UNSW SCIENCE

School of Maths and Statistics

Course outline

MATH3121

Mathematical Methods and Partial Differential Equations

Term 1, 2023

Cricos Provider Code: 00098G

Staff

Position	Name	Email	Room
Lecturer-in-charge	Dr Christopher Angstmann	c.angstmann@unsw.edu.au	RC-4076

Please refer to your Timetable on MyUNSW for your Lecture Tut, Lab enrolment days and times. Timetable weblink: http://timetable.unsw.edu.au/2023/MATH3121.html

Administrative Contacts

Please visit the School of Mathematics and Statistics website for a range of information on School Policies, Forms and Help for Students.

For information on Courses, please go to “Current Students” and either Undergraduate and/or Postgraduate”, Course Homepage” for information on all course offerings,

The “Student Notice Board” can be located by going to the “Current Students” page; Notices are posted regularly for your information here. Please familiarise yourself with the information found in these locations. The School web page is: https://www.maths.unsw.edu.au

If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

By email Undergraduate ug.mathsstats@unsw.edu.au
By phone: 9385 7053 or 9385 7011

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 state your student number in all emails.**

Course Information

Assumed knowledge / Pre-Requisite: 12 units of credit in Level 2 Mathematics courses including MATH2011 or MATH2111, and MATH2121 or MATH2221, or both MATH2019(DN) and MATH2089, or both MATH2069(DN) and MATH2099

We are aware some course exclusions on the Handbook may be different to the School website. We are in the process of updating this information. Meanwhile, students should be following the Handbook course information with the School website information as a supplement.

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 Description

This course builds on MATH2120 Mathematical Methods for Differential Equations in that it is concerned with ways of solving the (usually partial) differential equations that arise mainly in physical, biological and engineering applications.

Analytical methods have considerable intrinsic interest, but their importance for applications is the driving motive behind this course. The main analytical tools developed in this course can be thought of as generalisations of the Fourier and power series representations of functions studied in MATH2120. This leads to new types of functions and to practical methods for solving differential equations. We will pay special attention to functions defined on infinite domains.

The course begins by characterising different partial differential equations (PDEs), and exploring similarity solutions and the method of characteristics to solve them. The Fourier transform, the natural extension of a Fourier series expansion is then investigated. For functions of time, the Fourier transform corresponds to the “spectrum” of the function or signal in the problem in the frequency domain. Closely related to the Fourier transform is the Laplace transform which is particularly useful for solving the initial value PDEs that arise in many physical applications. Although contour integration is an intrinsic part of using these transforms, only brief references to complex variable methods will be made.

Transforms give a wide insight into the behaviour of a function and suggests other possibilities for the integral representation of solutions of PDEs. By exploiting certain special solutions of a given linear PDE we eventually obtain the idea of a Green's function for the PDE and a corresponding integral form for the solution. The power of Green's functions can be observed in their use as the inverses of differential operators on both infinite and bounded domains.
Frequently it is not possible to evaluate in closed form the Fourier, Laplace or Green’s function integrals appearing in the solution of the given PDE. All is not lost as we can still explore the asymptotic behaviour of these integrals at large parameter values and obtain physically useful information on the solution of the underlying problem.

Assessment and Deadlines

Assessment	Week	Weighting %	Due date if applicable	Course Learning Outcome (CLO)
Assignment 1	Week 3	10%	Friday 5pm	CLO1, CLO2, CLO4
In Class Test	Week 5	20%	Tuesday 11am	CLO1 to CLO4
Assignment 2	Week 8	10%	Friday 5pm	CLO3,CLO4
Final Exam		60%	Exam Period	ALL

Late Submission of Assessment Tasks

A late penalty of 5% of the awarded mark will be applied per day or part day any assessment task is submitted more than 1 hour late. (Where "late" in this context means after any extensions granted for Special Consideration or Equitable Learning Provisions.) For example, an assessment task that was awarded 75% would be given 65% if it was 1-2 days late. Any assessment task submitted after 5 days will not be accepted.

Note that the penalty does not apply to

- Assessment tasks worth less than 5% of the total course mark, e.g. weekly quizzes, weekly class participation, or weekly homework tasks.
- Examinations and examination-style class tests
- Pass/Fail Assessments

Course Learning Outcomes (CLO)

1. Show an appreciation of various techniques, transforms and mathematical methods related to the solution of differential equations
2. Provide logical and coherent derivations of results
3. Solve problems via the methods for differential equations
4. Demonstrate increased competency in mathematical presentation, written and verbal skills

Course Schedule

The course will include material taken from some of the following topics. This is should only serve as a guide as it is not an extensive list of the material to be covered and the timings are approximate. The course content is ultimately defined by the material covered in lectures.

Weeks	Topic	Reading (if applicable)
1	Introduction and Revision	Refer to Moodle Lecture notes
2	Symmetries and Similarity Solutions	
3	The Method of Characteristics	
4	The Sturm-Liouville Equations	
5	Generalised Fourier series and their applications to PDEs	
7	Laplace Transforms	
8	Fourier Transforms	
9	Green's Functions	
10	Asymptotic methods for integrals	

Moodle

Log in to Moodle to find announcements, general information, notes, lecture slide, classroom tutorial and assessments etc.

https://moodle.telt.unsw.edu.au

School 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 Maths Stats web site starting at:

https://www.maths.unsw.edu.au/currentstudents/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.

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

The **UNSW Student Code** provides a framework for the standard of conduct expected of UNSW students with respect to their academic integrity and behaviour. It outlines the primary obligations of students and directs staff and students to the Code and related procedures.

In addition, it is important that students understand that it is not permissible to buy essay/writing services from third parties as the use of such services constitutes plagiarism because it involves using the words or ideas of others and passing them off as your own. Nor is it permissible to sell copies of lecture or tutorial notes as students do not own the rights to this intellectual property.

If a student breaches the Student Code with respect to academic integrity, the University may take disciplinary action under the **Student Misconduct Procedure**.

The UNSW Student Code and the Student Misconduct Procedure can be found at: https://student.unsw.edu.au/plagiarism

An online Module "Working with Academic Integrity" (https://student.unsw.edu.au/aim) is a six-lesson interactive self-paced Moodle module exploring and explaining all of these terms and placing them into your learning context. It will be the best one-hour investment you've ever made.

Plagiarism

Plagiarism is presenting another person's work or ideas as your own. Plagiarism is a serious breach of ethics at UNSW and is not taken lightly. So how do you avoid it? A one-minute video for an overview of how you can avoid plagiarism can be found https://student.unsw.edu.au/plagiarism.

Additional Support

ELISE (Enabling Library and Information Skills for Everyone)

ELISE is designed to introduce new students to studying at UNSW.

Completing the ELISE tutorial and quiz will enable you to:

- analyse topics, plan responses and organise research for academic writing and other assessment tasks
- effectively and efficiently find appropriate information sources and evaluate relevance to your needs
- use and manage information effectively to accomplish a specific purpose
- better manage your time
- understand your rights and responsibilities as a student at UNSW
- be aware of plagiarism, copyright, UNSW Student Code of Conduct and Acceptable Use of UNSW ICT Resources Policy
- be aware of the standards of behaviour expected of everyone in the UNSW community
- locate services and information about UNSW and UNSW Library

Some of these areas will be familiar to you, others will be new. Gaining a solid understanding of all the related aspects of ELISE will help you make the most of your studies at UNSW.

The *ELISE* training webpages:

https://subjectguides.library.unsw.edu.au/elise/aboutelise

Equitable Learning Services (ELS)

If you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage, then you should contact the Equitable Learning Services (previously known as SEADU) who provide confidential support and advice.

They assist students:

- living with disabilities
- with long- or short-term health concerns and/or mental health issues
- who are primary carers
- from low SES backgrounds
- of diverse genders, sexes and sexualities
- from refugee and refugee-like backgrounds
- from rural and remote backgrounds
- who are the first in their family to undertake a bachelor-level degree.

Their web site is: https://student.unsw.edu.au/els/services

Equitable Learning Services (ELS) may determine that your condition requires special arrangements for assessment tasks. Once the School has been notified of these, we will make every effort to meet the arrangements specified by ELS.

Additionally, if you have suffered significant misadventure that affects your ability to complete the course, please contact your Lecturer-in-charge in the first instance.

Academic Skills Support and the Learning Centre

The Learning Centre offers academic support programs to all students at UNSW Australia. We assist students to develop approaches to learning that will enable them to succeed in their academic study. For further information on these programs please go to:

http://www.lc.unsw.edu.au/services-programs

Applications for Special Consideration for Missed Assessment

Please adhere to the Special Consideration Policy and Procedures provided on the web page below when applying for special consideration.

https://student.unsw.edu.au/special-consideration

Please note that the application is not considered by the Course Authority, it is considered by a centralised team of staff at the Nucleus Student Hub.

The School will contact you (via student email account) after special consideration has been granted to reschedule your missed assessment, for a *lab test or paper-based test* only.

For applications for special consideration for *assignment extensions*, please note that the new submission date and/or outcome will be communicated through the special consideration web site only, no communication will be received from the School.

For Dates on Final Term Exams and Supplementary Exams please check the “Key Dates for Exams” ahead of time to avoid booking holidays or work obligations.
https://student.unsw.edu.au/exam-dates

If you believe your application for Special Consideration has not been processed, you should email specialconsideration@unsw.edu.au immediately for advice.

Course Evaluation and Development (MyExperience)

Student feedback is very important to continual course improvement. This is demonstrated within the School of Mathematics and Statistics by the implementation of the UNSW online student survey *myExperience*, which allows students to evaluate their learning experiences in an anonymous way. *myExperience* survey reports are produced for each survey. They are released to staff after all student assessment results are finalised and released to students. Course convenor will use the feedback to make ongoing improvements to the course.