

The Department of Mathematics

2021–22–B term

Course Name Partial Differential Equations

Course Number 201.1.0101

Course web page

<https://www.math.bgu.ac.il/en/teaching/spring2022/courses/partial-differential-equations>

Lecturer Prof. Boris Zaltzman, <boris@bgu.ac.il>, Office 211

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

Abstract

Requirements and grading¹

Course topics

- .1 Second order linear equations with two variables: classification of the equations in the case of constant and variable coefficients, characteristics, canonical forms.
- .2 Sturm-Liouville theory.
- .3 String or wave equation. Initial and boundary value conditions (fixed and free boundary conditions). The d'Alembert method for an infinitely long string. Characteristics. Wave problems for half-infinite and finite strings. A solution of a problem for a finite string with fixed and free boundary conditions by the method of separation of variables. The uniqueness proof by the energy method. Well-posedness of the vibrating string problem.
- .4 Laplace and Poisson equations. Maximum principle. Well-posedness of the Dirichlet problem. Laplace equation in a rectangle. Laplace equation in a circle and Poisson formula. An ill-posed problem - the Cauchy problem. Uniqueness of a solution of the Dirichlet problem. Green formula in the plane and its application to Neumann problems.

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



- .5 Heat equation. The method of separation of variables for the one-dimensional heat equation. Maximum principle. Uniqueness for the one-dimensional heat equation. The Cauchy problem for heat equations. Green's function in one dimension. If time permits: Green's function in the two dimensional case.
- .6 Non-homogeneous heat equations, Poisson equations in a circle and non-homogeneous wave equations.
- .7 If time permits: free vibrations in circular membranes. Bessel equations.