

Chemical And Process Thermodynamics 3rd Edition

This is the only book to apply thermodynamics to real-world process engineering problems, explaining the thermodynamics behind simulations from the view of academic and industrial authors to users of simulation programs. It comprises numerous solved examples, which simplify the understanding of the often complex calculation procedures, and discusses their advantages and disadvantages. The text also includes such special models as for formaldehyde, polymers, and associating compounds. Estimation methods for thermophysical properties and phase equilibria and thermodynamics of alternative separation processes are covered, as are new developments from recent years. For a deeper understanding additional problems are given at the end of each chapter. To solve the complex problems prepared Mathcad files, Excel files or the DDBSP Explorer version can be accessed via the Internet. While written for an advanced level, the text is easy to understand for every chemical engineer and chemist with a basic education in thermodynamics and phase equilibria, teaching students the engineering perspective of thermodynamics but also of interest to all companies active in chemistry, pharmacy, oil and gas processing, petrochemistry, refinery, food production, environmental protection and engineering.

Traditionally, the teaching of phase equilibria emphasizes the relationships between the thermodynamic variables of each phase in equilibrium rather than its engineering applications. This book changes the focus from the use of thermodynamics relationships to compute phase equilibria to the design and control of the phase conditions that a process needs. Phase Equilibrium Engineering presents a systematic study and application of phase equilibrium tools to the development of chemical processes. The thermodynamic modeling of mixtures for process development, synthesis, simulation, design and optimization is analyzed. The relation between the mixture molecular properties, the selection of the thermodynamic model and the process technology that could be applied are discussed. A classification of mixtures, separation process, thermodynamic models and technologies is presented to guide the engineer in the world of separation processes. The phase condition required for a given reacting system is studied at subcritical and supercritical conditions. The four cardinal points of phase equilibrium engineering are: the chemical plant or process, the laboratory, the modeling of phase equilibria and the simulator. The harmonization of all these components to obtain a better design or operation is the ultimate goal of phase equilibrium engineering. Methodologies are discussed using relevant industrial examples. The molecular nature and composition of the process mixture is given a key role in process decisions. Phase equilibrium diagrams are used as a drawing board for process implementation.

With the encroachment of the Internet into nearly all aspects of work and life, it seems as though information is everywhere. However, there is information and then there is correct, appropriate, and timely information. While we might love being able to turn to Wikipedia® for encyclopedia-like information or search Google® for the thousands of links on a topic, engineers need the best information, information that is evaluated, up-to-date, and complete. Accurate, vetted information is necessary when building new skyscrapers or developing new prosthetics for returning military veterans. While the award-winning first edition of *Using the Engineering Literature* used a roadmap analogy, we now need a three-dimensional analysis reflecting the complex and dynamic nature of research in the information age. *Using the Engineering Literature, Second Edition* provides a guide to the wide range of resources available in all fields of engineering. This second edition has been thoroughly revised and features new sections on nanotechnology as well as green engineering. The information age has greatly impacted the way engineers find information. Engineers have an effect, directly and indirectly, on almost all aspects of our lives, and it is vital that they find the right information at the right time to create better products and processes. Comprehensive and up to date, with expert chapter authors, this book fills a gap in the literature, providing critical information in a user-friendly format.

Designed as an undergraduate-level textbook in Chemical Engineering, this student-friendly, thoroughly class-room tested book, now in its second edition, continues to provide an in-depth analysis of chemical engineering thermodynamics. The book has been so organized that it gives comprehensive coverage of basic concepts and applications of the laws of thermodynamics in the initial chapters, while the later chapters focus at length on important areas of study falling under the realm of chemical thermodynamics. The reader is thus introduced to a thorough analysis of the fundamental laws of thermodynamics as well as their applications to practical situations. This is followed by a detailed discussion on relationships among thermodynamic properties and an exhaustive treatment on the thermodynamic properties of solutions. The role of phase equilibrium thermodynamics in design, analysis, and operation of chemical separation methods is also deftly dealt with. Finally, the chemical reaction equilibria are skillfully explained. Besides numerous illustrations, the book contains over 200 worked examples, over 400 exercise problems (all with answers) and several objective-type questions, which enable students to gain an in-depth understanding of the concepts and theory discussed. The book will also be a useful text for students pursuing courses in chemical engineering-related branches such as polymer engineering, petroleum engineering, and safety and environmental engineering. New to This Edition • More Example Problems and Exercise Questions in each chapter • Updated section on Vapour–Liquid Equilibrium in Chapter 8 to highlight the significance of equations of state approach • GATE Questions up to 2012 with answers

This book explores sustainability engineering through the lens of the manufacturing and chemical process industries to elucidate the safe and economic implementation of process designs used to transform raw materials into useful finished products. The author applies the tenets of sustainability science to develop an engineering methodology that supports the perpetual availability of raw materials through recycling/reuse/repurposing, incorporates inexhaustible supplies, such as solar energy and municipal waste, and encompasses the husbandry of these resources in a manner that minimizes negative environmental impacts. Anyone involved in the design or manufacture of chemicals, or the upgrade of existing manufacturing processes, will benefit from this book's suggestions for identifying improvement options, while adding the pivotal aspect of sustainability to the usual cost and safety equation optimization elements.

Annotation In this book, two of the field's leading experts bring together powerful advances in model-based control for chemical process engineering. From start to finish, Coleman Brosilow and Babu Joseph introduce practical approaches designed to solve real-world problems -- not just theory. The book contains extensive examples and exercises, and an accompanying CD-ROM contains hands-on MATLAB files that supplement the examples and help readers solve the exercises -- a feature found in no other book on the topic.

Process Control: Modeling, Design, and Simulation is the first complete introduction to process control that fully integrates software tools--helping you master critical techniques hands-on, using MATLAB-based computer simulations. Author B. Wayne Bequette includes process control diagrams, dynamic modeling, feedback control, frequency response analysis techniques, control loop tuning, and start-to-finish chemical process control case studies.

Nonequilibrium Thermodynamics: Transport and Rate Processes in Physical, Chemical and Biological Systems, Fourth Edition emphasizes the unifying role of thermodynamics in analyzing natural phenomena. This updated edition expands on the third edition by focusing on the general balance equations for coupled processes of physical, chemical and biological systems. Updates include stochastic approaches, self-organization criticality, ecosystems, mesoscopic thermodynamics, constructal law, quantum thermodynamics, fluctuation theory, information theory, and modeling the coupled biochemical systems. The book also emphasizes nonequilibrium thermodynamics tools, such as fluctuation theories, mesoscopic thermodynamic analysis, information theories, and quantum thermodynamics in describing and designing small scale systems. Provides a useful text for seniors and graduate students from diverse engineering and science programs. Highlights the fundamentals of equilibrium thermodynamics, transport processes and chemical reactions. Expands the theory of nonequilibrium thermodynamics and its use in coupled

transport processes and chemical reactions in physical, chemical and biological systems Presents a unified analysis for transport and rate processes in various time and space scales Discusses stochastic approaches in thermodynamic analysis, including fluctuation and information theories, mesoscopic nonequilibrium thermodynamics, constructal law and quantum thermodynamics This title aims to teach how to invent optimal and sustainable chemical processes by making use of systematic conceptual methods and computer simulation techniques. The material covers five sections: process simulation; thermodynamic methods; process synthesis; process integration; and design project including case studies. It is primarily intended as a teaching support for undergraduate and postgraduate students following various process design courses and projects, but will also be of great value to professional engineers interested in the newest design methods. Provides an introduction to the newest design methods. Of great value to undergraduate and postgraduate students as well as professional engineers. Numerous examples illustrate theoretical principles and design issues.

This textbook presents a modern treatment of fundamentals of heat and mass transfer in the context of all types of multiphase flows with possibility of phase-changes among solid, liquid and vapor. It serves equally as a textbook for undergraduate senior and graduate students in a wide variety of engineering disciplines including mechanical engineering, chemical engineering, material science and engineering, nuclear engineering, biomedical engineering, and environmental engineering. Multiphase Heat Transfer and Flow can also be used to teach contemporary and novel applications of heat and mass transfer. Concepts are reinforced with numerous examples and end-of-chapter problems. A solutions manual and PowerPoint presentation are available to instructors. While the book is designed for students, it is also very useful for practicing engineers working in technical areas related to both macro- and micro-scale systems that emphasize multiphase, multicomponent, and non-conventional geometries with coupled heat and mass transfer and phase change, with the possibility of full numerical simulation.

This didactic approach to the principles and modeling of mass transfer as it is needed in modern industrial processes is unique in combining a step-by-step introduction to all important fundamentals with the most recent applications. Based upon the renowned author's successful new modeling method as used for the O-18 process, the exemplary exercises included in the text are fact-proven, taken directly from existing chemical plants. Fascinating reading for chemists, graduate students, chemical and process engineers, as well as thermodynamics physicists.

Thermodynamics is a self-contained analysis of physical and chemical processes, based on classical thermodynamic principles. Emphasis is placed on the fundamental principles, with a combination of theory and practice, and demonstrating their application to a variety of disciplines. Included in this work are new approaches to irreversible processes, electromagnetic effects, adsorption phenomena, self-assembly, the origin of phase diagrams, critical phenomena, and Carathéodory's treatment of the second law. This book will appeal to graduate students and professional chemists and physicists who wish to acquire a more sophisticated overview of thermodynamics and related subject matter. · Easy-to-understand style appeals to both chemists and physicists · Discusses treatment of electromagnetic phenomena and adsorption of surface gases surfaces · Extensively revised to cater for advanced courses in thermodynamics

"CD-ROM includes all MATLAB/Simulink files used throughout the book."--Page 4 of cover.

First published in 1995, The Engineering Handbook quickly became the definitive engineering reference. Although it remains a bestseller, the many advances realized in traditional engineering fields along with the emergence and rapid growth of fields such as biomedical engineering, computer engineering, and nanotechnology mean that the time has come to bring this standard-setting reference up to date. New in the Second Edition 19 completely new chapters addressing important topics in bioinstrumentation, control systems, nanotechnology, image and signal processing, electronics, environmental systems, structural systems 131 chapters fully revised and updated Expanded lists of engineering associations and societies The Engineering Handbook, Second Edition is designed to enlighten experts in areas outside their own specialties, to refresh the knowledge of mature practitioners, and to educate engineering novices. Whether you work in industry, government, or academia, this is simply the best, most useful engineering reference you can have in your personal, office, or institutional library.

With a focus on actual industrial processes, e.g. the production of light alkenes, synthesis gas, fine chemicals, polyethylene, it encourages the reader to think "out of the box" and invent and develop novel unit operations and processes. Reflecting today's emphasis on sustainability, this edition contains new coverage of biomass as an alternative to fossil fuels, and process intensification. The second edition includes: New chapters on Process Intensification and Processes for the Conversion of Biomass Updated and expanded chapters throughout with 35% new material overall Text boxes containing case studies and examples from various different industries, e.g. synthesis loop designs, Sasol I Plant, Kaminsky catalysts, production of Ibuprofen, click chemistry, ammonia synthesis, fluid catalytic cracking Questions throughout to stimulate debate and keep students awake! Richly illustrated chapters with improved figures and flow diagrams Chemical Process Technology, Second Edition is a comprehensive introduction, linking the fundamental theory and concepts to the applied nature of the subject. It will be invaluable to students of chemical engineering, biotechnology and industrial chemistry, as well as practising chemical engineers. From reviews of the first edition: "The authors have blended process technology, chemistry and thermodynamics in an elegant manner... Overall this is a welcome addition to books on chemical technology." – The Chemist "Impressively wide-ranging and comprehensive... an excellent textbook for students, with a combination of fundamental knowledge and technology." – Chemistry in Britain (now Chemistry World)

Establish your professional credentials as a registered P.E. with Chemical Engineering A Review for the P.E. Exam The only P.E. examguide that conforms to the new NCEE guidelines! * Guides you step-by-step through every topic covered in the exam. * Follows NCEE question format and subject emphasis. * Practice exercises and problems, problem-solving strategies, and solutions. * Detailed coverage of thermodynamics, process design, mass transfer, heat transfer, chemical kinetics, fluid flow, and engineering economics.

This book differs from other thermodynamics texts in its objective which is to provide engineers with the concepts, tools, and experience needed to solve practical real-world energy problems. The presentation integrates computer tools (e.g., EES) with thermodynamic concepts to allow engineering students and practising engineers to solve problems they would otherwise not be able to solve. The use of examples, solved and explained in detail, and supported with property diagrams that are drawn to scale, is ubiquitous in this textbook. The examples are not trivial, drill problems, but rather complex and timely real world problems that are of interest by themselves. As with the presentation, the solutions to these examples are complete and do not skip steps. Similarly the book includes numerous end of chapter problems, both typeset and online. Most of these problems are more detailed

than those found in other thermodynamics textbooks. The supplements include complete solutions to all exercises, software downloads, and additional content on selected topics. These are available at the book web site www.cambridge.org/KleinandNellis.

The first two editions of Concise Chemical Thermodynamics proved to be a very popular introduction to a subject many undergraduate students perceive to be difficult due to the underlying mathematics. With its concise explanations and clear examples, the text has for the past 40 years clarified for countless students one of the most complicated branches of science. Chemical engineers face the challenge of learning the difficult concept and application of entropy and the 2nd Law of Thermodynamics. By following a visual approach and offering qualitative discussions of the role of molecular interactions, Koretsky helps them understand and visualize thermodynamics. Highlighted examples show how the material is applied in the real world. Expanded coverage includes biological content and examples, the Equation of State approach for both liquid and vapor phases in VLE, and the practical side of the 2nd Law. Engineers will then be able to use this resource as the basis for more advanced concepts.

Designed for undergraduate and graduate chemical engineering students. This book/disk package explains the rationale of thermodynamics from an experimental perspective. The Third Edition offers a thorough update and is unique in its recognition of the ever-expanding role of the personal computer in engineering practice. Focuses on learning the Why as well as the How of thermodynamics and integrates software to reinforce course concepts.

Master the principles of thermodynamics, and understand their practical real-world applications, with this deep and intuitive undergraduate textbook.

This book deals with the design and integration of chemical processes, emphasizing the conceptual issues that are fundamental to the creation of the process. Chemical process design requires the selection of a series of processing steps and their integration to form a complete manufacturing system. The text emphasizes both the design and selection of the steps as individual operations and their integration. Also, the process will normally operate as part of an integrated manufacturing site consisting of a number of processes serviced by a common utility system. The design of utility systems has been dealt with in the text so that the interactions between processes and the utility system and interactions between different processes through the utility system can be exploited to maximize the performance of the site as a whole. Chemical processing should form part of a sustainable industrial activity. For chemical processing, this means that processes should use raw materials as efficiently as is economic and practicable, both to prevent the production of waste that can be environmentally harmful and to preserve the reserves of raw materials as much as possible. Processes should use as little energy as economic and practicable, both to prevent the build-up of carbon dioxide in the atmosphere from burning fossil fuels and to preserve reserves of fossil fuels. Water must also be consumed in sustainable quantities that do not cause deterioration in the quality of the water source and the long-term quantity of the reserves. Aqueous and atmospheric emissions must not be environmentally harmful, and solid waste to landfill must be avoided. Finally, all aspects of chemical processing must feature good health and safety practice. It is important for the designer to understand the limitations of the methods used in chemical process design. The best way to understand the limitations is to understand the derivations of the equations used and the assumptions on which the equations are based. Where practical, the derivation of the design equations has been included in the text. The book is intended to provide a practical guide to chemical process design and integration for undergraduate and postgraduate students of chemical engineering, practicing process designers and chemical engineers and applied chemists working in process development. Examples have been included throughout the text. Most of these examples do not require specialist software and can be performed on spreadsheet software. Finally, a number of exercises have been added at the end of each chapter to allow the reader to practice the calculation procedures.

Engineering students in a wide variety of engineering disciplines from mechanical and chemical to biomedical and materials engineering must master the principles of transport phenomena as an essential tool in analyzing and designing any system or systems wherein momentum, heat and mass are transferred. This textbook was developed to address that need, with a clear presentation of the fundamentals, ample problem sets to reinforce that knowledge, and tangible examples of how this knowledge is put to use in engineering design. Professional engineers, too, will find this book invaluable as reference for everything from heat exchanger design to chemical processing system design and more. * Develops an understanding of the thermal and physical behavior of multiphase systems with phase change, including microscale and porosity, for practical applications in heat transfer, bioengineering, materials science, nuclear engineering, environmental engineering, process engineering, biotechnology and nanotechnology * Brings all three forms of phase change, i.e., liquid vapor, solid liquid and solid vapor, into one volume and describes them from one perspective in the context of fundamental treatment * Presents the generalized integral and differential transport phenomena equations for multi-component multiphase systems in local instance as well as averaging formulations. The molecular approach is also discussed with the connection between microscopic and molecular approaches * Presents basic principles of analyzing transport phenomena in multiphase systems with emphasis on melting, solidification, sublimation, vapor deposition, condensation, evaporation, boiling and two-phase flow heat transfer at the micro and macro levels * Solid/liquid/vapor interfacial phenomena, including the concepts of surface tension, wetting phenomena, disjoining pressure, contact angle, thin films and capillary phenomena, including interfacial balances for mass, species, momentum, and energy for multi-component and multiphase interfaces are discussed * Ample examples and end-of-chapter problems, with Solutions Manual and PowerPoint presentation available to the instructors

This textbook takes an interdisciplinary approach to the subject of thermodynamics and is therefore suitable for undergraduates in chemistry, physics and engineering courses. The book is an introduction to phenomenological thermodynamics and its applications to phase transitions and chemical reactions, with some references to statistical mechanics. It strikes the balance between the rigorousness of the Callen text and phenomenological approach of the

Atkins text. The book is divided in three parts. The first introduces the postulates and laws of thermodynamics and complements these initial explanations with practical examples. The second part is devoted to applications of thermodynamics to phase transitions in pure substances and mixtures. The third part covers thermodynamic systems in which chemical reactions take place. There are some sections on more advanced topics such as thermodynamic potentials, natural variables, non-ideal mixtures and electrochemical reactions, which make this book of suitable also to post-graduate students.

Natural phenomena consist of simultaneously occurring transport processes and chemical reactions. These processes may interact with each other and may lead to self-organized structures, fluctuations, instabilities, and evolutionary systems. Nonequilibrium Thermodynamics, Fourth Edition emphasizes the unifying role of thermodynamics in analyzing the natural phenomena. This edition updates and expands the previous chapters in the third edition by focusing on the general balance equations for coupled processes of physical, chemical, and biological systems. The updates expansions includes stochastic approaches, self-organization criticality, ecosystems, mesoscopic thermodynamics, constructal law, quantum thermodynamics, fluctuation theory, information theory, and modeling the coupled biochemical systems. The new edition emphasizes nonequilibrium thermodynamics tools, such as fluctuation theories, mesoscopic thermodynamic analysis, information theories, and quantum thermodynamics in describing and designing small scale systems. This new addition also come with more examples and practice problems. A useful text for seniors and graduate students from diverse engineering and science programs to analyze some nonequilibrium, coupled, evolutionary, stochastic, and dissipative processes Highlights fundamentals of equilibrium thermodynamics, transport processes and chemical reactions Expands the theory of nonequilibrium thermodynamics and its use in coupled transport processes and chemical reactions in physical, chemical, and biological systems Presents a unified analysis for transport and rate processes in various time and space scales Discusses stochastic approaches in thermodynamic analysis including fluctuation and information theories, mesoscopic nonequilibrium thermodynamics, constructal law, and quantum thermodynamics Has 195 fully solved examples and 280 practice problems An Instructor Resource containing the Solution Manual can be obtained from the authors

"This book is for the practicing engineer or scientist involved in process development and design. The emphasis is on applied thermodynamics and for this reason, the text is organized with respect to the stage of development of a process rather than according to logical development of thermodynamic principles. Therefore, it is assumed that the reader has some familiarity with concepts of ideality, activity coefficients, fugacity, chemical potential, etc."--Foreword

A brand new book, FUNDAMENTALS OF CHEMICAL ENGINEERING THERMODYNAMICS makes the abstract subject of chemical engineering thermodynamics more accessible to undergraduate students. The subject is presented through a problem-solving inductive (from specific to general) learning approach, written in a conversational and approachable manner. Suitable for either a one-semester course or two-semester sequence in the subject, this book covers thermodynamics in a complete and mathematically rigorous manner, with an emphasis on solving practical engineering problems. The approach taken stresses problem-solving, and draws from best practice engineering teaching strategies. FUNDAMENTALS OF CHEMICAL ENGINEERING THERMODYNAMICS uses examples to frame the importance of the material. Each topic begins with a motivational example that is investigated in context to that topic. This framing of the material is helpful to all readers, particularly to global learners who require big picture insights, and hands-on learners who struggle with abstractions. Each worked example is fully annotated with sketches and comments on the thought process behind the solved problems. Common errors are presented and explained. Extensive margin notes add to the book accessibility as well as presenting opportunities for investigation. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Designed for chemical engineering students and industry professionals, this book shows how to write reusable computer programs. Written in the three languages (C, C++, and MATLAB), it is accompanied by a CD-ROM featuring source code, executables, figures, and simulations. It also explains each program in detail.

An Introduction to Materials Engineering and Science for Chemical and Materials Engineers provides a solid background in materials engineering and science for chemical and materials engineering students. This book: Organizes topics on two levels; by engineering subject area and by materials class. Incorporates instructional objectives, active-learning principles, design-oriented problems, and web-based information and visualization to provide a unique educational experience for the student. Provides a foundation for understanding the structure and properties of materials such as ceramics/glass, polymers, composites, bio-materials, as well as metals and alloys. Takes an integrated approach to the subject, rather than a "metals first" approach.

Engineering Chemistry I has been primarily written for first year B.Tech students but can also be used by BSc and MSc students to clarify their fundamental knowledge. The book begins with the basic theories of chemistry in various disciplines in order to provide a necessary background for dealing with a number of different physiochemical phenomena. Key Features 1. Brief discussion of the concepts 2. Coverage of syllabus in totality 3. Examination-oriented approach 4. Large number of solved problems 5. Solution to previous year's question papers 6. Exercises at the end of each chapter

Designed as a textbook for the undergraduate students of chemical engineering and related disciplines such as biotechnology, polymer technology, petrochemical engineering, electrochemical engineering, environmental engineering and safety engineering, the chief objective of the book is to prepare students to make analysis of chemical processes through calculations and to develop systematic problem-solving skills in them. The text presents the fundamentals of chemical engineering operations and processes in a simple style that helps the students to gain a thorough understanding of chemical process calculations. The book deals with the principles of stoichiometry to formulate and solve material and energy balance problems in processes with and without chemical reactions. With the help of

examples, the book explains the construction and use of reference-substance plots, equilibrium diagrams, psychrometric charts, steam tables and enthalpy composition diagrams. It also elaborates on thermophysics and thermochemistry to acquaint the students with the thermodynamic principles of energy balance calculations. The book is supplemented with Solutions Manual for instructors containing detailed solutions of all chapter-end unsolved problems. NEW TO THE SECOND EDITION • Incorporates a new chapter on Bypass, Recycle and Purge Operations • Comprises updations in some sections and presents new sections on Future Avenues and Opportunities in Chemical Engineering, Processes in Biological and Energy Systems • Contains several new worked-out examples in the chapter on Material Balance with Chemical Reaction • Includes GATE questions with answers up to the year 2016 in Objective-type questions KEY FEATURES • SI units are used throughout the book. • All basic chemical engineering operations and processes are introduced, and different types of problems are illustrated with worked-out examples. • Stoichiometric principles are extended to solve problems related to bioprocessing, environmental engineering, etc. • Exercise problems (more than 810) are organised according to the difficulty level and all are provided with answers.

"The book provides a practical guide to chemical process design and integration for students and practicing process engineers in industry"--

"This book provides the reader with a self-study, step-by-step guide to doing thermodynamic calculations in Aspen Plus (Version 8.x). This is done by providing actual screen shots of the Aspen Plus interface to solve example problems of various types, including vapor-liquid, liquid-liquid, vapor-liquid-liquid and chemical reaction equilibria, and simple applications to liquefaction, distillation and liquid-liquid extraction"--

This practical how-to-do book deals with the design of sustainable chemical processes by means of systematic methods aided by computer simulation. Ample case studies illustrate generic creative issues, as well as the efficient use of simulation techniques, with each one standing for an important issue taken from practice. The didactic approach guides readers from basic knowledge to mastering complex flow-sheets, starting with chemistry and thermodynamics, via process synthesis, efficient use of energy and waste minimization, right up to plant-wide control and process dynamics. The simulation results are compared with flow-sheets and performance indices of actual industrial licensed processes, while the complete input data for all the case studies is also provided, allowing readers to reproduce the results with their own simulators. For everyone interested in the design of innovative chemical processes.

This book, now in its second edition, continues to provide a comprehensive introduction to the principles of chemical engineering thermodynamics and also introduces the student to the application of principles to various practical areas. The book emphasizes the role of the fundamental principles of thermodynamics in the derivation of significant relationships between the various thermodynamic properties. The initial chapter provides an overview of the basic concepts and processes, and discusses the important units and dimensions involved. The ensuing chapters, in a logical presentation, thoroughly cover the first and second laws of thermodynamics, the heat effects, the thermodynamic properties and their relations, refrigeration and liquefaction processes, and the equilibria between phases and in chemical reactions. The book is suitably illustrated with a large number of visuals. In the second edition, new sections on Quasi-Static Process and Entropy Change in Reversible and Irreversible Processes are included. Besides, new Solved Model Question Paper and several new Multiple Choice Questions are also added that help develop the students' ability and confidence in the application of the underlying concepts. Primarily intended for the undergraduate students of chemical engineering and other related engineering disciplines such as polymer, petroleum and pharmaceutical engineering, the book will also be useful for the postgraduate students of the subject as well as professionals in the relevant fields.

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