integral transforms naturally leads to the discussion of Green's function and integral forms of the solution of PDEs. The power of Green's functions can be observed in their use as the inverses of differential operators on both infinite and bounded domains. Finally, we will explore techniques to examine the asymptotic behaviour of functions.

The course comprises of weekly lectures and tutorials.

Course Aims

This course aims to introduce you to a range of techniques and theory that will be useful in solving partial differential equations (PDEs). Such equations are of significance due to their use in modelling phenomena from science, engineering and technology.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply various techniques, transforms and mathematical methods to solve differential equations.
CLO2 : Provide logical and coherent derivations of results.
CLO3 : Communicate mathematics effectively in written form.

Course Learning Outcomes	Assessment Item
CLO1 : Apply various techniques, transforms and mathematical methods to solve differential equations.	• Assignment 1 • Final exam • Assignment 2 • Class Test
CLO2 : Provide logical and coherent derivations of results.	• Assignment 1 • Final exam • Assignment 2 • Class Test
CLO3 : Communicate mathematics effectively in written form.	• Assignment 1 • Final exam • Assignment 2 • Class Test

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment 1 Assessment Format: Individual	10%	Start Date: 16/02/2024 05:00 PM Due Date: 01/03/2024 05:00 PM
Final exam Assessment Format: Individual	60%	Due Date: In the exam period
Assignment 2 Assessment Format: Individual	10%	Start Date: 29/03/2024 05:00 PM Due Date: 12/04/2024 05:00 PM
Class Test Assessment Format: Individual	20%	Due Date: 15/03/2024 11:00 AM

Assessment Details

Assignment 1

Assessment Overview

For the first assignment you will need to answer in-depth questions on content from the first two weeks of lectures. You may need to perform some research to address these problems. You should pay attention to how you present your answer, making sure that the logic is easy to follow. This assignment will be due in week 3. You will have access to the assignment at least a fortnight before it is due and be presented with feedback within a fortnight of the due date.

Course Learning Outcomes

- CLO1 : Apply various techniques, transforms and mathematical methods to solve differential equations.
- CLO2 : Provide logical and coherent derivations of results.
- CLO3 : Communicate mathematics effectively in written form.

Assessment information

Standard late submission penalties apply

Final exam

Assessment Overview

You will sit a two-hour exam during the formal exam period, which will cover content from the entire course. You will be required to present working to support your solutions. The style of questions will be similar to the class test.

Feedback is available through inquiry with the course convenor.

Course Learning Outcomes

- CLO1 : Apply various techniques, transforms and mathematical methods to solve differential equations.
- CLO2 : Provide logical and coherent derivations of results.
- CLO3 : Communicate mathematics effectively in written form.

Assignment 2

Assessment Overview

For the second assignment you will need to answer in-depth questions on content from the first eight weeks of lectures. You may need to perform some research to address these problems. You should pay attention to how you present your answer, making sure that the logic is easy to

follow. This assignment will be due in week 9. You will have access to the assignment at least a fortnight before it is due and be presented with feedback within a fortnight of the due date.

Course Learning Outcomes

- CLO1 : Apply various techniques, transforms and mathematical methods to solve differential equations.
- CLO2 : Provide logical and coherent derivations of results.
- CLO3 : Communicate mathematics effectively in written form.

Assessment information

Standard late submission penalties apply

Class Test

Assessment Overview

During class test 1 you will answer questions on the material from the first half of the course. The test will be 50 minutes long and take place during week 5. You will be required to present mathematical reasoning to support solutions to problems similar to those presented in lectures and tutorials.

Feedback will be provided within 2 weeks.

Course Learning Outcomes

- CLO1 : Apply various techniques, transforms and mathematical methods to solve differential equations.
- CLO2 : Provide logical and coherent derivations of results.
- CLO3 : Communicate mathematics effectively in written form.

Submission notes

This is an in person test held during the scheduled lecture time.

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Lectures in Week One will cover introductory material and revision of differential equations.
	Tutorial	The tutorial will cover the first problem sheet.
Week 2 : 19 February - 25 February	Lecture	Lectures in Week Two will cover symmetry methods and similarity solutions. Discussion of method of characteristics will also begin.
	Tutorial	The tutorial will finish any problems from the first sheet and complete the second sheet.
Week 3 : 26 February - 3 March	Lecture	Lectures in Week Three will cover the method of characteristics.
	Tutorial	The tutorial will cover the third problem sheet.
	Assessment	The first assignment is due at 5pm on Friday of Week 3. It shoudl be submitted via Moodle.
Week 4 : 4 March - 10 March	Lecture	Lectues in Week Four will cover Sturm-Liouville equations and begin discussion of generalised Fourier series.
	Tutorial	The turorial will cover the fourth problem sheet and if possible will also provide feedback on the first assignment.
Week 5 : 11 March - 17 March	Lecture	Lectures in Week Five will continue discussion of generalised Fourier series and may begin discussion of Laplace transforms.
	Tutorial	The tutorial will cover the fifth problem sheet.
	Assessment	The class test will be held during the sceduled lecture on Friday of Week Five. This is an in persion test.
Week 7 : 25 March - 31 March	Lecture	The lectures in Week Seven will cover Laplace transforms.
	Tutorial	The tutorial will provide feedback on the class test. We will also cover sheet six.
Week 8 : 1 April - 7 April	Lecture	Lectures in Week Eight will cover Fourier Transforms.
	Tutorial	The tutorial will cover sheet seven.
Week 9 : 8 April - 14 April	Lecture	Lectures in Week Nine will cover Green's Functions.
	Tutorial	The tutorial will cover sheet eight.
	Assessment	The second assignment is due at 5pm on Friday of Week Nine.
Week 10 : 15 April - 21 April	Lecture	Lectures will cover Asymptotic Methods for Integrals.
	Tutorial	The tutorial will cover sheet nine and general final exam preperation.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The topics covered in each week are subject to some variability. Material may be presented earlier or later. Refer to lecture notes for a more complete list of material covered.

Course Resources

Recommended Resources

There is no prescribed textbook for this course. There are a large number of good textbooks that cover the material from this course.

This is a small selection of books that have FREE electronic copies available through the library:

- “Introduction to Partial Differential Equations", Peter J. Olver
- “Applied Partial Differential Equations", J. David Logan
- “Essential Partial Differential Equations", David Griffiths, John Dold, David Silvester
- “Mathematical Methods for Engineers and Scientists 3", K. T. Tang

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Christopher Angstmann					No	Yes

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University’s conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University’s reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as

a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.
Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a “fit to sit/submit” rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines

School-specific Information

School of Mathematics and Statistics and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site. Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the web site starting at: The School of Mathematics and Statistics assessment policies

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Special Consideration - Short Extension Policy

The School of Mathematics and Statistics has carefully reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. Upon comprehensive examination of our course offerings that incorporate these types of assessments, we have concluded that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School of Mathematics and Statistics has decided to universally opt out of the Short Extension provision for all its courses, having pre-emptively integrated flexibility into our assessment deadlines. The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

Computing Lab

The main computing laboratory is room G012 of the Anita B.Lawrence Centre (formerly Red Centre). You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, located on the mezzanine level through the glass door (and along the corridor) opposite the School's entrance.

For more information, including opening hours, see the computing facilities webpage. Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

School Contact Information

School Contact Information

Please visit the School of Mathematics and Statistics website for a range of information.

For information on Courses, please go to “Student life & resources” and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within “Student life & resources” page. We also post notices in "Student noticeboard" for your information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

Undergraduate

E: ug.mathsstats@unsw.edu.au

P: 9385 7011 or 9385 7053

Postgraduate

E: pg.mathsstats@unsw.edu.au

P: 9385 7053

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please use your UNSW student email and state your student number in all emails to us.**