

# Elements Of Solid State Physics By J P Srivastava

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solid state physics v12

this book provides an introduction to the field of solid state physics for undergraduate students in physics chemistry engineering and materials science

although there are many books published in solid state physics there is a wide gap between the active field of research and the concept traditionally taught in solid state courses this book fills that gap the style is tutorial simple and completely self contained solid state physics explains to readers the newest advances in the area of condensed matter physics with rigorous but lucid mathematics examples are an integral part of the text and they are carefully designed to apply the fundamental principles illustrated in the text to currently active topics of research bridges the gap between fundamental principles and active fields of research including explanations of all the latest advances provides an in depth treatment of current research topics examples are integral to the text and apply fundamental principles to current topics of research both authors have many years of experience of teaching at a variety of levels undergraduate post graduate tutorial workshops and seminars

in recent decades solid state physics has seen many dramatic new developments and has become one of the largest independent branches of physics it has simultaneously expanded into many new areas playing a vital role in fields that were once the domain of the engineering and chemical sciences a consequence of this explosive development is that no single university lecturer can today be expected to have a detailed knowledge of all aspects of this vast subject likewise it is impossible to conceive of a course that could offer students a comprehensive understanding of the entire discipline and its many applications in view of this situation it is particularly valuable to have a textbook that gives a concise account of the essential elements of the physics of solids in this book the fundamental aspects of solid state physics are presented according to the scheme chemical bonding structure lattice dynamics and electronic properties we believe that this sequence is the optimum choice for tutorial purposes it enables the more difficult concepts to be introduced at a point where a basic understanding of fundamental ideas has already been achieved through the study of simple models and examples in addition to this carefully structured exposition of classical solid state theory based on the periodic solid and the one electron approximation the book also includes comprehensive descriptions of the most active areas in modern research magnetism superconductivity and semiconductor physics

lectures on solid state physics is a compilation of lectures concerned with various branches of solid state physics it aims to develop basic physical ideas that lead to a better understanding of phenomena and effects comprised of 11 chapters this book discusses several topics on solid state physics structure of solids interference effects in crystals lattice dynamics perfect and imperfect crystals electrons and electron theory of metals semiconductors electrical contact effects transport phenomena and magnetism students physics graduates electrical engineers chemists and metallurgists will find this book invaluable

a must have textbook for any undergraduate studying solid state physics this successful brief course in solid state physics is now in its second edition the clear and concise introduction not only describes all the basic phenomena and concepts but also such advanced issues as magnetism and superconductivity each section starts with a gentle introduction covering basic principles progressing to a more advanced level in order to present a comprehensive overview of the subject the book is providing qualitative discussions that help undergraduates understand concepts even if they can't follow all the mathematical detail the revised edition has been carefully updated to present an up to date account of the essential topics and recent developments in this exciting field of physics the coverage now includes ground breaking materials with high relevance for applications in communication and energy like graphene and topological insulators as well as transparent conductors the text assumes only basic mathematical knowledge on the part of the reader and includes more than 100 discussion questions and some 70 problems with solutions free to lecturers from the wiley vch website the author's webpage provides online notes on x ray scattering elastic constants the quantum hall effect tight binding model atomic magnetism and topological insulators this new edition includes the following updates and new features expanded coverage of mechanical properties of solids including an improved discussion of the yield stress crystal structure mechanical properties and band structure of graphene the coverage of electronic properties of metals is expanded by a section on the quantum hall effect including exercises new topics include the tight binding model and an expanded discussion on bloch waves with respect to semiconductors the discussion of solar cells has been extended and improved revised coverage of magnetism with additional material on atomic magnetism more extensive treatment of finite solids and nanostructures now including topological insulators recommendations for further reading have been updated and increased new exercises on hall mobility light penetrating metals band structure

written by two professors emeriti with a long and distinguished career both in research and teaching the book clearly shows the wide experience of its authors this is a good book carefully prepared full of details and appropriate for its scope those who will profit the most from it are the students who are obliged or prefer to study independently they will appreciate the clarity of exposition and will find the numerous problems both stimulating and rewarding what sets the book apart are undoubtedly the detailed solutions to all of the problems contemporary physicist this is an introductory book on solid state physics it is a translation of a hebrew version written for the open university in israel aimed mainly for self study the book contains appendices with the necessary background explains each calculation in detail and contains many solved problems the bulk of the book discusses the basic concepts of periodic crystals including lattice structures radiation scattering off crystals crystal bonding vibrations of crystals and electronic properties on the other hand the book also presents brief reviews of advanced topics e.g. quasicrystals soft condensed matter mesoscopic physics and the quantum hall effect there are also many specific examples drawn from modern research topics e.g. perovskite oxides relevant for high temperature superconductivity graphene electrons in low dimensions and more

the objective of solid state physics is to introduce college seniors and first year graduate students in physics electrical engineering materials science chemistry and related areas to this diverse and fascinating field i have attempted to present this complex subject matter in a coherent integrated manner emphasizing fundamental scientific ideas to give the student a strong understanding and feel for the physics and the orders of magnitude involved the subject is varied covering many important sophisticated and practical areas which at first may appear unrelated but which are actually built on the same foundation the bonding between atoms the periodic translational symmetry and the resulting electron energy levels the text is comprehensive enough so that the basics of broad areas of present research are covered yet flexible enough so that courses of varying lengths can be satisfied the exercises at the end of each chapter serve to reinforce and extend the text

learning solid state physics involves a certain degree of maturity since it involves tying together diverse

concepts from many areas of physics the objective is to understand in a basic way how solid materials behave to do this one needs both a good physical and mathematical background one definition of solid state physics is that it is the study of the physical e g the electrical dielectric magnetic elastic and thermal properties of solids in terms of basic physical laws in one sense solid state physics is more like chemistry than some other branches of physics because it focuses on common properties of large classes of materials it is typical that solid state physics emphasizes how physics properties link to electronic structure we have retained the term solid state physics even though condensed matter physics is more commonly used condensed matter physics includes liquids and non crystalline solids such as glass which we shall not discuss in detail modern solid state physics came of age in the late thirties and forties and had its most extensive expansion with the development of the transistor integrated circuits and microelectronics most of microelectronics however is limited to the properties of inhomogeneously doped semiconductors solid state physics includes many other areas of course among the largest of these are ferromagnetic materials and superconductors just a little less than half of all working physicists are in condensed matter a course in solid state physics typically begins with three broad areas 1 how and why atoms bind together to form solids 2 lattice vibrations and phonons and 3 electrons in solids one would then typically apply the above to 4 interactions especially of electrons with phonons 5 metals the fermi surface and alloys 6 semiconductors 7 magnetism 8 superconductivity 9 dielectrics and ferroelectrics 10 optical properties 11 defects and 12 certain other modern topics such as layered materials quantum hall effect mesoscopics nanophysics and soft condensed matter in this book we will consider all of these

this text presents a comprehensive study of various topics of solid state physics for the undergraduate and postgraduate students of pure and applied sciences and engineering disciplines the text is divided into 17 chapters the first seven chapters deal with structure related aspects such as lattice and crystal structures bonding packing and diffusion of atoms followed by imperfections and lattice vibrations chapter 8 deals mainly with experimental methods for determining structures of given materials while remaining chapters cover various physical properties of crystalline solids the treatment of the text has been kept simple and coherent a number of solved examples brief summary and definitions of important terms are included in each chapter for better understanding of the subject

assuming an elementary knowledge of quantum and statistical physics this book provides a guide to principal physical properties of condensed matter as well as the underlying theory necessary for an understanding of their origins

this highly regarded textbook provides a general introduction to solid state physics it covers a wide range of physical phenomena occurring in solids and discusses fundamental concepts for describing them traditional themes are complimented by modern topics like low dimensional systems strongly correlated materials nanoscale systems and non crystalline solids which are gaining increasing technical and scientific importance helpful for exam preparation are numerous exercises in all chapters

updated to reflect recent work in the field this book emphasizes crystalline solids going from the crystal lattice to the ideas of reciprocal space and brillouin zones and develops these ideas for lattice vibrations for the theory of metals and for semiconductors the theme of lattice periodicity and its varied consequences runs through eighty percent of the book other sections deal with major aspects of solid state physics controlled by other phenomena superconductivity dielectric and magnetic properties and magnetic resonance

this book presents a comprehensive introduction to solid state physics for undergraduate students of pure and applied sciences and engineering disciplines it acquaints the students with the fundamental properties of solids starting from their properties the coverage of basic topics is developed in terms of simple physical phenomenon supplemented with theoretical derivations and relevant models which provides strong grasp of the fundamental principles of physics in solids in a concise and self explanatory manner

the correlation between the microscopic composition of solids and their macroscopic electrical optical thermal properties is the goal of solid state physics this book is the deeply revised version of the french book *initiationa physique du solide* exercices commentes avec rappels de cours written more than 20 years ago it has five sections

solid state physics forms an important part of the undergraduate syllabi of physics in most of the

universities the existing competing books by indian authors have too complex technical language which makes them abstractive to indian students who use english as their secondary language solid state physics is written as per the core module syllabus of the major universities and targets undergraduate b sc students the book uses lecture style in explaining the concepts which would facilitate easy understanding of the concepts the topics have been dealt with precision and provide adequate knowledge of the subject

this second edition is aimed at students taking a firstcourse in this subject although it will also be of interest toprofessional physicists and electronic engineers requiring a graspof the fundamentals of this important area of physics basicconcepts are introduced in an easily accessible context forexample wave propagation in crystals is introduced using one andtwo dimensional geometries only when these basic ideas arefamiliar are generalisations to three dimensions and the elegantframework of the reciprocal lattice made extensively rewritten the second edition now includes new and expanded coverage ofsemiconductor devices the quantum hall effect quasicrystals hightemperature superconductors and techniques for the study of thesurfaces of solids a chapter on dielectrics and ferroelectrics hasalso been added solid state physics second edition features a carefully written and structured text to help students fullyunderstand this exciting subject a flow diagram allowing topics to be studied in differentorders or omitted altogether optional starred and highlighted sections containing moreadvanced and specialised material for the more ambitiousreader carefully selected problems at the end of each chapter designedto assist learning solutions are provided at the end of thebook

this book provides a practical approach to consolidate one s acquired knowledge or to learn new concepts in solid state physics through solving problems it contains 300 problems on various subjects of solid state physics the problems in this book can be used as homework assignments in an introductory or advanced course on solid state physics for undergraduate or graduate students it can also serve as a desirable reference book to solve typical problems and grasp mathematical techniques in solid state physics in practice it is more fascinating and rewarding to learn a new idea or technique through solving challenging problems rather than through reading only in this aspect this book is not a plain collection of problems but it presents a large number of problem solving ideas and procedures some of which are valuable to practitioners in condensed matter physics

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## Introduction

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