

Faculty of Health, Science and Technology Mathematics

Syllabus

Fourier Analysis

Course Code:	MAGC01
Course Title:	Fourier Analysis <i>Fourieranalys</i>
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has at least 60 credits in first-cycle course/s as entry requirements (G2F)

Major Field of Study: MAA (Mathematics)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2023-09-01, and is valid from the Spring semester 2024 at Karlstad University.

Prerequisites

Registered for 60 ECTS credits in Mathematics with 45 ECTS credits completed, including Linear Algebra, 7.5 ECTS credits, Calculus in Several Variables, 7.5 ECTS credits, Differential Equations and Vector Calculus, 6.0 ECTS credits, and Introduction to Calculus, 7.5 ECTS credits, or equivalent

Learning Outcomes

Upon completion of the course the student should be able to:

- apply summation by parts and properties of the Dirichlet kernel to determine pointwise or uniform convergence of trigonometric series,

- apply the convergence theorems to determine pointwise or uniform convergence of the Fourier series for a given piecewise smooth function,

- apply Parseval's equality to evaluate the sums of series,

- perform summation of Fourier series using Fejér and other summation kernels,

- develop elementary functions in series of Legendre polynomials,

- determine Fourier transforms using elementary methods of integration and the table of standard transforms,

- apply the Fourier convolution theorem to evaluate convolutions and solve integral equations,

- solve selected initial and boundary value problems, for instance for two- and three-

dimensional wave and heat partial differential equations, using the Fourier method, Fourier series, and Fourier transform,

- prove a given selection of key theorems treated in the course, and

- give oral and written accounts of mathematical problems solved independently.

Content

- Fourier coefficients and Fourier series of periodic functions.

- Convergence of Fourier series for piecewise smooth functions.
- Summation by parts.
- Dirichlet kernel. Summation kernels.
- General Fourier series (introduction to L2 theory) .
- Bessels inequality and Parsevals equality.
- Convolutions.
- Fourier transform.
- Plancherel theorem.
- Orthogonal polynomials, especially Legendre polynomials.

- Solution of some initial and boundary value problems for partial differential equations using Fourier series and Fourier transform.

Students are required to complete a minor individual project.

Reading List

See separate document.

Examination

Examination is in the form of a written exam and a written and oral presentation of the project.

The number of assessment opportunities is limited to three per academic year.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades

One of the grades Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional information

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.