Preface

Algebra has played a central and decisive role in all branches of mathematics and, in turn, in all branches of science and engineering. It is not possible for a lecturer to cover, physically in a classroom, the amount of algebra which a graduate student (irrespective of the branch of science, engineering, or mathematics in which he prefers to specialize) needs to master. In addition, there are a variety of students in a class. Some of them grasp the material very fast and do not need much of assistance. At the same time, there are serious students who can do equally well by putting a little more effort. They need some more illustrations and also more exercises to develop their skill and confidence in the subject by solving problems on their own. Again, it is not possible for a lecturer to do sufficiently many illustrations and exercises in the classroom for the aforesaid purpose. This is one of the considerations which prompted me to write a series of three volumes on the subject starting from the undergraduate level to the advance postgraduate level. Each volume is sufficiently rich with illustrations and examples together with numerous exercises. These volumes also cater for the need of the talented students with difficult, challenging, and motivating exercises which were responsible for the further developments in mathematics. Occasionally, the exercises demonstrating the applications in different disciplines are also included. The books may also act as a guide to teachers giving the courses. The researchers working in the field may also find it useful.

The first volume consists of 11 chapters, which starts with language of mathematics (logic and set theory) and centers around the introduction to basic algebraic structures, viz., groups, rings, polynomial rings, and fields together with fundamentals in arithmetic. This volume serves as a basic text for the first-year course in algebra at the undergraduate level. Since this is the first introduction to the abstract-algebraic structures, we proceed rather leisurely in this volume as compared with the other volumes.

The present (second) volume contains 10 chapters which includes the fundamentals of linear algebra, structure theory of fields and the Galois theory, representation theory of groups, and the theory of group extensions. It is needless to say that linear algebra is the most applicable branch of mathematics, and it is essential

for students of any discipline to develop expertise in the same. As such, linear algebra is an integral part of the syllabus at the undergraduate level. Indeed, a very significant and essential part (Chaps. 1–5) of linear algebra covered in this volume does not require any background material from Volume 1 of the book except some amount of set theory. General linear algebra over rings, Galois theory, representation theory of groups, and the theory of group extensions follow linear algebra, and indeed these are parts of the syllabus for the second- and the third-year students of most of the universities. As such, this volume together with the first volume may serve as a basic text for the first-, second-, and third-year courses in algebra.

The third volume of the book contains 10 chapters, and it can act as a text for graduate and advance graduate students specializing in mathematics. This includes commutative algebra, basics in algebraic geometry, semi-simple Lie algebras, advance representation theory, and Chevalley groups. The table of contents gives an idea of the subject matter covered in the book.

There is no prerequisite essential for the book except, occasionally, in some illustrations and exercises, some amount of calculus, geometry, or topology may be needed. An attempt to follow the logical ordering has been made throughout the book.

My teacher (Late) Prof. B.L. Sharma, my colleague at the University of Allahabad, my friend Dr. H.S. Tripathi, my students Prof. R.P. Shukla, Prof. Shivdatt, Dr. Brajesh Kumar Sharma, Mr. Swapnil Srivastava, Dr. Akhilesh Yadav, Dr. Vivek Jain, Dr. Vipul Kakkar, and above all, the mathematics students of the University of Allahabad had always been the motivating force for me to write a book. Without their continuous insistence, it would have not come in the present form. I wish to express my warmest thanks to all of them.

Harish-Chandra Research Institute (HRI), Allahabad, has always been a great source for me to learn more and more mathematics. I wish to express my deep sense of appreciation and thanks to HRI for providing me all infrastructural facilities to write these volumes.

Last but not least, I wish to express my thanks to my wife Veena Srivastava who had always been helpful in this endeavor.

In spite of all care, some mistakes and misprints might have crept in and escaped my attention. I shall be grateful to any such attention. Criticisms and suggestions for the improvement of the book will be appreciated and gratefully acknowledged.

Allahabad, India Ramji Lal
April 2017

http://www.springer.com/978-981-10-4255-3

Algebra 2
Linear Algebra, Galois Theory, Representation theory,
Group extensions and Schur Multiplier
Lal, R.
2017, XVIII, 432 p., Hardcover
ISBN: 978-981-10-4255-3