אוניברסיטת
בן-גוריון בנגב

The Department of Mathematics

2017–18–B term

Course Name Introduction to Partial Dffieretial Equations

Course Number 201.1.0291

Course web page
`https://math.bgu.ac.il//en/teaching/spring2018/courses/introduction-to-partial-d`

Office Hours `https://math.bgu.ac.il/en/teaching/hours`

Abstract

Requirements and grading[1]

Introduction to partial dffierential equations ? The first order equations: a linear equation, a quasilinear equation, resolving the initial value problem by the method of characteristic curves. ? Classfiication of the second order equations: elliptic, hyperbolic and parabolic equations, exam- ples of Laplace, Wave and Heat equations. ? Elliptic equations: Laplace and Poisson?s equations, Dirichlet and Neumann boundary value problems, Poisson?s kernel, Green?s functions, properties of harmonic functions, Maximum prin- ciple. ? Analytical methods for resolving partial dffierential 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. ? Heat equation: initial value problem in unbounded domain, basic formula for the solution, initial-boundary value problems in bounded domains, Maximum principle. ? Wave equation: Dalamber formula, non-homogenous equation, Wave equation in higher dimen- sions. ? If time permits: Legendre polynomials and spherical functions. Literature: ? Pinchover Y.; Rubinstein J. Introduction to partial dfiferential equations (in Hebrew), Depart- ment of mathematics, Technion, ,2011 ? John F. Partial dffierential equations, Reprin t of the fourth edition. Applied Mathematical Scien ces, .1 Springer-Verlag, New York, ,1991 ? Evans Lawrence C. Partial Dffierential Equations, Second Edition, ? Gilbarg D.; Trudinger N. S. Elliptic partial dffierential equations of second order, Reprint of the 1998 edition.

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

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Classics in Mathematics. Springer-Ver lag, Berlin, ,2001 ? Zauderer E. Partial dffierential equations of applied mathematics, Second edition. Pure and Appli ed Mathematics (New York). A Wiley-Interscience Public ation. John Wiley & Sons, Inc., New York, .1989 xvi+891 pp. ISBN: .0-471-61298-7 1

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 R^n.

.2 The Laplace transform. Connections with convolutions and the Fourier transform. Laguerre polynomials. Applications to ODE's. Uniqueness, Lerch's theorem.

.3 Classfiication 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 dffierential 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.

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 dffierential equations, Reprint of the fourth edition. Applied Mathematical Sciences, .1 Springer-Verlag, New York, .1991

.4 Evans Lawrence C. Partial Dffierential Equations, Second Edition.

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.6 Zauderer E. Partial dffierential 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