School of Information and Physical Sciences

MATH3205: Applied Fourier Analysis
Callaghan
Semester 1 - 2024

COURSE OUTLINE

OVERVIEW

Course Description

The course introduces Fourier analysis from an applied perspective. Fourier series and the Fourier transform are developed as links between the domains of time and frequency. Connections between the analogue and digital worlds are made through the sampling theorem and the Fast Fourier Transform. Applications to quantum physics are explored through Heisenberg uncertainty. Further applications to partial differential equations, tomography and probability/statistics are also explored.

Academic Progress Requirements

Nil

Assumed Knowledge
Contact Hours

MATH2310
Callaghan
Lecture
Face to Face On Campus
3 hour(s) per week(s) for 13 week(s) starting Week 1

Unit Weighting
Workload

10
Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator	**Callaghan** A/Pr Jeffrey Hogan Jeff.Hogan@newcastle.edu.au (02) 4921 7235 Consultation: see Canvas
School Office	**School of Information and Physical Sciences** SR233, Social Sciences Building Callaghan CESE-SIPS-Admin@newcastle.edu.au +61 2 4921 5513 9am-5pm (Mon-Fri)

SYLLABUS

Course Content	• Separation of variables • Fourier series, Fourier transforms and applications • Sturm-Liouville problems and expansions • Shannon sampling and Heisenberg uncertainty • Discrete and Fast Fourier Transforms • Applications: tomography, partial differential equations, probability.
Course Learning Outcomes	**On successful completion of this course, students will be able to:** 1. read, follow and critique arguments of a mathematical nature. 2. formulate and communicate reasoned arguments of a mathematical nature. 3. apply the techniques of Fourier analysis to problems in physics and engineering.
Course Materials	Lecture Materials: - All course materials (lecture notes, assignments and solutions) will be delivered via Canvas. **Recommended Reading:** Books that may be useful to students include: *Fourier Series and Integrals*, H. Dym and H.P. McKean, Academic Press *The Evolution of Applied Harmonic Analysis*, E. Prestini, Birkhäuser *Fourier Analysis and its Applications*, G.B. Folland, Wadsworth & Brooks/Cole *A First Course in Fourier Analysis,* D.W. Kammler, Cambridge University Press

ASSESSMENTS

This course has 3 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Class Test	Wednesday class of week 7	Individual	25%	1, 2, 3
2	Homework assignments (x5)	Start of Wednesday classes of weeks 3, 5, 8, 10 and 12	Individual	25%	1, 2, 3
3	Examination ' Formal	Formal examination period	Individual	50%	1, 2, 3

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Class Test

Assessment Type	In Term Test
Description	Written answers to questions posed from previous weeks in the course
Weighting	25%
Due Date	Wednesday class of week 7
Submission Method	In class
Assessment Criteria	Mathematical correctness and presentation of solutions
Return Method	In class
Feedback Provided	Returned Work - Two weeks after submission
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Homework assignments (x5)

Assessment Type	Written Assignment
Description	Written answers to questions related to the course material.
Weighting	25%
Due Date	Start of Wednesday classes of weeks 3, 5, 8, 10 and 12.
Submission Method	In class
Assessment Criteria	Mathematical correctness and presentation of solutions
Return Method	In class
Feedback Provided	Returned Work - Two weeks after submission.
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - Examination ' Formal

Assessment Type	Formal Examination
Description	Multiple choice and written questions arising from the course material. Students are allowed to use a non-graphing non-programmable scientific calculator. Calculator reference cards are not permitted.
Weighting	50%
Due Date	Formal examination period
Submission Method	Formal exam
Assessment Criteria	Mathematical correctness and presentation of solutions
Return Method	Not returned
Feedback Provided	No feedback
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Communication Methods

Communication methods used in this course include:

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s).
Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:
1.   the assessment item is a major assessment item; or
2.   the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3.   you are requesting a change of placement; or
4.   the course has a compulsory attendance requirement.
Before applying you must refer to the Adverse Circumstance Affecting Assessment Items

Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.