RATIONS RESEARCH

AND APPLICATIONS

6TH EDITION

esearch: Theory and Applications is a comprehensive textbook for courses in quantitative methods, search, management science, analytical methods for decision-making, and other related subjects. The edition of the book further enhances the easy-to-understand approach adopted in earlier editions. This ovides the readers an understanding of the problem-solving methods based on a careful discussion of lation, solution procedures, and analysis of results.

res

l chapters have been reorganized and/or rewritten to facilitate better and easier understanding of the and text material.

pter begins with a Preview and Learning Objectives to guide the students and help them focus on nding a specific topic under study.

he chapters contain Management Cases to help students understand various business situations, and olutions to managerial issues that are raised while using specific techniques of operations research.

pter contains Concept Quizzes to help students reinforce their understanding of the principles and ons of operations research techniques.

ons are well illustrated with numerous interesting and varied business-oriented examples.

al Questions, Self-Practice Problems with Hints and Answers have been provided in each chapter to udents to learn at their own pace.

conforms to the latest trends of questions appearing in universities and professional examinations.

es included in most of the chapters provide basic theoretical support to the development of specific es used in solving decision-making problems appearing in the chapters.

es to questions appearing in the examinations of various Indian universities have been updated.

intended to serve as a core textbook for the students of MBA/ PGDBM, MCom, CA and ICWA who need to the basic concepts of operations research and apply these directly to real-life business problems. It also requirements of the students of MA/MSc (Mathematics, Statistics, Operations Research), MCA, MIT, /BTech, AMIE, who need both theoretical and practical knowledge related to operations research.

harma, formerly a Professor at the Faculty of Management Studies, University of Delhi, is currently a Amity Business School, Amity University, Noida. He has also served as the Director of G L Bajaj Institute of nt and Technology, Greater Noida; Institute of Management Studies, Noida; and Maharishi Institute of nt, Noida. Prof. Sharma has more than 35 years of experience teaching quantitative techniques, operations usiness statistics/mathematics and project management. He is a Gold Medalist in Mathematics and has Visiting Professor at Group ESSEC (A Graduate School of Management), France, and Amity University, Dubai

harma has authored 30 books on quantitative techniques, operations research, business statistics/ cs, industrial management, management of systems, etc. These books have been widely appreciated by uate and postgraduate students taking courses of the various Indian universities, and management s. He has also written over 100 research papers/management cases. Prof. Sharma is actively involved in rojects, and also conducts Management Development Programmes for both public and private sector

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J K SHARMA

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Preface to the First Edition

The primary objective in writing this book is to provide the readers the insight into structures and processes that Operations Research can offer and the enormous practical utility of its various techniques.

The aim is to explain the concepts and simultaneously to develop in readers an understanding of problem-solving methods based upon a careful discussion of model formulation, solution procedures and analysis. To this end, numerous solved business-oriented examples have been presented throughout the text. Unsolved *Self Practice Problems with Hints and Answers*, and *Review Questions* have been added in each chapter to strengthen the conceptual as well as practical knowledge of the reader.

The book is designed to be self-contained and comprises of 29 chapters divided into four parts and Appendices A and B. Topics providing theoretical support to certain results used for solving business problems in Part II are discussed in Part IV. The book is intend to serve as a core text primarily for students of MBA/PGDBM, MCom, CA, ICWA who need to understand basic concepts of operations research and apply results directly to real-life business problems. The book also suits the requirements of students appearing for MA/MSc (Maths, Statistics, Operations Research), MCA, BE/BTech (Computer Science) and AMIE, who need both theoretical and practical knowledge of operations research techniques, as well as for those preparing for IAS, NET, ISI and other competitive examinations.

I hope that the presentation and sequence of chapters have made the text interesting and lucid. In writing this book I have benefitted immensely by referring to many books and publications. I express my gratitude to all such authors, publishers and institutions; many of them have been listed in the references. If anybody has been left out inadvertently, I seek their pardon.

I express my sincere gratitude to my teachers Prof. Kanti Swarup and Dr S D Sharma for their blessings and inspiration. I wish to acknowledge my sincere thanks to my students, friends and colleagues, particularly to Prof M P Gupta and Prof A S Narag for their valuable suggestions and encouragement during the preparation of this text. I would like to thank the publishers for the efficient and thoroughly professional way in which the whole project was managed. In the end let me thank my wife and children for the unflagging support and encouragement they gave me while I worked on this book.

Any suggestions to improve the book in contents or in style are always welcome and will be appreciated and acknowledged.

J K Sharma

Contents

Chapter 1

Operations Research: An Introduction

"The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency."

– Bill Gates

PREVIEW

This chapter presents a framework of a possible structural analysis of problems pertaining to an organization in order to arrive at an optimal solution using operations research approach.

LEARNING OBJECTIVES

After reading this chapter you should be able to

- understand the need of using operations research – a quantitative approach for effective decision-making.
- know the historical perspective of operations research approach.
- know various definitions of operations research, its characteristics and various phases of scientific study.
- recognize, classify and use of various models for solving a problem under consideration.
- be familiar with several computer software available for solving an operations research model.

CHAPTER OUTLINE