

## Introduction To Transport Phenomena Solutions Thomson

Market\_Desc: - Chemical, Mechanical, Nuclear, Industrial Engineers Special Features: - Careful attention is paid to the presentation of the basic theory- Enhanced sections throughout text provide much firmer foundation than the first edition- Literature citations are given throughout for reference to additional material About The Book: The long-awaited revision of a classic! This new edition presents a balanced introduction to transport phenomena, which is the foundation of its long-standing success. Topics include mass transport, momentum transport and energy transport, which are presented at three different scales: molecular, microscopic and macroscopic.

Analysis of Transport Phenomena, Second Edition, provides a unified treatment of momentum, heat, and mass transfer, emphasizing the concepts and analytical techniques that apply to these transport processes. The second edition has been revised to reinforce the progression from simple to complex topics and to better introduce the applied mathematics that is needed both to understand classical results and to model novel systems. A common set of formulation, simplification, and solution methods is applied first to heat or mass transfer in stationary media and then to fluid mechanics, convective heat or mass transfer, and systems involving various kinds of coupled fluxes. FEATURES: \* Explains classical methods and results, preparing students for engineering practice and more advanced study or research \* Covers everything from heat and mass transfer in stationary media to fluid mechanics, free convection, and turbulence \* Improved organization, including the establishment of a more integrative approach \* Emphasizes concepts and analytical techniques that apply to all transport processes \* Mathematical techniques are introduced more gradually to provide students with a better foundation for more complicated topics discussed in later chapters

This will be a substantial revision of a good selling text for upper division/first graduate courses in biomedical transport phenomena, offered in many departments of biomedical and chemical engineering. Each chapter will be updated accordingly, with new problems and examples incorporated where appropriate. A particular emphasis will be on new information related to tissue engineering and organ regeneration. A key new feature will be the inclusion of complete solutions within the body of the text, rather than in a separate solutions manual. Also, Matlab will be incorporated for the first time with this Fourth Edition.

Integrating nonequilibrium thermodynamics and kinetic theory, this unique text presents a novel approach to the subject of transport phenomena.

This short primer provides a concise and tutorial-style introduction to transport phenomena in Newtonian fluids , in particular the transport of mass, energy and momentum. The reader will find detailed derivations of the transport equations for

these phenomena, as well as selected analytical solutions to the transport equations in some simple geometries. After a brief introduction to the basic mathematics used in the text, Chapter 2, which deals with momentum transport, presents a derivation of the Navier-Stokes-Duhem equation describing the basic flow in a Newtonian fluid. Also provided at this stage are the derivations of the Bernoulli equation, the pressure equation and the wave equation for sound waves. The boundary layer, turbulent flow and flow separation are briefly reviewed. Chapter 3, which addresses energy transport caused by thermal conduction and convection, examines a derivation of the heat transport equation. Finally, Chapter 4, which focuses on mass transport caused by diffusion and convection, discusses a derivation of the mass transport equation.

Part II covers applications in greater detail. The three transport phenomena--heat, mass, and momentum transfer--are treated in depth through simultaneous (or parallel) developments.

This book presents the foundations of fluid mechanics and transport phenomena in a concise way. It is suitable as an introduction to the subject as it contains many examples, proposed problems and a chapter for self-evaluation.

This unique resource offers over 200 well-tested bioengineering problems for teaching and examinations. Solutions are available to instructors online.

This classic text on fluid flow, heat transfer, and mass transport has been brought up to date in this second edition. The author has added a chapter on "Boiling and Condensation" that expands and rounds out the book's comprehensive coverage on transport phenomena. These new topics are particularly important to current research in renewable energy resources involving technologies such as windmills and solar panels. The book provides you and other materials science and engineering students and professionals with a clear yet thorough introduction to these important concepts. It balances the explanation of the fundamentals governing fluid flow and the transport of heat and mass with common applications of these fundamentals to specific systems existing in materials engineering. You will benefit from:

- The use of familiar examples such as air and water to introduce the influences of properties and geometry on fluid flow.
- An organization with sections dealing separately with fluid flow, heat transfer, and mass transport. This sequential structure allows the development of heat transport concepts to employ analogies of heat flow with fluid flow and the development of mass transport concepts to employ analogies with heat transport.
- Ample high-quality graphs and figures throughout.
- Key points presented in chapter summaries.
- End of chapter exercises and solutions to selected problems.
- An all new and improved comprehensive index.

Presenting engineering fundamentals and biological applications in a unified way, this book provides learners with the skills necessary to develop and critically analyze models of biological transport and reaction processes. It covers topics in fluid mechanics, mass transport, and biochemical interactions, with engineering concepts motivated by specific biological problems. For researchers in biomedical engineering.

Transport and Surface Phenomena provides an overview of the key transfers taking place in reactions and explores how calculations of momentum, energy and mass transfers can help researchers develop the most appropriate, cost effective solutions to chemical problems. Beginning with a thorough overview of the nature of transport phenomena, the book goes on to explore balances in transport phenomena, including key equations for assessing balances, before concluding by outlining mathematical methods for solving the transfer equations.

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Drawing on the experience of its expert authors, it is an accessible introduction to the field for students, researchers and professionals working in chemical engineering. The book and is also ideal for those in related fields such as physical chemistry, energy engineering, and materials science, for whom a deeper understanding of these interactions could enhance their work. The fourth edition of Transport Phenomena Fundamentals continues with its streamlined approach to the subject, based on a unified treatment of heat, mass, and momentum transport using a balance equation approach. The new edition includes more worked examples within each chapter and adds confidence-building problems at the end of each chapter. Some numerical solutions are included in an appendix for students to check their comprehension of key concepts. Additional resources online include exercises that can be practiced using a wide range of software programs available for simulating engineering problems, such as, COMSOL®, Maple®, Fluent, Aspen, Mathematica, Python and MATLAB®, lecture notes, and past exams. This edition incorporates a wider range of problems to expand the utility of the text beyond chemical engineering. The text is divided into two parts, which can be used for teaching a two-term course. Part I covers the balance equation in the context of diffusive transport—momentum, energy, mass, and charge. Each chapter adds a term to the balance equation, highlighting that term's effects on the physical behavior of the system and the underlying mathematical description. Chapters familiarize students with modeling and developing mathematical expressions based on the analysis of a control volume, the derivation of the governing differential equations, and the solution to those equations with appropriate boundary conditions. Part II builds on the diffusive transport balance equation by introducing convective transport terms, focusing on partial, rather than ordinary, differential equations. The text describes paring down the full, microscopic equations governing the phenomena to simplify the models and develop engineering solutions, and it introduces macroscopic versions of the balance equations for use where the microscopic approach is either too difficult to solve or would yield much more information that is actually required. The text discusses the momentum, Bernoulli, energy, and species continuity equations, including a brief description of how these equations are applied to heat exchangers, continuous contactors, and chemical reactors. The book introduces the three fundamental transport coefficients: the friction factor, the heat transfer coefficient, and the mass transfer coefficient in the context of boundary layer theory. Laminar flow situations are treated first followed by a discussion of turbulence. The final chapter covers the basics of radiative heat transfer, including concepts such as blackbodies, graybodies, radiation shields, and enclosures.

The term 'transport phenomena' describes the fundamental processes of momentum, energy, and mass transfer. This text provides a thorough discussion of transport phenomena, laying the foundation for understanding a wide variety of operations used by chemical engineers. The book is arranged in three parallel parts covering the major topics of momentum, energy, and mass transfer. Each part begins with the theory, followed by illustrations of the way the theory can be used to obtain fairly complete solutions, and concludes with the four most common types of averaging used to obtain approximate solutions. A broad range of technologically important examples, as well as numerous exercises, are provided throughout the text. Based on the author's extensive teaching experience, a suggested lecture outline is also included. This book is intended for first-year graduate engineering students; it will be an equally useful reference for researchers in this field.

The subject of transport phenomena has long been thoroughly and expertly addressed on the graduate and theoretical levels. Now Transport Phenomena and Unit Operations: A Combined Approach endeavors not only to introduce the fundamentals of the discipline to a broader, undergraduate-level audience but also to apply itself to the concerns of practicing engineers as they design, analyze, and construct industrial equipment. Richard Griskey's innovative text combines the often separated but intimately related disciplines of transport phenomena and

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unit operations into one cohesive treatment. While the latter was an academic precursor to the former, undergraduate students are often exposed to one at the expense of the other.

Transport Phenomena and Unit Operations bridges the gap between theory and practice, with a focus on advancing the concept of the engineer as practitioner. Chapters in this comprehensive volume include: Transport Processes and Coefficients Frictional Flow in Conduits Free and Forced Convective Heat Transfer Heat Exchangers Mass Transfer; Molecular Diffusion Equilibrium Staged Operations Mechanical Separations Each chapter contains a set of comprehensive problem sets with real-world quantitative data, affording students the opportunity to test their knowledge in practical situations. Transport Phenomena and Unit Operations is an ideal text for undergraduate engineering students as well as for engineering professionals.

Computational techniques have become indispensable tools in solving complex problems in transport phenomena. This book provides a clear, user-oriented introduction to the subject of computational transport phenomena. Each self-contained chapter includes a detailed worked example and a discussion of the problem system equations. Also included are the numerical methods used; computer code for the solution of the problem system equations; discussion of the numerical solution with emphasis on physical interpretation; and, when appropriate, a comparison of the numerical solution with an analytical solution or a discussion of how the numerical solution goes beyond what can be done analytically, especially for nonlinear problems. Intended for students and a broad range of scientists and engineers, the book includes computer code written in transportable Fortran so the reader can produce the numerical solutions and then extend them to other cases.

Introduction to Transport Phenomena Solutions Manual Transport Phenomena Introductory Transport Phenomena Wiley Global Education

Laminar Flow and Convective Transport Processes: Scaling Principles and Asymptotic Analysis presents analytic methods for the solution of fluid mechanics and convective transport processes, all in the laminar flow regime. This book brings together the results of almost 30 years of research on the use of nondimensionalization, scaling principles, and asymptotic analysis into a comprehensive form suitable for presentation in a core graduate-level course on fluid mechanics and the convective transport of heat. A considerable amount of material on viscous-dominated flows is covered. A unique feature of this book is its emphasis on scaling principles and the use of asymptotic methods, both as a means of solution and as a basis for qualitative understanding of the correlations that exist between independent and dependent dimensionless parameters in transport processes. Laminar Flow and Convective Transport Processes is suitable for use as a textbook for graduate courses in fluid mechanics and transport phenomena and also as a reference for researchers in the field.

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This textbook offers an introduction to multiple, interdependent transport phenomena as they occur in various fields of physics and technology like transport of momentum, heat, and matter. These phenomena are found in a number of combined processes in the fields of chemical, food, biomedical, and environmental sciences. The book puts a special emphasis on numerical modeling of both purely diffusive mechanisms and macroscopic transport such as fluid dynamics, heat and mass convection. To favor the applicability of the various concepts, they are presented with a simplicity of exposure, and synthesis has been preferred with respect to completeness. The book includes more than 130 graphs and figures, to facilitate the understanding of the various topics. It also presents many modeling examples throughout the text, to control that the

learned material is properly understood.

Transport Phenomena in Dispersed Media addresses the main problems associated with the transfer of heat, mass and momentum. The authors focus on the analytical solutions of the mass and heat transfer equations; the theoretical problems of coalescence, coagulation, aggregation and fragmentation of dispersed particles; the rheology of structured aggregate and kinetically stable disperse systems; the precipitation of particles in a turbulent flow; the evolution of the distribution function; the stochastic counterpart of the mass transfer equations; the dissipation of energy in disperse systems; and many other problems that distinguish this book from existing publications. Key Selling Features Covers all technological processes taking place in the oil and gas complex, as well as in the petrochemical industry Presents new original solutions for calculating design as well as for the development and implementation of processes of chemical technology Organized to first provide an extensive review of each chapter topic, solve specific problems, and then review the solutions with the reader Contains complex mathematical expressions for practical calculations Compares results obtained on the basis of mathematical models with experimental data Prof. Newman is considered one of the great chemical engineers of his time. His reputation derives from his mastery of all phases of the subject matter, his clarity of thought, and his ability to reduce complex problems to their essential core elements. He is a member of the National Academy of Engineering, Washington, DC, USA, and has won numerous national awards including every award offered by the Electrochemical Society, USA. His motto, as known by his colleagues, is "do it right the first time." He has been teaching undergraduate and graduate core subject courses at the University of California, Berkeley (UC Berkeley), USA, since joining the faculty in 1966. His method is to write out, in long form, everything he expects to convey to his class on a subject on any given day. He has maintained and updated his lecture notes from notepad to computer throughout his career. This book is an exact reproduction of those notes. This book demonstrates how to solve the classic problems of fluid mechanics, starting with the Navier–Stokes equation. It explains when it is appropriate to simplify a problem by neglecting certain terms through proper dimensional analysis. It covers concepts such as microscopic interpretation of fluxes, multicomponent diffusion, entropy production, nonnewtonian fluids, natural convection, turbulent flow, and hydrodynamic stability. It amply arms any serious problem solver with the tools to address any problem.

This book provides a thorough overview of transport phenomena in complex fluids, based on the latest research results and the newest methods for their analytical prediction and numerical simulation. The respective chapters cover several topics, including: a description of the structural features of the most common complex fluids (polymer and surfactant solutions, colloidal suspensions); an introduction to the most common non-Newtonian constitutive models and their relationship with the fluid microstructure; a detailed overview of the experimental methods used to characterise the thermophysical properties, bulk rheology, and surface properties of complex fluids; a comprehensive introduction to heat, mass, and momentum transport, and to hydrodynamic instabilities in complex fluids; and an introduction to state-of-the-art numerical methods used to simulate complex fluid flows, with a focus on the Smoothed Particle Hydrodynamics (SPH) and the Dissipative Particle Dynamics (DPD)

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techniques. Subsequent chapters provide in-depth descriptions of phenomena such as thermal convection, elastic turbulence, mixing of complex fluids, thermophoresis, sedimentation, and non-Newtonian drops and sprays. The book addresses research scientists and professionals, engineers, R&D managers and graduate students in the fields of engineering, chemistry, biology, medicine, and the applied and fundamental sciences.

This book is a research monograph on transport phenomena. The topics discussed are often mathematically simple, though conceptually complex. The book is written in a colloquial style which a good teacher uses in the classroom. It originates from the author's wealth of teaching experience in this area and incorporates suggestions from colleagues worldwide.

Introductory Transport Phenomena by R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot, and Daniel Klingenberg is a new introductory textbook based on the classic Bird, Stewart, Lightfoot text, Transport Phenomena. The authors' goal in writing this book reflects topics covered in an undergraduate course. Some of the rigorous topics suitable for the advanced students have been retained. The text covers topics such as: the transport of momentum; the transport of energy and the transport of chemical species. The organization of the material is similar to Bird/Stewart/Lightfoot, but presentation has been thoughtfully revised specifically for undergraduate students encountering these concepts for the first time. Devoting more space to mathematical derivations and providing fuller explanations of mathematical developments—including a section of the appendix devoted to mathematical topics—allows students to comprehend transport phenomena concepts at an undergraduate level.

Transport phenomena are the physical forces and processes by which energy and mass are moved into, out of, and throughout a system. Systems that are changing from one state (phase) to another, such as liquid to gas, are said to be "multiphase." This advanced text, for the first time, teaches the fundamentals of transport phenomena, including the relevant thermodynamics and kinetics, in the context of multiphase systems. Students will find this an accessible guide to the understanding of an often dauntingly complex subject, with ample worked-out examples taken from real-life engineering problems and helpful end-of-chapter problems to help reinforce abstract concepts. \*Develops and understanding of the thermal and physical behavior of multiphase systems \*Reviews underlying thermodynamics, including thermal equilibria and stability, thermodynamics of surfaces \*Covers all types of phase changes, including melting and solidification, sublimation and vapor deposition, boiling, condensation, and evaporation \*Ample end-of-chapter problems \*Solutions Manual

Enables readers to apply transport phenomena principles to solve advanced problems in all areas of engineering and science This book helps readers elevate their understanding of, and their ability to apply, transport phenomena by introducing a broad range of advanced topics as well as analytical and numerical solution techniques.

Readers gain the ability to solve complex problems generally not addressed in undergraduate-level courses, including nonlinear, multidimensional transport, and transient molecular and convective transport scenarios. Avoiding rote memorization, the author emphasizes a dual approach to learning in which physical understanding and problem-solving capability are developed simultaneously. Moreover, the author builds both readers' interest and knowledge by: Demonstrating that transport phenomena are

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pervasive, affecting every aspect of life Offering historical perspectives to enhance readers' understanding of current theory and methods Providing numerous examples drawn from a broad range of fields in the physical and life sciences and engineering Contextualizing problems in scenarios so that their rationale and significance are clear This text generally avoids the use of commercial software for problem solutions, helping readers cultivate a deeper understanding of how solutions are developed. References throughout the text promote further study and encourage the student to contemplate additional topics in transport phenomena. Transport Phenomena is written for advanced undergraduates and graduate students in chemical and mechanical engineering. Upon mastering the principles and techniques presented in this text, all readers will be better able to critically evaluate a broad range of physical phenomena, processes, and systems across many disciplines.

This introduction to transport phenomena in materials engineering balances an explanation of the fundamentals governing fluid flow and the transport of heat and mass with their common applications to specific systems in materials engineering. It introduces the influences of properties and geometry on fluid flow using familiar fluids such as air and water. Covers topics such as engineering units and pressure in static fluids; momentum transport and laminar flow of Newtonian fluids; equations of continuity and conservation of momentum and fluid flow past submerged objects; turbulent flow; mechanical energy balance and its application to fluid flow; transport of heat by conduction; transport of heat by convection; transient heat flow; heat transport by thermal radiation; mass transport in the solid state by diffusion; mass transport in fluids. Includes extensive appendices.

This text provides a teachable and readable approach to transport phenomena (momentum, heat, and mass transport) by providing numerous examples and applications, which are particularly important to metallurgical, ceramic, and materials engineers. Because the authors feel that it is important for students and practicing engineers to visualize the physical situations, they have attempted to lead the reader through the development and solution of the relevant differential equations by applying the familiar principles of conservation to numerous situations and by including many worked examples in each chapter. The book is organized in a manner characteristic of other texts in transport phenomena. Section I deals with the properties and mechanics of fluid motion; Section II with thermal properties and heat transfer; and Section III with diffusion and mass transfer. The authors depart from tradition by building on a presumed understanding of the relationships between the structure and properties of matter, particularly in the chapters devoted to the transport properties (viscosity, thermal conductivity, and the diffusion coefficients). In addition, generous portions of the text, numerous examples, and many problems at the ends of the chapters apply transport phenomena to materials processing.

"Professor William J. Thomson emphasizes the formulation of differential equations to describe physical problems, helping readers understand what they are doing - and why. The solutions are either simple (separable, linear second order) or derivable with a differential equation solver."--BOOK JACKET.

Fully comprehensive introduction to the rapidly emerging area of micro systems technology Transport Phenomena in Micro Systems explores the fundamentals of the new technologies related to Micro-Electro-Mechanical Systems (MEMS). It deals with

the behavior, precise control and manipulation of fluids that are geometrically constrained to a small, typically sub-millimeter, scale, such as nl, pl, fl, small size, low energy consumption, effects of the micro domain and heat transfer in the related devices. The author describes in detail and with extensive illustration micro fabrication, channel flow, transport laws, magnetophoresis, micro scale convection and micro sensors and activators, among others. This book spans multidisciplinary fields such as material science and mechanical engineering, engineering, physics, chemistry, microtechnology and biotechnology. Brings together in one collection recent and emerging developments in this fast-growing area of micro systems Covers multidisciplinary fields such as materials science, mechanical engineering, microtechnology and biotechnology, et al Comprehensive coverage of analytical models in microfluidics and MEMS technology Introduces micro fluidics applications include the development of inkjet printheads, micro-propulsion, and micro thermal technologies Presented in a very logical format Supplies readers with problems and solutions

This introductory text discusses the essential concepts of three fundamental transport processes, namely, momentum transfer, heat transfer, and mass transfer. Apart from chemical engineering, transport processes play an increasingly important role today in the fields of biotechnology, nanotechnology and microelectronics. The book covers the basic laws of momentum, heat and mass transfer. All the three transport processes are explained using two approaches—first by flux expressions and second by shell balances. These concepts are applied to formulate the physical problems of momentum, heat and mass transfer. Simple physical processes from the chemical engineering field are selected to understand the mechanism of these transfer operations. Though these problems are solved for unidirectional flow and laminar flow conditions only, turbulent flow conditions are also discussed. Boundary conditions and Prandtl mixing models for turbulent flow conditions are explained as well. The unsteady-state conditions for momentum, heat and mass transfer have also been highlighted with the help of simple cases. Finally, the approach of analogy has also been adopted in the book to understand these three molecular transport processes. Different analogies such as Reynolds, Prandtl, von Kármán and Chilton–Colburn are discussed in detail. This book is designed for the undergraduate students of chemical engineering and covers the syllabi on Transport Phenomena as currently prescribed in most institutes and universities.

Advanced Transport Phenomena is ideal as a graduate textbook. It contains a detailed discussion of modern analytic methods for the solution of fluid mechanics and heat and mass transfer problems, focusing on approximations based on scaling and asymptotic methods, beginning with the derivation of basic equations and boundary conditions and concluding with linear stability theory. Also covered are unidirectional flows, lubrication and thin-film theory, creeping flows, boundary layer theory, and convective heat and mass transport at high and low Reynolds numbers. The emphasis is on basic physics, scaling and nondimensionalization, and approximations that can be used to obtain solutions that are due either to geometric simplifications, or large or small values of dimensionless parameters. The author emphasizes setting up problems and extracting as much information as possible short of obtaining detailed solutions of differential equations. The book also focuses on the solutions of representative problems. This

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reflects the book's goal of teaching readers to think about the solution of transport problems.

This invaluable text, provides a much-needed overview of both the theoretical development, as well as appropriate numerical solutions, for all aspects of transport phenomena. It contains a basic introduction to many aspects of fluid mechanics, heat transfer and mass transfer, and the conservation equations for mass, energy and momentum are discussed with reference to engineering applications. Heat transfer by conduction, radiation, natural and forced convection is studied, as well as mass transfer and incompressible fluid mechanics. The second part of the book deals with numerical methods used to solve the problems encountered earlier. The basic concepts of finite difference and finite volume methods are presented. Other subjects usually covered in mathematical textbooks such as vector and tensor analysis, Laplace transforms, and Runge-Kutta methods are discussed in the Appendices. \* Offers comprehensive coverage of both transport phenomena and numerical and analytical solutions to the problems. \* Includes comprehensive coverage of numerical techniques. \* Provides real-life problems and solutions, which are vital to the understanding and implementation of applications. This work will be welcomed not only by senior and graduate students in mechanical, aeronautical and chemical engineering, but also for engineers practising in these fields.

Fluid and flow problems in porous media have attracted the attention of industrialists, engineers and scientists from varying disciplines, such as chemical, environmental, and mechanical engineering, geothermal physics and food science. There has been an increasing interest in heat and fluid flows through porous media, making this book a timely and appropriate resource. Each chapter is systematically detailed to be easily grasped by a research worker with basic knowledge of fluid mechanics, heat transfer and computational and experimental methods. At the same time, the readers will be informed of the most recent research literature in the field, giving it dual usage as both a post-grad text book and professional reference. Written by the recent directors of the NATO Advanced Study Institute session on 'Emerging Technologies and Techniques in Porous Media' (June 2003), this book is a timely and essential reference for scientists and engineers within a variety of fields.

A clear, user-oriented introduction to the subject of computational transport phenomena, first published in 1997.

Modeling in Transport Phenomena, Second Edition presents and clearly explains with example problems the basic concepts and their applications to fluid flow, heat transfer, mass transfer, chemical reaction engineering and thermodynamics. A balanced approach is presented between analysis and synthesis, students will understand how to use the solution in engineering analysis. Systematic derivations of the equations and the physical significance of each term are given in detail, for students to easily understand and follow up the material. There is a strong incentive in science and engineering to understand why a phenomenon behaves the way it does. For this purpose, a complicated real-life problem is transformed into a mathematically tractable problem while preserving the essential features of it. Such a process, known as mathematical modeling, requires understanding of the basic concepts. This book teaches students these basic concepts and shows the similarities between them. Answers to all problems are provided allowing students to check their solutions.

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Emphasis is on how to get the model equation representing a physical phenomenon and not on exploiting various numerical techniques to solve mathematical equations. A balanced approach is presented between analysis and synthesis, students will understand how to use the solution in engineering analysis. Systematic derivations of the equations as well as the physical significance of each term are given in detail. Many more problems and examples are given than in the first edition - answers provided. This book teaches the basic equations of transport phenomena in a unified manner and uses the analogy between heat transfer and mass and momentum to explain the more difficult concepts. Part I covers the basic concepts in transport phenomena. Part II covers applications in greater detail. Part III deals with the transport properties. The three transport phenomena-heat, mass, and momentum transfer-are treated in depth through simultaneous (or parallel) developments. Transport properties such as viscosity, thermal conductivity, and mass diffusion coefficient are introduced in a simple manner early on and then applied throughout the rest of the book. Advanced discussion is provided separately. An entire chapter is devoted to the crucial material of non-Newtonian phenomena. This book covers heat transfer as it pertains to transport phenomena, and covers mass transfer as it relates to the analogy with heat and momentum. The book includes a complete treatment of fluid mechanics for Ch. E's. The treatment begins with Newton's law and including laminar flow, turbulent flow, fluid statics, boundary layers, flow past immersed bodies, and basic and advanced design in pipes, heat exchanges, and agitation vessels. This text is the only one to cover modern agitation design and scale-up thoroughly. The chapter on turbulence covers not only traditional approaches but also includes the most contemporary concepts of the transition and of coherent structures in turbulence. The book includes an extensive treatment of fluidization. Computer programs and numerical methods are integrated throughout the text, especially in the example problems.

Integrated, modern approach to transport phenomena for graduate students, featuring examples and computational solutions to develop practical problem-solving skills.

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