Book Review: Transforms and Partial Differential Equations

By Dr. P. Kandasamy, Dr. K. Thilagavathy, Dr. K. Gunavathy.

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This book is updated from the original edition published in 1996. And this is the latest 5th edition 2014 till now. It has been designed as a textbook on Engineering Mathematics for students of B.E., B.Tech and B.Sc. (Applied Sciences) has been now split into two volumes to cater to the needs of syllabus semester-wise. This book is mainly prepared based on the Anna University syllabus.

This book consists of 5 units. The major topics are Partial Differential Equations (PDE), its applications, Fourier series, Z-Transforms and its Applications. In order to solve the wide variety of situations, we are using Fourier transforms. And for solving several model physical processes using effective mathematical tools, we are using PDE and its applications. For discrete time systems, the Z-transforms techniques had been developed.

Here there are 5 Chapters, in which Chapter 1 talks about the Fourier series. The author derives the Dirichlet's conditions. General Fourier series, Odd and even functions, Half range sine and cosine series and problems based on expressing the given function in various type solutions in cosine and sine with conditions given. In many engineering applications, we require an expansion of a given function over an integral of length other than π or 2π. The author starts with periodic functions. In the second part of this Chapter, Parseval's Theorem and the concept of root-mean value (r.m.s) and Rectangular rule for integration, in engineering application elaborated clearly. Many Physical experiment based examples are given. Rectangular rules for integration topics are also included. Fourier series in complex form with various solved examples and exercise problems are also included.

In Chapter 2, the author explains the formation of differential equations with examples and exercise problems are given to practice solutions of PDE are explained and solved. And the author solved the first order PDE by several methods having some standard forms. And here comes one of the main topics to solve PDE. Lagrange's linear equation which is of the form $Pp + Qq = R$ is explained by the authors in a clear cut way. In this Chapter, Solving of higher order PDE with constant coefficients is explained. The authors are dividing this as Homogeneous and Nonhomogenous linear equations. And a vast explanation is given for each and every problem which helps the reader to solve the higher order PDE.

Chapter 3 explains the Boundary Value Problems (BVP) to solve the problems with boundary conditions. There are some methods to solve the BVP explained. Method of Separation of Variables is one of the methods to solve with solutions of the form $Z = X(x)Y(y)$. The authors are employing this method for the reader to be used in most of the applied partial differential equations to solve the equation classification of PDE has been clearly explained by the authors. The author is explaining the Transverse Vibration of a stretched elastic string and derivation. Solving various equations like wave equation, Heat flow Equations like 1-D Heat Equations, 2-D Heat Equations and Polar equations. Examples for Heat flow equations explained which helps the reader to solve them easily. These are the basic application topics which are perfectly solved by the author with step by step explanation. More number of application based questions are given as an exercise to solve

by the reader and similar examples are given which minimize the burden of solving the applications of PDE.

Here the author explains about the Fourier transforms very clearly in Chapter 4. The author is including more about the integral Fourier transform very briefly of various types with great examples. Many naming transforms are given very briefly like Laplace transforms, Hankel Transform, Mellin Transform, etc. This Chapter is somewhat based on Fourier series Chapter 1 which has the basic concepts of Fourier series. Fourier Integral theorem is explained. Applications to BVP are explained based on Fourier transforms using Cosine and Sine transforms with many examples and exercises. The first part is completely explaining about the infinite and the last part is Infinite Fourier Transforms based problems. At the end of this Chapter, examples and exercise problems with answer keys are given for the reader to practice.

In Chapter 5, Z-Transform plays an important role in the communication and control engineering. This Z-Transform is like Laplace transforms: explained basic definitions, properties and theorems of Z-transform are explained with solved examples by the author. Here the Convolution sequences in Z-Transforms are explained in detail. The table of basic and inverse transforms is solved by 3 methods and that is followed by differentiation with examples.

From our point of view, the advantage is mainly meant for examination point with so many examples and with model and previous year question papers. Readers can understand the subject very easily by reading this book. Once we start to solve, we'll get some ideas based on Transforms and PDE. The book is recommended to anyone who wants to learn any aspects of PDE.

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DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCE

[1] Dr. P. Kandasamy, Dr. K. Thilagavathy, Dr. K. Gunavathy,"Transforms and Partial Differential Equations", S. Chand & Company Pvt. Ltd., 5th Edition 2014.

BIOGRAPHIES

D. Vivek received the B.Sc. Degree in Mathematics from Ooty Govt. Arts College in 2010, M.Sc. Degree in Mathematics from Sri Ramakrishna Mission Vidyalaya College of Arts & Science in 2013 and the Ph.D. degree in Mathematics from Sri Ramakrishna Mission Vidyalaya College of Arts and Science in 2019. He is currently working as Assistant Professor of Mathematics at PSG College of Arts & Science, Coimbatore, India. His research interests include Fuzzy Differential Equations, Numerical Solutions, and Fractional Differential Equations.

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