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Algebra. An approach via module theory. (English) Zbl 0768.00003

Graduate Texts in Mathematics. 136. New York: Springer-Verlag. x, 526 p. (1992).

From the preface: “Perhaps the principal distinguishing feature of this book is its point of view. Many textbooks tend to be encyclopedic. We have tried to write one that is thematic with a consistent point of view. The theme, as indicated by our title, is that of modules (though our intention has not been to write a textbook purely on module theory). We begin with some group and ring theory, to set the stage, and then, in the heart of the book, develop module theory. Having developed it, we present some of its applications: canonical forms for linear transformations, bilinear forms, and group representations.” The book is very carefully written. All new concepts are illustrated by many examples. Any chapter ends with exercises (totally more than 400). The book will be of use for any person studying the first year graduate algebra course.

Contents: Preface; Chapter 1 Groups: 1.1 Definitions and examples, 1.2 Subgroups and cosets, 1.3 Normal subgroups, isomorphism theorems, and automorphism groups, 1.4 Permutation representation and the Sylow theorem, 1.5 The symmetric group and symmetry groups, 1.6 Direct and semidirect products, groups of low order, 1.8 Exercises; Chapter 2 Rings: 2.1 Definitions and examples, 2.2 Ideals, quotient rings, and isomorphism theorems, 2.3 Quotient fields and localization, 2.4 Polynomial rings, 2.5 Principal ideal domains and Euclidean domains, 2.6 Unique factorization domains, 2.7 Exercises; Chapter 3 Modules and vector spaces: 3.1 Definitions and examples, 3.2 Submodules and quotient modules, 3.3 Direct sums, exact sequences and hom, 3.4 Free modules, 3.5 Projective modules, 3.6 Free modules over PID, 3.7 Finitely generated modules over PIDs, 3.8 Complemented submodules, 3.9 Exercises; Chapter 4 Linear algebra: 4.1 Matrix algebra, 4.2 Determinants and linear equations, 4.3 Matrix representations of homomorphisms, 4.4 Canonical form theory, 4.5 Computational examples, 4.6 Inner product spaces and normal linear transformations, 4.7 Exercises; Chapter 5 Matrices over PIDs: 5.1 Equivalence and similarity, 5.2 Hermite normal form, 5.3 Smith normal form, 5.4 Computational examples, 5.5 A rank criterion for similarity, 5.6 Exercises; Chapter 6 Bilinear and quadratic forms: 6.1 Duality, 6.2 Bilinear and sesquilinear forms, 6.3 Quadratic forms, 6.4 Exercises; Chapter 7 Topics in module theory: 7.1 Simple and semisimple rings and modules, 7.2 Multilinear algebra, 7.3 Exercises; Chapter 8 Group representations: 8.1 Examples and general results, 8.2 Representations of Abelian groups, 8.3 Decomposition of the regular representation, 8.4 Characters, 8.5 Induced representations, 8.6 Permutation representations, 8.7 Concluding remarks, 8.8 Exercises; Appendix; Bibliography; Index of Notation; Index of Terminology.

Reviewer: J.Ponizovskij (St.Peterburg)

MSC:

- [00A05](#) Mathematics in general
- [12-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to field theory
- [13-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to commutative algebra
- [15-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to linear algebra
- [16-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to associative rings and algebras
- [20-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to group theory

Cited in **46** Documents