

Introduction To Nanoscience And Nanotechnology

This book provides a comprehensive overview of the rapidly developing field of molecular electronics. It focuses on our present understanding of the electrical conduction in single-molecule circuits and provides a thorough introduction to the experimental techniques and theoretical concepts. It will also constitute as the first textbook-like introduction to both the experiment and theory of electronic transport through single atoms and molecules. In this sense, this publication will prove invaluable to both researchers and students interested in the field of nanoelectronics and nanoscience in general. Molecular Electronics is self-contained and unified in its

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presentation. It may be used as a textbook on nanoelectronics by graduate students and advanced undergraduates studying physics and chemistry. In addition, included are previously unpublished material that will help researchers gain a deeper understanding into the basic concepts involved in the field of molecular electronics.

Nanoscience stands out for its interdisciplinarity. Barriers between disciplines disappear and the fields tend to converge at the very smallest scale, where basic principles and tools are universal. Novel properties are inherent to nanosized systems due to quantum effects and a reduction in dimensionality: nanoscience is likely to continue to revolutionize many areas of human activity, such as materials science, nanoelectronics, information processing, biotechnology and medicine. This textbook spans all fields of nanoscience, covering its basics and broad applications. After an introduction to the physical

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and chemical principles of nanoscience, coverage moves on to the adjacent fields of microscopy, nanoanalysis, synthesis, nanocrystals, nanowires, nanolayers, carbon nanostructures, bulk nanomaterials, nanomechanics, nanophotonics, nanofluidics, nanomagnetism, nanotechnology for computers, nanochemistry, nanobiology, and nanomedicine. Consequently, this broad yet unified coverage addresses research in academia and industry across the natural scientists. Didactically structured and replete with hundreds of illustrations, the textbook is aimed primarily at graduate and advanced-undergraduate students of natural sciences and medicine, and their lecturers.

Introduction to Nanoscience and Nanotechnology: A Workbook
By M. Kuno

Chemistry of Nanomaterials: Fundamentals and Applications

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provides a foundational introduction to this chemistry. Beginning with an introduction to the field of nanoscience and technology, the book goes on to outline a whole range of important effects, interactions and properties. Tools used to assess such properties are discussed, followed by chapters putting this fundamental knowledge in context by providing examples of nanomaterials and their applications in the real world. Drawing on the experience of its expert authors, this book is an accessible introduction to the interactions at play in nanomaterials for both upper-level students and researchers. Highlights the foundational chemical interactions at play in nanomaterials Provides accessible insight for readers across multidisciplinary fields Places nanomaterial chemistry in the context of the broader field of nanoscale research

Chemistry of Nanomaterials

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The Science of the Small in Physics, Engineering, Chemistry, Biology and Medicine

Introduction to Nanoscience and Nanomaterials

Introduction To Nanoscience And Nanotechnology

An Introduction to Modern Concepts in Nanoscience

This text focuses on the synthesis, properties and applications of nanostructures and nanomaterials, particularly inorganic nanomaterials. It provides coverage of the fundamentals and processing techniques with regard to synthesis, properties, characterization and applications of nanostructures and nanomaterials.

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This textbook is aimed primarily at the senior undergraduate and first year graduate students from the various engineering and sciences departments including physics, chemistry, materials engineering, chemical engineering, electrical engineering, mechanical engineering, bioengineering, and biology. Researchers in the areas of nanomaterials and nanoscience will also find the book useful for building the background necessary to understand the current literature and as a reference book. The text assumes only a basic level of competency in physics, chemistry and mathematics. Some of the background

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material and introductory matter are included in the first few chapters and as appendices.

Although this material may be familiar to some of the students, it is the author's experience after teaching such a course for many years that this can not be taken for granted and moreover, serves as a ready reference to understand the text. As the area of nanoscience, nanotechnology and nanomaterials is a fast developing one, an approach which equips the students to comprehend the developing field rather than providing a large volume of information is essential. With this in view, while providing a

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broad perspective, the book emphasizes basics of nanoscience and nanoscale materials and goes into sufficient depth for the reader to be able to handle numerical problems. The treatment is kept at a level which is easily comprehensible to an undergraduate student. Solved examples are provided in each chapter to aid understanding and a set of problems is given at the end of each chapter.

Textbook presenting the fundamentals of nanoscience and nanotechnology with a view to nanoelectronics. Covers the underlying physics; nanostructures, including nanoobjects; methods

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for growth, fabrication and characterization of nanomaterials; and nanodevices. Provides a unifying framework for the basic ideas needed to understand the recent developments in the field. Includes numerous illustrations, homework problems and a number of interactive Java applets. For advanced undergraduate and graduate students in electrical and electronic engineering, nanoscience, materials, bioengineering and chemical engineering. Instructor solutions and Java applets available from www.cambridge.org/9780521881722. Given the rapid advances in the field, this book

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offers an up-to-date introduction to nanomaterials and nanotechnology. Though condensed into a relatively small volume, it spans the whole range of multidisciplinary topics related to nanotechnology. Starting with the basic concepts of quantum mechanics and solid state physics, it presents both physical and chemical synthetic methods, as well as analytical techniques for studying nanostructures. The size-specific properties of nanomaterials, such as their thermal, mechanical, optical and magnetic characteristics, are discussed in detail. The book goes on to illustrate the various applications of

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nanomaterials in electronics, optoelectronics, cosmetics, energy, textiles and the medical field and discusses the environmental impact of these technologies. Many new areas, materials and effects are then introduced, including spintronics, soft lithography, metamaterials, the lotus effect, the Gecko effect and graphene. The book also explains the functional principles of essential techniques, such as scanning tunneling microscopy (STM), atomic force microscopy (AFM), scanning near field optical microscopy (SNOM), Raman spectroscopy and photoelectron microscopy. In closing, Chapter 14, 'Practicals',

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provides a helpful guide to setting up and conducting inexpensive nanotechnology experiments in teaching laboratories.

Nanocomputing

Nanostructures and Nanomaterials

INTRODUCTION TO NANO

Nanoscience And Nanotechnology In Engineering

Nanoscience and Plant-Soil Systems

An introduction to the electrical and transport properties of graphene and other two dimensional nanomaterials.

Do you ever wonder why size is so

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important at the scale of nanosystems? Do you want to understand the fundamental principles that govern the properties of nanomaterials? Do you want to establish a foundation for working in the field of nanoscience and nanotechnology? Then this book is written with you in mind. Foundations for Nanoscience and Nanotechnology provides some of the physical chemistry needed to understand why properties of small systems differ both from their

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constituent molecular entities and from the corresponding bulk matter. This is not a book about nanoscience and nanotechnology, but rather an exposition of basic knowledge required to understand these fields. The collection of topics makes it unique, and these topics include: The concept of quantum confinement and its consequences for electronic behaviour (Part II) The importance of surface thermodynamics for activity and

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interactions of nanoscale systems (Part III) The need to consider fluctuations as well as mean properties in small systems (Part IV) The interaction of light with matter and specific applications of spectroscopy and microscopy (Part V) This book is written for senior undergraduates or junior graduate students in science or engineering disciplines who wish to learn about or work in the areas of nanoscience and nanotechnology, but who

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do not have the requisite background in chemistry or physics. It may also be useful as a refresher or summary text for chemistry and physics students since the material is focused on those aspects of quantum mechanics, thermodynamics, and statistical mechanics that specifically relate to the size of objects.

This book is meant to serve as a textbook for beginners in the field of nanoscience and nanotechnology. It can

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also be used as additional reading in this multifaceted area. It covers the entire spectrum of nanoscience and technology: introduction, terminology, historical perspectives of this domain of science, unique and widely differing properties, advances in the various synthesis, consolidation and characterization techniques, applications of nanoscience and technology and emerging materials and technologies.

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The usage of nanoscience and nanotechnology in engineering directly links academic research in nanoscience and nanotechnology to industries and daily life. As a result, numerous nanomaterials, nanodevices and nanosystems for various engineering purposes have been developed and used for human betterment. This book, which consists of eight self-contained chapters, provides the essential theoretical knowledge and important

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experimental techniques required for the research and development on nanoscience and nanotechnology in engineering, and deals with the five key topics in this area – Nanoscience and Nanotechnology in Engineering is based on the many lectures and courses presented around the world by its authors.

A Gentle Introduction to the Next Big Idea

An Introduction to Theory and

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Experiment

Food Nanoscience and Nanotechnology

An Introduction

Nanotechnology

This book covers the basics of nanotechnology and provides a solid understanding of the subject. Starting from a brush-up of the basic quantum mechanics and materials science, the book helps to gradually build up understanding of the various effects of quantum confinement, optical-electronic properties

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of nanoparticles and major nanomaterials. The book covers the various physical, chemical and hybrid methods of nanomaterial synthesis and nanofabrication as well as advanced characterization techniques. It includes chapters on the various applications of nanoscience and nanotechnology. It is written in a simple form, making it useful for students of physical and material sciences.

From the reviews: "...A class in nanoscale science and technology is daunting for the educator, who must organize a large

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collection of materials to cover the field, and for the student, who must absorb all the new concepts. This textbook is an excellent resource that allows students from any engineering background to quickly understand the foundations and exciting advances of the field. The example problems with answers and the long list of references in each chapter are a big plus for course tutors. The book is organized into seven sections. The first, nanoscale fabrication and characterization, covers nanolithography,

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self-assembly, and scanning probe microscopy. Of these, we enjoyed the section on nanolithography most, as it includes many interesting details from industrial manufacturing processes. The chapter on self-assembly also provides an excellent overview by introducing six types of intermolecular interactions and the ways these can be employed to fabricate nanostructures. The second section covers nanomaterials and nanostructures. Out of its 110 pages, 45 are devoted to carbon nanotubes.

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Fullerenes and quantum dots each have their own chapter that focuses on the properties and applications of these nanostructures. Nanolayer, nanowire, and nanoparticle composites of metals and semiconductors are briefly covered (just 12 pages), with slightly more discussion of specific applications. The section on nanoscale electronics begins with a history of microelectronics before discussing the difficulties in shrinking transistor size further. The discussion of problems (leakage current, hot electrons,

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doping fluctuations, etc.) and possible solutions (high- k dielectrics, double-gate devices) could easily motivate deeper discussions of nanoscale electrical transport. A chapter on molecular electronics considers transport through alkanes, molecular transistors, and DNA in a simple, qualitative manner we found highly instructive. Nanoscale magnetic systems are examined in the fourth section. The concept of quantum computation is nicely presented, although the discussion of how this can be achieved

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with controlled spin states is (perhaps necessarily) not clear. We found the chapter on magnetic storage to be one of the most lucid in the book. The giant magnetoresistive effect, operation of spin valves, and issues in magnetic scaling are easier to understand when placed in the context of the modern magnetic hard disk drive. Micro- and nanoelectromechanical systems are covered with an emphasis on the integration of sensing, computation, and communication. Here, the student can see advanced applications of lithography.

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The sixth section, nanoscale optoelectronics, describes quantum dots, organic optoelectronics, and photonic crystals. The chapter on organic optoelectronics is especially clear in its discussion of the fundamentals of this complicated field. The book concludes with an overview of nanobiotechnology that covers biomimetics, biomolecular motors, and nanofluidics. Because so many authors have contributed to this textbook, it suffers a bit from repetition. However, this also allows sections to be omitted

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without any adverse effect on student comprehension. We would have liked to see more technology to balance the science; apart from the chapters on lithography and magnetic storage, little more than an acknowledgment is given to commercial applications. Overall, this book serves as an excellent starting point for the study of nanoscale science and technology, and we recommend it to anyone with a modest scientific background. It is also a great vehicle to motivate the study of science at a time when interest is waning.

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*Nanotechnology educators should look no further." (MATERIALS TODAY, June 2005)
WINNER 2009 CHOICE AWARD OUTSTANDING ACADEMIC TITLE! Nanotechnology is no longer a subdiscipline of chemistry, engineering, or any other field. It represents the convergence of many fields, and therefore demands a new paradigm for teaching. This textbook is for the next generation of nanotechnologists. It surveys the field's broad landscape, exploring the physical basics such as nanorheology, nanofluidics, and*

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nanomechanics as well as industrial concerns such as manufacturing, reliability, and safety. The authors then explore the vast range of nanomaterials and systematically outline devices and applications in various industrial sectors. This color text is an ideal companion to Introduction to Nanoscience by the same group of esteemed authors. Both titles are also available as the single volume Introduction to Nanoscience and Nanotechnology Qualifying instructors who purchase either of these volumes (or

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the combined set) are given online access to a wealth of instructional materials. These include detailed lecture notes, review summaries, slides, exercises, and more. The authors provide enough material for both one- and two-semester courses. The maturation of nanotechnology has revealed it to be a unique and distinct discipline rather than a specialization within a larger field. Its textbook cannot afford to be a chemistry, physics, or engineering text focused on nano. It must be an integrated, multidisciplinary, and

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specifically nano textbook. The archetype of the modern nano textbook, Introduction to Nanoscience and Nanotechnology builds a solid background in characterization and fabrication methods while integrating the physics, chemistry, and biology facets. The remainder of this color text focuses on applications, examining engineering aspects as well as nanomaterials and industry-specific applications in such areas as energy, electronics, and biotechnology. Also available in two course-specific volumes: Introduction to

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Nanoscience elucidates the nanoscale along with the societal impacts of nanoscience, then presents an overview of characterization and fabrication methods. The authors systematically discuss the chemistry, physics, and biology aspects of nanoscience, providing a complete picture of the challenges, opportunities, and inspirations posed by each facet before giving a brief glimpse at nanoscience in action: nanotechnology. Fundamentals of Nanotechnology surveys the field's broad landscape, exploring the physical basics

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such as nanorheology, nanofluidics, and nanomechanics as well as industrial concerns such as manufacturing, reliability, and safety. The authors then explore the vast range of nanomaterials and systematically outline devices and applications in various industrial sectors. Qualifying instructors who purchase either of these volumes (or the combined set) are given online access to a wealth of instructional materials. These include detailed lecture notes, review summaries, slides, exercises, and more.

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The authors provide enough material for both one- and two-semester courses.

A Problem Focused Approach

Introduction to Nanoelectronics

Fundamentals and Applications for Students

Essentials in Nanoscience and Nanotechnology

Foundations for Nanoscience and Nanotechnology

Nanoscience and nanotechnology have had a great impact on the food industry. They have increased the nutritional and functional properties of a number of food products and have aided in food preservation

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through the addition of antimicrobials or the reduction of water activity. These and many other applications have emerged in recent years to transform food science and technology. This book proposes to look at some of these applications and their effect on food production and innovation.

Quantum mechanics transcends and supplants classical mechanics at the atomic and subatomic levels. It provides the underlying framework for many subfields of physics, chemistry and materials science, including condensed matter physics, atomic physics, molecular physics, quantum chemistry, particle physics, and nuclear physics. It is the only way we can understand

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the structure of materials, from the semiconductors in our computers to the metal in our automobiles. It is also the scaffolding supporting much of nanoscience and nanotechnology. The purpose of this book is to present the fundamentals of quantum theory within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology. As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and engineering twenty years ago is no longer satisfactory today. Hence, the emphasis on new topics that are not included in older reference texts, such as quantum information theory, decoherence and

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dissipation, and on applications to nanotechnology, including quantum dots, wires and wells. This book provides a novel approach to Quantum Mechanics whilst also giving readers the requisite background and training for the scientists and engineers of the 21st Century who need to come to grips with quantum phenomena The fundamentals of quantum theory are provided within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology Older books on quantum mechanics do not contain the amalgam of ideas, concepts and tools necessary to prepare engineers and scientists to deal with the new facets of quantum

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mechanics and their application to quantum information science and nanotechnology As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and engineering twenty years ago is no longer satisfactory today There are many excellent quantum mechanics books available, but none have the emphasis on nanotechnology and quantum information science that this book has

Tomorrow's nanoscientist will have a truly interdisciplinary and nano-centric education, rather than, for example, a degree in chemistry with a specialization in nanoscience. For this to happen, the

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field needs a truly focused and dedicated textbook. This full-color masterwork is such a textbook. It introduces the nanoscale along with the societal impacts of nanoscience, then presents an overview of characterization and fabrication methods. The authors systematically discuss the chemistry, physics, and biology aspects of nanoscience, providing a complete picture of the challenges, opportunities, and inspirations posed by each facet before giving a brief glimpse at nanoscience in action: nanotechnology. This book is written to provide a companion volume to Fundamentals of Nanotechnology. The two companion volumes are also available bound together in the single

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volume, Introduction to Nanoscience and Nanotechnology Qualifying instructors who purchase either of these volumes (or the combined set) are given online access to a wealth of instructional materials. These include detailed lecture notes, review summaries, slides, exercises, and more. The authors provide enough material for both one- and two-semester courses.

Long awaited new edition of this highly successful textbook, provides once more a unique introduction to the concepts, techniques and applications of nanoscale systems by covering its entire spectrum up to recent findings on graphene.

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A Textbook of Nanoscience and Nanotechnology

Introduction to Nano

Nanotechnology and Nanomaterials in the Treatment of Life-threatening Diseases

Computational Physics for Nanoscience and Nanotechnology

From Electronic Structure to Quantum Transport

Nanotechnology and Nanomaterials in the Treatment of Life-threatening Diseases takes a scientific approach to nanotechnology and nanomaterials applications in medicine, while also explaining the core biological principles for an audience of biomedical engineers,

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materials scientists, pharmacologists, and medical diagnostic technicians. The book is structured by major disease groups, offering a practical, application-based focus for scientists, engineers, and clinicians alike. The spectrum of medical applications is explored, from diagnostics and imaging to drug delivery, monitoring, therapies, and disease prevention. It also focuses specifically on the synthesis of nanomaterials and their potential health risks (particularly toxicity).

Nanomedicine — the application of nanomaterials and devices for addressing medical problems — has demonstrated great potential for enabling improved

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diagnosis, treatment, and monitoring of many serious illnesses, including cancer, cardiovascular and neurological disorders, HIV/AIDS, and diabetes, as well as many types of inflammatory and infectious diseases. Gain an understanding of how nanotechnologies and nanomaterials can be deployed in the fight against the major life-threatening diseases: cancer, neurological disorders (including Alzheimer's and Parkinson's), cardiovascular diseases, and HIV/AIDS Discover the latest developments in nanomedicine, from therapies and drug delivery to diagnostics and disease prevention The authors cover the health risks of nanomaterials as well as

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their benefits, considering toxicity and potential carcinogens

The branch of science which focuses on the study and manipulation of structures and materials on the nanometer scale is called nanoscience. It is a multi-disciplinary field which employs the principles of physics, chemistry, medicine, biology, material science, engineering and computing. It seeks to develop an understanding of the mechanical, electrical and optical properties of these structures, as they are different from the macro-scale properties due to the quantum mechanical effects.

Nanotechnology refers to the industrial application of

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matter on an atomic, molecular, and supramolecular scale. It draws on the principles of various other branches such as organic chemistry, surface science, semiconductor physics, molecular biology, micro-fabrication, and molecular engineering. Nanotechnology finds extensive application in the areas of medicine, electronics, consumer products and energy production. This book provides comprehensive insights into the field of nanoscience and nanotechnology. It presents the complex subject of nanoscience and nanotechnology in the most comprehensible and easy to understand language.. Those with an interest in the nanoscience and nanotechnology

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field would find this book helpful.

Nanotechnology: An Introduction, Second Edition, is ideal for the newcomer to nanotechnology, someone who also brings a strong background in one of the traditional disciplines, such as physics, mechanical or electrical engineering, or chemistry or biology, or someone who has experience working in microelectromechanical systems (MEMS) technology. This book brings together the principles, theory, and practice of nanotechnology, giving a broad, yet authoritative, introduction to the possibilities and limitations of this exciting and rapidly developing field. The book's author, Prof Ramsden, also discusses

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design, manufacture, and applications and their impact on a wide range of nanotechnology areas. Provides an overview of the rapidly growing and developing field of nanotechnology Focuses on key essentials, and structured around a robust anatomy of the subject Brings together the principles, theory, and practice of nanotechnology, giving a broad, yet authoritative, introduction to the possibilities and limitations of this exciting and rapidly developing field

This book recalls the basics required for an understanding of the nanoworld (quantum physics, molecular biology, micro and nanoelectronics) and gives examples of

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applications in various fields: materials, energy, devices, data management and life sciences. It is clearly shown how the nanoworld is at the crossing point of knowledge and innovation. Written by an expert who spent a large part of his professional life in the field, the title also gives a general insight into the evolution of nanosciences and nanotechnologies. The reader is thus provided with an introduction to this complex area with different "tracks" for further personal comprehension and reflection. This guided and illustrated tour also reveals the importance of the nanoworld in everyday life.

Molecular Electronics

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Fundamentals and Applications

Introduction to Quantum Nanotechnology

Introductory Nanoscience

Introduction to Nanoscale Science and Technology

Nanotechnology makes use of materials and systems at the scale of the atom: the nanometer (one billionth of a meter). Exploiting advances in scientific measurement at that scale and the ability to manipulate material at that scale, scientists and engineers have found ever increasing uses for nano-sized metals, polymers, and ceramics to create new functional materials, better coatings, better

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fluid flow, and a host of other improvements to everyday components and manufactured goods and systems. And this is only the beginning. Within 10 years, it is projected that nanoscience will enable us to have hand-held supercomputers, all ceramic internal combustion engines, backpack energy systems and more. This is the first-ever, true introductory textbook on the essential fundamentals that comprise what nanoscience is all about. Covering the physics, chemistry, and engineering applications of the more widely studied types of nano-scale materials and processes, this text can be

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used in by a wide variety of courses and programs, from those offered in departments of physics and chemistry to those in mechanical, materials, chemical and electrical engineering. Broken into convenient modules, the instructor will find a good deal of flexibility in which specific topics to cover and to what depth. Ample end-of-chapter problems and exercises will help to reinforce the subjects learned and offer opportunities for further study.

KEY FEATURES

- * Covers the fundamental physics and chemistry of a wide and representative class of nano-scale materials and processes,*

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*including molecular structures, macromolecular structures, and surfaces and interfaces * Explains such key concepts as self-assembly, chemical bonding, materials characterization techniques, and relevant quantum mechanics * Provides understanding of the processing and uses of thin films, nano particles, nanotubes and nanofibers, and nanocomposites * Gives students ample-end-of-chapter problems and exercises * Offers a companion web site that will host Solutions Manual (access-restricted) as well as instructive video clips, recommended further reading and additional exercises (open*

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access)

This book provides in-depth reviews of the effects of nanoparticles on the soil environment, their interactions with plants and also their potential applications as nanofertilizers and pesticides. It offers insights into the current trends and future prospects of nanotechnology, including the benefits and risks and the impact on agriculture and soil ecosystems. Individual chapters explore topics such as nanoparticle biosynthesis, engineered nanomaterials, the use of nanoclays for remediation of polluted sites, nanomaterials in water desalination,

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their effect on seed germination, plant growth, and nutrient transformations in soil, as well as the use of earthworms as bioremediating agents for nanoparticles. It is a valuable resource for researchers in academia and industry working in the field of agriculture, crop protection, plant sciences, applied microbiology, soil biology and environmental sciences.

Introduction to Nanoscience and Nanotechnology
CRC Press

This book describes various aspects of nanoscience and nanotechnology. It begins with an introduction to nanoscience and

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nanotechnology and includes a historical prospective, nanotechnology working in nature, man -made nanomaterial and impact of nanotechnology illustrated with examples. It goes on to describes general synthetic approaches and strategies and also deals with the characterization of nanomaterial using modern tools and techniques to give basic understanding to those interested in learning this emerging area. It then deals with different kinds of nanomaterial such as inorganics, carbon based-, nanocomposites and self-assembled/supramolecular nano structures in terms of their varieties, synthesis,

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properties etc. In addition, it contains chapters devoted to unique properties with mathematical treatment wherever applicable and the novel applications dealing with information technology, pollution control (environment, water), energy, nanomedicine, healthcare, consumer goods etc.

Fundamentals of Nanotechnology

Introduction to Nanoscience and

Nanotechnology: a Workbook

Synthesis, Properties, and Applications

An Introduction to Nanoscience and

Nanotechnology

Introduction to Graphene-Based Nanomaterials

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This book serves as introduction to quantum theory with emphasis on dynamical behaviour and applications of quantum mechanics, with minimal discussion of formalism. The goal is to help engineering and physics students begin to learn the tools for a quantum toolbox they will need to work in this area. Designed for upper-level undergraduate and graduate students, Introductory Nanoscience asks key questions about the quantitative concepts that underlie this new field. How are the optical and electrical properties of nanomaterials dependent upon size, shape, and morphology? How do we construct nanometer-

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sized objects? Using solved examples thr
In Nanotechnology: A Gentle Introduction to
the Next Big Idea, nanotech pioneer Mark
Ratner and tech entrepreneur Daniel Ratner
show how nanotech works, what's new, what's
next, and why nanotech may be the next \$1
trillion industry. They survey every area of
R&D: nanobots, quantum and DNA computing,
nanosensors, biostructures, neuro-electronic
interfaces, molecular motors, and much more.
Simple, brief, and nearly math-free, this is
the perfect briefing on nanotech technology
and business for every non-technical reader.
This self-confessed introduction provides

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technical administrators and managers with a broad, practical overview of the subject and gives researchers working in different areas an appreciation of developments in nanotechnology outside their own fields of expertise.

Introduction to Nanoscience

Nanotechnology: Principles and Practices

Nanoscience

Introduction to Nanotechnology

Science, Nanotechnology, Engineering, and Applications

Nanoscience is not physics, chemistry, engineering or biology. It is all of them, and it is time for a text that

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integrates the disciplines. This is such a text, aimed at advanced undergraduates and beginning graduate students in the sciences. The consequences of smallness and quantum behaviour are well known and described Richard Feynman's visionary essay 'There's Plenty of Room at the Bottom' (which is reproduced in this book). Another, critical, but thus far neglected, aspect of nanoscience is the complexity of nanostructures. Hundreds, thousands or hundreds of thousands of atoms make up systems that are complex enough to show what is fashionably called 'emergent behaviour'. Quite new phenomena arise from rare configurations of the system. Examples are the Kramer's

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theory of reactions (Chapter 3), the Marcus theory of electron transfer (Chapter 8), and enzyme catalysis, molecular motors, and fluctuations in gene expression and splicing, all covered in the final Chapter on Nanobiology. The book is divided into three parts. Part I (The Basics) is a self-contained introduction to quantum mechanics, statistical mechanics and chemical kinetics, calling on no more than basic college calculus. A conceptual approach and an array of examples and conceptual problems will allow even those without the mathematical tools to grasp much of what is important. Part II (The Tools) covers microscopy, single molecule manipulation and measurement, nanofabrication and self-

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assembly. Part III (Applications) covers electrons in nanostructures, molecular electronics, nano-materials and nanobiology. Each chapter starts with a survey of the required basics, but ends by making contact with current research literature.

In the last few years, several “bottom-up” and “top-down” synthesis routes have been developed to produce tailored hybrid nanoparticles (HNPs). This book provides a new insight into one of the most promising “bottom-up” techniques, based on a practical magnetron-sputtering inert-gas-condensation method. A modified magnetron-sputtering-based inert-gas-condensation (MS-IGC) system is presented, and its performances under

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different conditions are evaluated. Designed for graduate students, researchers in physics, materials science, biophysics and related fields, and process engineers, this new resource fills a critical need to understand the fundamentals behind the design and tailoring of the nanoparticles produced by the MS-IGC method. It shows that the morphology, the size and the properties of the nanoparticles can be modulated by tuning the deposition parameters such as the energy, the cooling rate, and the collision and coalescence processes experienced by the nanoparticles during their formation. The mechanisms of formation of different HNPs are suggested, combining the physico-chemical properties of the materials with the

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experimental conditions. This book illustrates the potential of MS-IGC method to synthesize multifunctional nanoparticles and nanocomposites with accurate control on their morphology and structure. However, for a better understanding of HNPs formation, further improvements in characterization methods of aggregation zone conditions are needed. In addition, the optimization of the yield and harvesting process of HNPs is essential to make this method sufficiently attractive for large-scale production.

Explore foundational and advanced topics in nanoscience with this intuitive introduction In the newly revised Second Edition of Introduction to Nanoscience

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and Nanotechnology, renowned researcher Dr. Chris Binns delivers an accessible and broad-based treatment of nanoscience and nanotechnology. Beginning with the fundamental physicochemical properties of nanoparticles and nanostructures, the book moves on to discuss how these properties can be exploited to produce high-performance materials and devices. Following chapters explore naturally occurring nanoparticles and artificially engineered carbon nanoparticles, their mechanical properties, and their applications in nanotechnological science. Both design ideologies for manufacturing nanostructures—bottom-up and top-down—are examined, as is the idea that the two methodologies can

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be combined to allow for the imaging, probing, and manipulation of nanostructures. A survey of the current state of nanotechnology rounds out the text and introduces the reader to a variety of novel and exciting applications of nanoscience. The book also includes: A thorough introduction to the importance and impact of particle size on the magnetic, mechanical, and chemical properties of materials Comprehensive explorations of carbon nanostructures, including bucky balls and nanotubes, and single-nanoparticle devices Practical discussions of colloids and nanoscale interfaces, as well as nanomechanics and nanofluidics In-depth examinations of the medical applications of functional

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nanoparticles, including the treatment of tumors by hyperthermia and medical diagnosis Perfect for senior undergraduate and graduate students in materials science and engineering, Introduction to Nanoscience and Nanotechnology will also earn a place in the libraries of early-career and established researchers with professional or personal interests in nanoscience and nanotechnology.

This book provides a comprehensive overview of the computational physics for nanoscience and nanotechnology. Based on MATLAB and the C++ distributed computing paradigm, the book gives instructive explanations of the underlying physics for

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mesoscopic systems with many listed programs that readily compute physical properties into nanoscales. Many generated graphical pictures demonstrate not only the principles of physics, but also the methodology of computing.

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Quantum Mechanics with Applications to
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