

## The Department of Mathematics

2021–22–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/fall2022/courses/introduction-to-partial>

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

### Abstract

### Requirements and grading<sup>1</sup>

### 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.

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<sup>1</sup>Information 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.