Radiation Protection And Dosimetry An Introduction To Health Physics

The proposed book aims to explain the basic principles, concepts and regulations behind radiation protection and their application in the field of radiation oncology practice. This book will be useful to all those students, teachers and practicing professionals involved in the field of radiation oncology.

One essential characteristic of life is the exchange of matter and energy between organisms and their environment. Radiation is a form of energy that has always been around in nature and will forever be the companion of human beings throughout life. In order to assess the impact of radiation exposures properly, it is essential to introduce appropriate quantities and units which can then be used for quantification of exposures from various sources. In principle, radiation protection is mainly aimed at controlling radiation exposure, while radiation dosimetry deals primarily with the measurement of relevant radiation quantities especially doses. This book is divided into two parts. The first contains up-to-date definitions of the most significant radiation quantities including their interpretation. In the second part, the exposures of both individuals and population at large to various types of natural and man-made sources are compared and discussed. The concept of quantities and units as well as analysis of exposure due to various sources in our environment is based on the latest, highly regarded authentic sources such as ICRU, ICRP, IAEA and particularly UNSCEAR reports and recommendations. The material reflects the latest review of the current terminology in radiation protection dosimetry and the contemporary assessment of radiation exposures of the population, radiation workers and patients.

Contents:IntroductionRadiation Quantities and Units: Definitions and Interpretations:Quantities and Units — General AspectsSources of RadiationRadiation FieldsInteractions of Radiation with MatterDosimetry Quantities and UnitsQuantities and Units in Radiation ProtectionOther Quantities Recently Adopted by the ICRU and ICRPAssessment of Exposures from Natural and Man-Made Sources:Basis for ComparisonPublic Exposure from Natural RadiationPopulation Exposures from Man-Made SourcesExposures from the Medical Use of Radiation and RadionuclidesOccupational Radiation Exposures Readership: Nuclear physicists, radiation physicists and environmentalists interested in radiation exposures and radioactive contamination. keywords:Radiation Protection;Dosimetry;Radiation Quantities and Units;Radiation Exposure;Medical Exposure;Occupational Exposure;Public Exposure “… an excellent job … especially that of serving as a valuable reference … Thus, if your need is an excellent compilation of the quantities and units associated with radiation protection dosimetry, this book is an excellent choice. If your need is an excellent compilation of population and occupational exposures due to natural and artificial radiation sources, this book is an excellent choice.” John W Poston, Sr. Official Journal of the Health Phys. Society USA

Experimental microdosimetry deals with the measurement of charged particle energy deposition in tissue equivalent volumes, ranging in size from nanometres to micrometres. Microdosimetry is employed to improve our understanding of the relationship between radiation energy deposition, the resulting biological effects, and the appropriate quantities to be used in characterizing and quantifying radiation quality. Although many reviews and contributions to the field have been published over the past fifty years, this new book is the first to provide a single, up to date, and easily accessible account of experimental microdosimetry. This book is designed to be used in medical, radiation, and health physics courses and by Master’s and PhD students. In addition to serving as an introductory text to the field for graduate students, this book will also be of interest as a teaching and reference resource for graduate supervisors and established researchers. Drs. Lennart Lindborg and Anthony Waker have spent a life-time career in experimental microdosimetry research in academic, industrial and regulatory environments and have observed the development of the field from its early days as a recognized discipline; they bring to this book particular knowledge and experience in the design, construction, operation and use of tissue equivalent gas ionization counters and chambers.

Exercises with Solutions in Radiation Physics

A Glossary of Physics, Radiation Protection and Dosimetry in Diagnostic Organ Imaging

Introduction to Radiological Physics and Radiation Dosimetry

Medical Radiation Dosimetry

Radiation Safety in Radiation Oncology

Mathematical modelling is an important part of nuclear medicine. Therefore, several chapters of this book have been dedicated towards describing this topic. In these chapters, an emphasis has been put on describing the mathematical modelling of the radiation transport of photons and electrons, as well as on the transportation of radiopharmaceuticals between different organs and compartments. It also includes computer models of patient dosimetry. Two chapters of this book are devoted towards introducing the concept of biostatistics and radiobiology. These chapters are followed by chapters detailing dosimetry procedures commonly used in the context of diagnostic imaging, as well as patient-specific dosimetry for radiotherapy treatments. For safety reasons, many of the methods used in nuclear medicine and molecular imaging are tightly regulated. Therefore, this volume also highlights the basic principles for radiation protection. It discusses the process of how guidelines and regulations aimed at minimizing radiation exposure are determined and implemented by international organisations. Finally, this book describes how different dosimetry methods may be utilized depending on the intended target, including whole-body or organ-specific imaging, as well as small-scale to cellular dosimetry. This text will be an invaluable resource for libraries, institutions, and clinical and academic medical physicists searching for a complete account of what defines nuclear medicine. The most comprehensive reference available providing a state-of-the-art overview of the field of nuclear medicine Edited by a leader in the field, with contributions from a team of experienced medical physicists, chemists, engineers, scientists, and clinical medical personnel Includes the latest practical research in the field, in addition to explaining fundamental theory and the field's history

This guidebook explores the basics of the interaction of radiation with matter both from the physical and chemical aspects and the relation to biological effects. Calculations of absorbed doses and dose equivalent and ways to minimize

exposure and optimization of radiation protection in light of the latest international recommenda-tions are discussed and examples are shown. Frequently used dosimeters, radiation detectors with an emphasis on TL and chemi-cal dosimeters and the dosimetry of fast neutron beams with spe-cial attention to medical uses in neutron therapy are discussed. The latest data on exposure resulting from natural and man-made sources in the environment is also covered.

This text/reference provides an excellent introduction to fundamental topics in radiation protection, including energetics, kinetics, interaction, external radiation protection, dosimetry, standards, and measurement. Chapters on radioactive waste and radon, topics not normally covered in introductory texts, have been incorporated as well. An extensive glossary of terms, abbreviations, acronyms, physical constants, units, and unit conversions provides a ready source of frequently needed information. Several appendices contain specifications and vendors for commercially available portable radiation survey instruments, personal dosimeters, and radon/radon progeny monitors.

Handbook of Nuclear Medicine and Molecular Imaging for Physicists

Computational Methods in Nuclear Radiation Shielding and Dosimetry

A Selection of Research Papers on Novel Photon Radiation Dosimetry Problems in Radiation Protection Contexts

An Introduction to Health Physics

Fundamentals of Radiation Dosimetry

Combining facets of health physics with medicine, An Introduction to Radiation Protection in Medicine covers the background of the subject and the medical situations where radiation is the tool to diagnose or treat human disease. Encouraging newcomers to the field to properly and efficiently function in a versatile and evolving work setting, it familiarizes them with the particular problems faced during the application of ionizing radiation in medicine. The text builds a fundamental knowledge base before providing practical descriptions of radiation safety in medicine. It covers basic issues related to radiation protection, including the physical science behind radiation protection and the radiobiological basis of radiation protection. The text also presents operational and managerial tools for organizing radiation safety in a medical workplace. Subsequent chapters form the core of the book, focusing on the practice of radiation protection in different medical disciplines. They explore a range of individual uses of ionizing radiation in various branches of medicine, including radiology, nuclear medicine, external beam radiotherapy, and brachytherapy. With contributions from experienced practicing physicists, this book provides essential information about dealing with radiation safety in the rapidly shifting and diverse environment of medicine.

The first edition of this book was published in 2000 and it has become the standard for shielding design in the UK. The second edition is designed to be a compendium of information for radiation protection physicists involved in specification of shielding requirements for X-Ray facilities.

This book is a compilation of the most widely used computational methods and techniques for calculating shielding parameters that are required for radiation-shielding investigations of dosimetric materials. The theoretical, experimental, and simulation methods and their applications are described. The book is divided into thirteen chapters that are arranged in a systematic order and written by experienced scientists and academicians worldwide. The gamma-ray shielding parameter calculations with the Monte Carlo simulation techniques viz. MCNP, GEANT4, FLUKA, and EGS5 codes are illustrated. Descriptions of various software such as XCOM, WinXCom, FLUKA, Phy-X, BMIX, ASFIT, and ANSI are provided. A review of fundamental quantities for calculation of ambient dose, i.e., photon and neutron buildup factors, is presented. A phantom-based computation model has been included to indicate the applications of radiation dosimetry in medical diagnostics. The chapters on computed-tomography (CT) have been included to provide insight into the radiations' diagnostic capabilities and applications. The shielding effectiveness of some materials such as ignimbrite rocks, amorphous metals, marbles, dosimetric materials, and novel shielding materials have been investigated. The most recent concept of multi-layered shielding and related buildup factors' influence on the shielding effectiveness is described with a computer program, the RIMP-TOOLKIT. This book is the result of the authors' hard-work and determination during the worldwide lockdown period caused by the spread of COVID-19. The conclusions presented in this book will be useful in nuclear radiation shielding and for dosimetric purposes. Additionally, this book will be helpful for postgraduate students of physics and chemistry.

On the Retirement of E.P. Goldfinch, Founder of Radiation Protection Dosimetry

Experimental Methods and Applications

Radiation Protection Dosimetry

Practical Radiation Protection Dosimetry

A Glossary of Physics, Radiation Protection & Dosimetry in Diagnostic Organ Imaging

Although many radiation protection scientists and engineers use dose coefficients, few know the origin of those dose coefficients. This is the first book in over 40 years to address the topic of radiation protection dosimetry in intimate detail. Advanced Radiation Protection Dosimetry covers all methods used in radiation protection dosimetry, including advanced external and internal radiation dosimetry concepts and regulatory applications. This book is an ideal reference for both scientists and practitioners in radiation protection and students in graduate health physics and medical physics courses. Features: A much-needed book filling a gap in the market in a rapidly expanding area Contains the history, evolution, and the most up-to-date computational dosimetry models Authored and edited by internationally recognized authorities and subject area specialists Interrogates both the origins and methodologies of dose coefficient calculation Incorporates the latest international guidance for radiation dosimetry and protection

This book provides a comprehensive yet accessible overview of all relevant topics in the field of radiation protection (health physics). The text is organized to introduce the reader to basic principles of radiation emission and propagation, to review current knowledge and historical aspects of the biological effects of radiation, and to cover important operational topics such as radiation shielding and dosimetry. The author's website contains materials for instructors including PowerPoint slides for lectures and worked-out solutions to end-of-chapter exercises. The book serves as an essential handbook for practicing health physics professionals.

The application of radiation to medical problems plays an ever-increasing role in diagnosis and treatment of disease. It is essential that medical physicists have the knowledge, understanding and practical skills to implement radiation protection as new techniques are developed. Practical Radiation Protection in Healthcare provides a practical guide for medical physicists and others involved with radiation protection in the healthcare environment. The guidance is based on principles set out in current recommendations of the International Commission for Radiological Protection and methods developed by a variety of professional bodies. Written by practitioners experienced in the field this practical reference manual covers both established techniques and new areas of application. This new edition has be fully revised and updated to cover new requirements linked to the increased knowledge of radiation effects, and the development of new technology. Each specialist area is covered in a separate chapter to allow easy reference with individual chapters being assigned to different types of non-ionising radiations. Tabulated data is included to allow the reader to carry out calculations for situations encountered frequently without reference to further texts.

An Introduction to Radiation Protection in Medicine

A Radical Reappraisal

Radiation Protection in Nuclear Medicine

Radiation Shielding for Diagnostic Radiology

Studies in Radiation Protection Dosimetry

A straightforward presentation of the broad concepts underlying radiological physics and radiation dosimetry for the graduate-level student. Covers photon and neutron attenuation, radiation and charged particle equilibrium, interactions of photons and charged particles with matter, radiotherapy dosimetry, as well as photographic, calorimetric, chemical, and thermoluminescence dosimetry. Includes many new derivations, such as Kramers X-ray spectrum, as well as topics that have not been thoroughly analyzed in other texts, such as broad-beam attenuation and geometrics, and the reciprocity theorem. Subjects are layed out in a logical sequence, making the topics easier for students to follow. Supplemented with numerous diagrams and tables.

This book begins with the basic terms and definitions and takes a student, step by step, through all areas of medical physics. The book covers radiation therapy, diagnostic radiology, dosimetry, radiation shielding, and nuclear medicine, all at a level suitable for undergraduates. This title not only describes the basics concepts of the field, but also emphasizes numerical and mathematical problems and examples. Students will find An Introduction to Medical Physics to be an indispensible resource in preparations for further graduate studies in the field.

The textbook begins with exercises related to radioactive sources and decay schemes. The problems covered include series decay and how to determine the frequency and energy of emitted particles in disintegrations. The next chapter deals with the interaction of ionizing radiation, including the treatment of photons and charged particles. The main focus is on applications based on the knowledge of interaction, to be used in subsequent work and courses. The textbook then examines detectors and measurements, including both counting statistics and properties of pulse detectors. The chapter that follows is dedicated to dosimetry, which is a major subject in medical radiation physics. It covers theoretical applications, such as different equilibrium situations and cavity theories, as well as experimental dosimetry, including ionization chambers and solid state and liquid dosimeters. A shorter chapter deals with radiobiology, where different cell survival models are considered. The last chapter concerns radiation protection and health physics. Both radioecology and radiation shielding calculations are covered. The textbook includes tables to simplify the solutions of the exercises, but the reader is mainly referred to important websites for importing necessary data.

Radiation Protection Dosimetry in Medecine

3rd Conference : Report

Practical Radiation Protection in Healthcare

Introduction to Radiation Protection Dosimetry

Dosimetry and Radiation Protection

Over the past few decades, the radiological science community has developed and applied numerous models of the human body for radiation protection, diagnostic imaging, and nuclear medicine therapy. The Handbook of Anatomical Models for Radiation Dosimetry provides a comprehensive review of the development and application of these computational models, known as "phantoms." An ambitious and unparalleled project, this pioneering work is the result of several years of planning and preparation involving 64 authors from across the world. It brings together recommendations and information sanctioned by the International Commission on Radiological Protection (ICRP) and documents 40 years of history and the progress of those involved with cutting-edge work with Monte Carlo Codes and radiation protection dosimetry. This volume was in part spurred on by the ICRP's key decision to adopt voxelized computational phantoms as standards for radiation protection purposes. It is an invaluable reference for those working in that area as well as those employing or developing anatomical models for a a number of clinical applications. Assembling the work of nearly all major phantom developers around the world, this volume examines: The history of the research and development in computational phantoms Detailed accounts for each of the well-known phantoms, including the MIRD-5, GSF Voxel Family Phantoms, NCAT, UF Hybrid Pediatric Phantoms, VIP-Man, and the latest ICRP Reference Phantoms Physical phantoms for experimental radiation dosimetry The smallest voxel size (0.2 mm), phantoms developed from the Chinese Visible Human Project Applications for radiation protection dosimetry involving environmental, nuclear power plant, and internal contamination exposures Medical applications, including nuclear medicine therapy, CT examinations, x-ray radiological image optimization, nuclear medicine imaging, external photon and proton treatments, and management of respiration in modern image-guided radiation treatment Patient-specific phantoms used for radiation treatment planning involving two Monte Carlo code systems: GEANT4 and EGS Future needs for research and development Related data sets are available for download on the authors' website. The breadth and depth of this work enables readers to obtain a unique sense of the complete scientific process in computational phantom development, from the conception of an idea, to the identification of original anatomical data, to solutions of various computing problems, and finally, to the ownership and sharing of results in this groundbreaking field that holds

so much promise.
This book reviews ionising radiation quantities and the relationships between them and discusses the principles underlying their measurement. The emphasis is on the determination of absorbed dose and related dosimetric quantities.
To meet the demands of practicing radiologic technologists, andstudents in training, Blackwell introduces the first volume ofthe Rad Tech's Guide Series. Rad Tech's Guide toRadiation Protection gets to the heart of what the moderntechnologist does by providing all of the information needed tounderstand basic radiobiology, the sources of radiation exposure,factors affecting dose to patients and personnel, and themost up-to-date dose management techniques. This on the sport reference is: Both a concise review for board preparation exams, as wellas a handy reference guide for the busy rad tech. A guide to the most current standards for radiation protectionwith references to major relevant organizations and keyreports. Pocket size -- take it anywhere!
Handbook of Anatomical Models for Radiation Dosimetry
Radiation Protection and Dosimetry

An Introduction to Radiation Protection
Proceedings of the Third Conference on Radiation Protection and Dosimetry, Sheraton Plaza Hotel, Orlando, Florida, October 21-24, 1991

This book explains clearly and in detail all aspects of radiation protection in nuclear medicine, including measurement quantities and units, detectors and dosimeters, and radiation biology. Discussion of radiation doses to patients and to embryos, fetuses, and children forms a central part of the book. Phantom models, biokinetic models, calculations, and software solutions are all considered, and a further chapter is devoted to quality assurance and reference levels. Occupational exposure also receives detailed attention. Exposure resulting from the production, labeling, and injection of radiopharmaceuticals and from contact with patients is discussed and shielding calculations are explained. The book closes by considering exposure of the public and summarizing the "rules of thumb" for radiation protection in nuclear medicine. This is an ideal textbook for students and a ready source of useful information for nuclear medicine specialists and medical physics experts.

Accurate radiation dosimetry is a requirement of radiation oncology, diagnostic radiology and nuclear medicine. It is necessary so as to satisfy the needs of patient safety, therapeutic and diagnostic optimisation, and retrospective epidemiological studies of the biological effects resulting from low absorbed doses of ionising radiation. The radiation absorbed dose received by the patient is the ultimate consequence of the transfer of kinetic energy through collisions between energetic charged particles and atoms of the tissue being traversed. Thus, the ability of the medical physicist to both measure and calculate accurately patient dosimetry demands a deep understanding of the physics of charged particle interactions with matter. Interestingly, the physics of charged particle energy loss has an almost exclusively theoretical basis, thus necessitating an advanced theoretical understanding of the subject in order to apply it appropriately to the clinical regime. ? Each year, about one-third of the world's population is exposed to ionising radiation as a consequence of diagnostic or therapeutic medical practice. The optimisation of the resulting radiation absorbed dose received by the patient and the clinical outcome sought, whether diagnostic or therapeutic, demands accuracy in the evaluation of the radiation absorbed doses resulting from such exposures. This requirement arrises primarily from two broadly-encompassing factors: The requirement in radiation oncology for a 5% or less uncertainty in the calculation and measurement of absorbed dose so as to optimise the therapeutic ratio of the probabilities of tumour control and normal tissue complications; and The establishment and further refinement of dose reference levels used in diagnostic radiology and nuclear medicine to minimise the amount of absorbed dose for a required degree of diagnostic benefit. The radiation absorbed dose is the outcome of energetic charged particles decelerating and transferring their kinetic energy to tissue. The calculation of this energy deposition, characterised by the stopping power, is unique in that it is derived entirely from theoretical principles. This dominant role of the associated theory makes its understanding of fundamental to the calculation of the radiation absorbed dose to the patient. The theoretical development of charged particle energy loss recognised in medical physics textbooks is in general limited to basic derivations based upon classical theory, generally a simplified form of the Bohr theory. More advanced descriptions of, for example, the Bethe-Bloch quantum result usually do not go beyond the simple presentation of the result without full explanation of the theoretical development of the theory and consideration of its limitations, its dependencies upon the Born perturbation theory and the various correction factors needed to correct for the failures of that Born theory at higher orders. This is not appropriate for a full understanding of the theory that its importance deserves. The medical radiation physicist should be aware of the details of the theoretical derivations of charged particle energy loss in order to appreciate the levels of accuracy in tabular data provided in reports and the calculation methodologies used in modern Monte Carlo calculations of radiation dosimetry.

This book describes the interaction of living matter with photons, neutrons, charged particles, electrons and ions. The authors are specialists in the field of radiation protection. The book synthesizes many years of experiments with external radiation exposure in the fields of dosimetry and radiation shielding in medical, industrial and research fields. It presents the basic physical concepts including dosimetry and offers a number of tools to be used by students, engineers and technicians to assess the radiological risk and the means to avoid them by calculating the appropriate shields. The theory of radiation interaction in matter is presented together with empirical formulas and abacus. Numerous numerical applications are treated to illustrate the different topics. The state of the art in radiation protection and dosimetry is presented in detail, especially in the field of simulation codes for external exposure to radiation, medical projects and advanced research. Moreover, important data spread in different up to date references are presented in this book. The book deals also with accelerators, X-rays facilities, sealed sources, dosimetry, Monte Carlo simulation and radiation regulation. Each chapter is split in two parts depending on the level of details the readers want to focus on. The first part, accessible to a large public, provides a lot of simple examples to help understanding the physics concepts under radiation external exposure. The second part, called “Additional Information” is not mandatory; it aims on explaining topics more deeply, often using mathematical formulations. The book treats fundamental radiometric and dosimetric quantities to describe the interaction in materials under the aspects of absorbed dose processes in tissues. Definitions and applications on limited and operational radiation protection quantities are given. An important aspect are practical engineering tools in industrial, medical and research domains. Source characterization and shielding design are addressed. Also more ”exotic” topics, such as ultra intense laser and new generation accelerators, are treated. The state of the art is presented to help the reader to work with the book in a self-consistent way. The basic knowledge necessary to apply Monte Carlo methods in the field of radiation protection and dosimetry for external radiation exposure is provided. Coverage of topics such as variance reduction, pseudo-random number generation and statistic estimators make the book useful even to experienced Monte Carlo practitioners. Solved problems help the reader to understand the Monte Carlo process. The book is meant to be used by researchers, engineers and medical physicist. It is also valuable to technicians and students.

Special Issue. Non-ionising radiation

Applied Physics of External Radiation Exposure
Developments in Radiation Protection Dosimetry
An Introduction to Medical Physics
Rad Tech's Guide to Radiation Protection
Radiation Protection and DosimetryAn Introduction to Health PhysicsSpringer Science & Business Media
Microdosimetry
Radionuclide and Radiation Protection Data Handbook 2002
Extended Synopses
Advanced Radiation Protection Dosimetry
Radiation Protection