

The Department of Mathematics

2017–18–B term

Course Name Advanced Analysis for Communication Engineering

Course Number 201.1.0241

Course web page

<https://www.math.bgu.ac.il/en/teaching/spring2018/courses/advanced-analysis-for-communication-engineering>

Office Hours <https://www.math.bgu.ac.il/en/teaching/hours>

Abstract

Requirements and grading¹

- .1 Complex numbers: Cartesian coordinates, polar coordinates. Functions of a complex variable. Basic properties of analytic functions, the exponential function, trigonometric functions. Definition of contour integral. The Cauchy Integral Formula. Residues and poles. Evaluation of improper real integrals with the use of residues.
- .2 Inner product functional spaces. Orthogonal and orthonormal systems. Generalized Fourier series. Theorem on orthogonal projection. Bessel's inequality and Parseval's equality.
- .3 Trigonometric Fourier series. Complex form of Fourier series. Fourier series expansion defined over various intervals. Pointwise and uniform convergence of Fourier series. Completeness of trigonometric system and Parseval's equality. Differentiation and integration of Fourier series.
- .4 The Fourier integral as a limit of Fourier series. The Fourier transform: definition and basic properties. The inverse Fourier transform. The convolution theorem, Parseval's theorem for the Fourier transform. A relation between Fourier and Laplace transforms. Application of Fourier transform to partial differential equations and image processing.

¹Information may change during the first two weeks of the term. Please consult the webpage for updates



- .5 Distributions (generalized functions). The Heaviside step function, the impulse delta-function. Derivative of distribution. Convergence of sequences in the space of distributions. The Fourier transform of distributions.

Course topics

- .1 Complex numbers: Cartesian coordinates, polar coordinates. Functions of a complex variable. Basic properties of analytic functions, the exponential function, trigonometric functions. Definition of contour integral. The Cauchy Integral Formula. Residues and poles. Evaluation of improper real integrals with the use of residues.
- .2 Inner product functional spaces. Orthogonal and orthonormal systems. Generalized Fourier series. Theorem on orthogonal projection. Bessel's inequality and Parseval's equality.
- .3 Trigonometric Fourier series. Complex form of Fourier series. Fourier series expansion defined over various intervals. Pointwise and uniform convergence of Fourier series. Completeness of trigonometric system and Parseval's equality. Differentiation and integration of Fourier series.
- .4 The Fourier integral as a limit of Fourier series. The Fourier transform: definition and basic properties. The inverse Fourier transform. The convolution theorem, Parseval's theorem for the Fourier transform. A relation between Fourier and Laplace transforms. Application of Fourier transform to partial differential equations and image processing.
- .5 Distributions (generalized functions). The Heaviside step function, the impulse delta-function. Derivative of distribution. Convergence of sequences in the space of distributions. The Fourier transform of distributions.