

The Department of Mathematics

2023–24–A term

Course Name Integral Transforms and Partial Differential Equations

Course Number 201.1.0291

Course web page

<https://www.math.bgu.ac.il/en/teaching/fall2024/courses/introduction-to-partial>

Lecturer Prof. Arkady Poliakovsky, <poliakov@bgu.ac.il>, Office 314

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

Abstract

Requirements and grading¹

Course topics

- .1 The Fourier transform: convolutions, the inversion formula, Plancherel's theorem, Hermite functions, tempered distributions. The Poisson summation formula. The Fourier transform in \mathbb{R}^n .
- .2 The Laplace transform. Connections with convolutions and the Fourier transform. Laguerre polynomials. Applications to ODE's. Uniqueness, Lerch's theorem.
- .3 Classification of the second order PDE: elliptic, hyperbolic and parabolic equations, examples of Laplace, Wave and Heat equations.
- .4 Elliptic equations: Laplace and Poisson equations, Dirichlet and Neumann boundary value problems, Poisson kernel, Green's functions, properties of harmonic functions, Maximum principle
- .5 Analytical methods for resolving partial differential equations: Sturm-Liouville problem and the method of separation of variables for bounded domains, applications for Laplace, Wave and Heat equations including non-homogenous problems. Applications of Fourier and Laplace transforms for resolving problems in unbounded domains.

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

Bibliography

- .1 Stein E. and Shakarchi R., Fourier analysis, Princeton University Press, .2003
- .2 Korner T.W., Fourier analysis, Cambridge University Press, .1988
- .3 Katznelson Y., An Introduction to Harmonic Analysis, Dover publications.
- .4 John, Partial differential equations, Reprint of the fourth edition. Applied Mathematical Sciences, .1 Springer-Verlag, New York, .1991
- .4 Evans Lawrence C. Partial Differential Equations, Second Edition.
- .5 Gilbarg D.; Trudinger N. S. Elliptic partial differential equations of second order, Reprint of the 1998 edition. Classics in Mathematics. Springer-Verlag, Berlin, .2001
- .6 Zauderer E. Partial differential equations of applied mathematics, Second edition. Pure and Applied Mathematics (New York). A Wiley-Interscience Publication. John Wiley & Sons, Inc., New York, .1989 xvi+891 pp. ISBN: .0-471-61298-7