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### CHEMICAL ENGINEERING DESIGN

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#### PRINCIPLES, PRACTICE AND ECONOMICS OF PLANT AND PROCESS DESIGN

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*Elsevier Chemical Engineering Design, Second Edition*, deals with the application of chemical engineering principles to the design of chemical processes and equipment. Revised throughout, this edition has been specifically developed for the U.S. market. It provides the latest US codes and standards, including API, ASME and ISA design codes and ANSI standards. It contains new discussions of conceptual plant design, flowsheet development, and revamp design; extended coverage of capital cost estimation, process costing, and economics; and new chapters on equipment selection, reactor design, and solids handling processes. A rigorous pedagogy assists learning, with detailed worked examples, end of chapter exercises, plus supporting data, and Excel spreadsheet calculations, plus over 150 Patent References for downloading from the companion website. Extensive instructor resources, including 1170 lecture slides and a fully worked solutions manual are available to adopting instructors. This text is designed for chemical and biochemical engineering students (senior undergraduate year, plus appropriate for capstone design courses where taken, plus graduates) and lecturers/tutors, and professionals in industry (chemical process, biochemical, pharmaceutical, petrochemical sectors). New to this edition: Revised organization into Part I: Process Design, and Part II: Plant Design. The broad themes of Part I are flowsheet development, economic analysis, safety and environmental impact and optimization. Part II contains chapters on equipment design and selection that can be used as supplements to a lecture course or as essential references for students or practicing engineers working on design projects. New discussion of conceptual plant design, flowsheet development and revamp design Significantly increased coverage of capital cost estimation, process costing and economics New chapters on equipment selection, reactor design and solids handling processes New sections on fermentation, adsorption, membrane separations, ion exchange and chromatography Increased coverage of batch processing, food, pharmaceutical and biological processes All equipment chapters in Part II revised and updated with current information Updated throughout for latest US codes and standards, including API, ASME and ISA design codes and ANSI standards Additional worked examples and homework problems The most complete and up to date coverage of equipment selection 108 realistic commercial design projects from diverse industries A rigorous pedagogy assists learning, with detailed worked examples, end of chapter exercises, plus supporting data and Excel spreadsheet calculations plus over 150 Patent References, for downloading from the companion website Extensive instructor resources: 1170 lecture slides plus fully worked solutions manual available to adopting instructors

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#### ANALYSIS, SYNTHESIS AND DESIGN OF CHEMICAL PROCESSES

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*Pearson Education The Leading Integrated Chemical Process Design Guide: Now with New Problems, New Projects, and More* More than ever, effective design is the focal point of sound chemical engineering. Analysis, Synthesis, and Design of Chemical Processes, Third Edition, presents design as a creative process that integrates both the big picture and the small details—and knows which to stress when, and why. Realistic from start to finish, this book moves readers beyond classroom exercises into open-ended, real-world process problem solving. The authors introduce integrated techniques for every facet of the discipline, from finance to operations, new plant design to existing process optimization. This fully updated Third Edition presents entirely new problems at the end of every chapter. It also adds extensive coverage of batch process design, including realistic examples of equipment sizing for batch sequencing; batch scheduling for multi-product plants; improving production via intermediate storage and parallel equipment; and new optimization techniques specifically for batch processes. Coverage includes Conceptualizing and analyzing chemical processes: flow diagrams, tracing, process conditions, and more Chemical process economics: analyzing capital and manufacturing costs, and predicting or assessing profitability Synthesizing and optimizing chemical processing: experience-based principles, BFD/PFD, simulations, and more Analyzing process performance via I/O models, performance curves, and other tools Process troubleshooting and “debottlenecking” Chemical engineering design and society: ethics, professionalism, health, safety, and new “green engineering” techniques Participating successfully in chemical engineering design teams Analysis, Synthesis, and Design of Chemical Processes, Third Edition, draws on nearly 35 years of innovative chemical engineering instruction at West Virginia University. It includes suggested curricula for both single-semester and year-long design courses; case studies and design projects with practical applications; and appendixes with current equipment cost data and preliminary design information for eleven chemical processes—including seven brand new to this edition.

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#### CHEMICAL PROCESS DESIGN AND INTEGRATION

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*John Wiley & Sons* Written by a highly regarded author with industrial and academic experience, this new edition of an established bestselling book provides practical guidance for students, researchers, and those in chemical engineering. The book includes a new section on sustainable energy, with sections on carbon capture and sequestration, as a result of increasing environmental awareness; and a companion website that includes problems, worked solutions, and Excel spreadsheets to enable students to carry out complex calculations.

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#### DYNAMIC FLOWSHEET SIMULATION OF SOLIDS PROCESSES

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*Springer Nature* This book presents the latest advances in flowsheet simulation of solids processes, focusing on the dynamic behaviour of systems with interconnected solids processing units, but also covering stationary simulation. The book includes the modelling of solids processing units, for example for comminution, sifting and particle formulation and also for reaction systems. Furthermore, it examines new approaches for the description of solids and their property distributions and for the mathematical treatment of flowsheets with multivariate population balances.

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#### PROCESS PLANT LAYOUT

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*Butterworth-Heinemann Process Plant Layout, Second Edition*, explains the methodologies used by professional designers to layout process equipment and pipework, plots, plants, sites, and their corresponding environmental features in a safe, economical way. It is supported with tables of separation distances, rules of thumb, and codes of practice and standards. The book includes more than seventy-five case studies on what can go wrong when layout is not properly considered. Sean Moran has thoroughly rewritten and re-illustrated this book to reflect advances in technology and best practices, for example, changes in how designers balance layout density with cost, operability, and safety considerations. The content covers the ‘why’ underlying process design company guidelines, providing a firm foundation for career growth for process design engineers. It is ideal for process plant designers in contracting, consultancy, and for operating companies at all stages of their careers, and is also of importance for operations and maintenance staff involved with a new build, guiding them through plot plan reviews. Based on interviews with over 200 professional process plant designers Explains multiple plant layout methodologies used by professional process engineers, piping engineers, and process architects Includes advice on how to choose and use the latest CAD tools for plant layout Ensures that all methodologies integrate to comply with worldwide risk management legislation

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#### PROCESS SAFETY FOR ENGINEERS

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##### AN INTRODUCTION

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*John Wiley & Sons Process Safety for Engineers* Familiarizes an engineer new to process safety with the concept of process safety management In this significantly revised second edition of *Process Safety for Engineers: An Introduction*, CCPS delivers a comprehensive book showing how Process Safety concepts are used to reduce operational risks. Students, new engineers, and others new to process safety will benefit from this book. In this updated edition, each chapter begins with a detailed incident case study, provides steps that help address issues, and contains problem sets which can be assigned to students. The second edition covers: Process Safety: including an overview of CCPS’ Risk Based Process Safety Hazards: specifically fire and explosion, reactive chemical, and toxicity Design considerations for hazard control: including Hazard Identification and Risk Analysis Management of operational risk: including management of change In addition, the book presents how Process Safety performance is monitored and sustained. The associated online resources are linked to the latest online CCPS resources and lectures.

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#### RULES OF THUMB FOR CHEMICAL ENGINEERS

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##### A MANUAL OF QUICK, ACCURATE SOLUTIONS TO EVERYDAY PROCESS ENGINEERING PROBLEMS

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*Gulf Professional Publishing* The most complete guide of its kind, this is the standard handbook for chemical and process engineers. All new material on fluid flow, long pipe, fractionators, separators and accumulators, cooling towers, gas treating, blending, troubleshooting field cases, gas solubility, and density of irregular solids. This substantial addition of material will also include conversion tables and a new appendix, “Shortcut Equipment Design Methods.” This convenient volume helps solve field engineering problems with its hundreds of common sense techniques, shortcuts, and calculations. Here, in a compact, easy-to-use format, are practical tips, handy formulas, correlations, curves, charts, tables, and shortcut methods that will save engineers valuable time and effort. Hundreds of common sense techniques and calculations help users quickly and accurately solve day-to-day design, operations, and equipment problems.

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#### SELECTED PROBLEMS IN FLUID FLOW AND HEAT TRANSFER

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*MDPI* Fluid flow and heat transfer processes play an important role in many areas of science and engineering, from the planetary scale (e.g., influencing weather and climate) to the microscopic scales of enhancing heat transfer by the use of nanofluids; understood in the broadest possible sense, they also underpin the performance of many energy systems. This topical Special Issue of *Energies* is dedicated to the recent advances in this very broad field. This book will be of interest to readers not only in the fields of mechanical, aerospace, chemical, process and petroleum, energy, earth, civil, and flow instrumentation engineering but, equally, biological and medical sciences, as well as physics and mathematics; that is, anywhere that “fluid flow and heat transfer” phenomena may play an important

role or be a subject of worthy research pursuits.

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## **PROCESS ENGINEERING RENEWAL 2**

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### **RESEARCH**

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*John Wiley & Sons*

## **CHEMICAL ENGINEERING DESIGN**

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### **SI EDITION**

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*Elsevier Chemical Engineering Design* is one of the best-known and most widely adopted texts available for students of chemical engineering. It completely covers the standard chemical engineering final year design course, and is widely used as a graduate text. The hallmarks of this renowned book have always been its scope, practical emphasis and closeness to the curriculum. That it is written by practicing chemical engineers makes it particularly popular with students who appreciate its relevance and clarity. Building on this position of strength the fifth edition covers the latest aspects of process design, operations, safety, loss prevention and equipment selection, and much more. Comprehensive in coverage, exhaustive in detail, and supported by extensive problem sets at the end of each chapter, this is a book that students will want to keep to hand as they enter their professional life. The leading chemical engineering design text with over 25 years of established market leadership to back it up; an essential resource for the compulsory design project all chemical engineering students take in their final year. A complete and trusted teaching and learning package: the book offers a broader scope, better curriculum coverage, more extensive ancillaries and a more student-friendly approach, at a better price, than any of its competitors. Endorsed by the Institution of Chemical Engineers, guaranteeing wide exposure to the academic and professional market in chemical and process engineering.

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## **CHEMICAL PROCESS DESIGN AND SIMULATION: ASPEN PLUS AND ASPEN HYSYS APPLICATIONS**

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*John Wiley & Sons* A comprehensive and example oriented text for the study of chemical process design and simulation. *Chemical Process Design and Simulation* is an accessible guide that offers information on the most important principles of chemical engineering design and includes illustrative examples of their application that uses simulation software. A comprehensive and practical resource, the text uses both Aspen Plus and Aspen Hysys simulation software. The author describes the basic methodologies for computer aided design and offers a description of the basic steps of process simulation in Aspen Plus and Aspen Hysys. The text reviews the design and simulation of individual simple unit operations that includes a mathematical model of each unit operation such as reactors, separators, and heat exchangers. The author also explores the design of new plants and simulation of existing plants where conventional chemicals and material mixtures with measurable compositions are used. In addition, to aid in comprehension, solutions to examples of real problems are included. The final section covers plant design and simulation of processes using nonconventional components. This important resource: Includes information on the application of both the Aspen Plus and Aspen Hysys software that enables a comparison of the two software systems. Combines the basic theoretical principles of chemical process and design with real-world examples. Covers both processes with conventional organic chemicals and processes with more complex materials such as solids, oil blends, polymers and electrolytes. Presents examples that are solved using a new version of Aspen software, ASPEN One 9. Written for students and academics in the field of process design, *Chemical Process Design and Simulation* is a practical and accessible guide to the chemical process design and simulation using proven software.

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## **SEPARATION PROCESS PRINCIPLES WITH APPLICATIONS USING PROCESS SIMULATORS, 4TH EDITION**

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*Wiley Global Education Separation Process Principles with Applications Using Process Simulator, 4th Edition* is the most comprehensive and up-to-date treatment of the major separation operations in the chemical industry. The 4th edition focuses on using process simulators to design separation processes and prepares readers for professional practice. Completely rewritten to enhance clarity, this fourth edition provides engineers with a strong understanding of the field. With the help of an additional co-author, the text presents new information on bioseparations throughout the chapters. A new chapter on mechanical separations covers settling, filtration and centrifugation including mechanical separations in biotechnology and cell lysis. Boxes help highlight fundamental equations. Numerous new examples and exercises are integrated throughout as well.

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## **PRINCIPLES AND CASE STUDIES OF SIMULTANEOUS DESIGN**

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*John Wiley & Sons* There are many comprehensive design books, but none of them provide a significant number of detailed economic design examples of typically complex industrial processes. Most of the current design books cover a wide variety of topics associated with process design. In addition to discussing flowsheet development and equipment design, these textbooks go into a lot of detail on engineering economics and other many peripheral subjects such as written and oral skills, ethics, "green" engineering and product design. This book presents general process design principles in a concise readable form that can be easily comprehended by students and engineers when developing effective flow sheet and control structures. Ten detailed case studies presented illustrate an in-depth and quantitative way the application of these general principles. Detailed economic steady-state designs are developed that satisfy economic criterion such as minimize total annual cost of both capital and energy or return on incremental capital investment. Complete detailed flow sheets and Aspen Plus files are provided. Then conventional PI control structures are developed and tested for their ability to maintain product quality during disturbances. Complete Aspen Dynamics files are provided of the dynamic simulations.

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## **CHEMICAL ENGINEERING DESIGN PROJECT**

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### **A CASE STUDY APPROACH, SECOND EDITION**

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*CRC Press* This new edition follows the original format, which combines a detailed case study - the production of phthalic anhydride - with practical advice and comprehensive background information. Guiding the reader through all major aspects of a chemical engineering design, the text includes both the initial technical and economic feasibility study as well as the detailed design stages. Each aspect of the design is illustrated with material from an award-winning student design project. The book embodies the "learning by doing" approach to design. The student is directed to appropriate information sources and is encouraged to make decisions at each stage of the design process rather than simply following a design method. Thoroughly revised, updated, and expanded, the accompanying text includes developments in important areas and many new references.

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## **GUIDELINES FOR ENGINEERING DESIGN FOR PROCESS SAFETY**

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*John Wiley & Sons* This updated version of one of the most popular and widely used CCPS books provides plant design engineers, facility operators, and safety professionals with key information on selected topics of interest. The book focuses on process safety issues in the design of chemical, petrochemical, and hydrocarbon processing facilities. It discusses how to select designs that can prevent or mitigate the release of flammable or toxic materials, which could lead to fire, explosion, or environmental damage. Key areas to be enhanced in the new edition include inherently safer design, specifically concepts for design of inherently safer unit operations and Safety Instrumented Systems and Layer of Protection Analysis. This book also provides an extensive bibliography to related publications and topic-specific information, as well as key information on failure modes and potential design solutions.

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## **ONTOCAPE**

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### **A RE-USABLE ONTOLOGY FOR CHEMICAL PROCESS ENGINEERING**

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*Springer Science & Business Media* Motivation for this Book Ontologies have received increasing attention over the last two decades. Their roots can be traced back to the ancient philosophers, who were interested in a conceptualization of the world. In the more recent past, ontologies and ontological engineering have evolved in computer science, building on various roots such as logics, knowledge representation, information modeling and management, and (knowledge-based) information systems. Most recently, largely driven by the next generation internet, the so-called Semantic Web, ontological software engineering has developed into a scientific field of its own, which puts particular emphasis on the theoretical foundations of representation and reasoning, and on the methods and tools required for building ontology-based software applications in diverse domains. Though this field is largely dominated by computer science, close relationships have been established with its diverse areas of application, where researchers are interested in exploiting the results of ontological software engineering, particularly to build large knowledge-intensive applications at high productivity and low maintenance effort. Consequently, a large number of scientific papers and monographs have been published in the very recent past dealing with the theory and practice of ontological software engineering. So far, the majority of those books are dedicated to the theoretical foundations of ontologies, including philosophical treatises and their relationships to established methods in information systems and ontological software engineering.

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## **COULSON & RICHARDSON'S CHEMICAL ENGINEERING**

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*Chemical Engineering Volume 2* covers the properties of particulate systems, including the character of individual particles and their behaviour in fluids. Sedimentation of particles, both singly and at high concentrations, flow in packed and fluidised beds and filtration are then examined. The latter part of the book deals with separation processes, such as distillation and gas absorption, which illustrate applications of the fundamental principles of mass transfer introduced in *Chemical Engineering Volume 1*. In conclusion, several techniques of growing importance - adsorption, ion exchange, chromatographic and membrane separations, and process intensification - are described. \* A logical progression of chemical engineering concepts, volume 2 builds on fundamental principles contained in *Chemical Engineering volume 1* and these volumes are fully cross-referenced \* Reflects the growth in complexity and stature of chemical engineering over the last few years \* Supported with further reading at the end of each chapter and graded problems at the end of the book

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## **PROCESS ANALYSIS AND SIMULATION IN CHEMICAL ENGINEERING**

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*Springer* This book offers a comprehensive coverage of process simulation and flowsheeting, useful for undergraduate students of Chemical Engineering and Process Engineering as theoretical and practical support in Process Design, Process Simulation, Process Engineering, Plant Design, and Process Control courses. The main concepts related to process simulation and application tools are presented and discussed in the framework of typical problems found in engineering design. The topics presented in the chapters are organized in an inductive way, starting from the more simplistic simulations up to some complex problems.

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## MASS BALANCES FOR CHEMICAL ENGINEERS

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*Walter de Gruyter GmbH & Co KG* This textbook summarizes the fundamentals of mass balance relevant for chemical engineers and an easy and comprehensive manner. Plenty of example calculations, schemes and flow diagrams facilitate the understanding. Case studies from relevant topics such as sustainable chemistry illustrate the theory behind current applications.

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## CHEMICAL REACTOR DESIGN AND CONTROL

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*John Wiley & Sons* Chemical Reactor Design and Control uses process simulators like Matlab®, Aspen Plus, and Aspen Dynamics to study the design of chemical reactors and their dynamic control. There are numerous books that focus on steady-state reactor design. There are no books that consider practical control systems for real industrial reactors. This unique reference addresses the simultaneous design and control of chemical reactors. After a discussion of reactor basics, it: Covers three types of classical reactors: continuous stirred tank (CSTR), batch, and tubular plug flow Emphasizes temperature control and the critical impact of steady-state design on the dynamics and stability of reactors Covers chemical reactors and control problems in a plantwide environment Incorporates numerous tables and shows step-by-step calculations with equations Discusses how to use process simulators to address diverse issues and types of operations This is a practical reference for chemical engineering professionals in the process industries, professionals who work with chemical reactors, and students in undergraduate and graduate reactor design, process control, and plant design courses.

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## CHEMICAL PROCESS ENGINEERING

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### DESIGN AND ECONOMICS

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*CRC Press* Chemical Process Engineering presents a systematic approach to solving design problems by listing the needed equations, calculating degrees-of-freedom, developing calculation procedures to generate process specifications- mostly pressures, temperatures, compositions, and flow rates- and sizing equipment. This illustrative reference/text tabulates numerous easy-to-follow calculation procedures as well as the relationships needed for sizing commonly used equipment.

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## CHEMICAL ENGINEERING DESIGN

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### CHEMICAL ENGINEERING

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*Elsevier* Chemical Engineering Design is one of the best-known and widely adopted texts available for students of chemical engineering. It deals with the application of chemical engineering principles to the design of chemical processes and equipment. Revised throughout, the fourth edition covers the latest aspects of process design, operations, safety, loss prevention and equipment selection, among others. Comprehensive and detailed, the book is supported by problems and selected solutions. In addition the book is widely used by professionals as a day-to-day reference. Best selling chemical engineering text Revised to keep pace with the latest chemical industry changes; designed to see students through from undergraduate study to professional practice End of chapter exercises and solutions

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## PRODUCT-DRIVEN PROCESS DESIGN

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### FROM MOLECULE TO ENTERPRISE

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*Walter de Gruyter GmbH & Co KG* Product-driven process design – from molecule to enterprise provides process engineers and process engineering students with access to a modern and stimulating methodology to process and product design. Throughout the book the links between product design and process design become evident while the reader is guided step-by-step through the different stages of the intertwining product and process design activities. Both molecular and enterprise-wide considerations in design are introduced and addressed in detail. Several examples and case studies in emerging areas such as bio- and food-systems, pharmaceuticals and energy are discussed and presented. This book is an excellent guide and companion for undergraduate, graduate students as well as professional practitioners.

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## BIODIESEL

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### FROM PRODUCTION TO COMBUSTION

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*Springer* This book presents in-depth information on the state of the art of global biodiesel production and investigates its impact on climate change. Subsequently, it comprehensively discusses biodiesel production in terms of production systems (reactor technologies) as well as biodiesel purification and upgrading technologies. Moreover, the book reviews essential parameters in biodiesel production systems as well as major principles of operation, process control, and trouble-shooting in these systems. Conventional and emerging applications of biodiesel by-products with a view to further economize biodiesel production are also scrutinized. Separate chapters are dedicated to economic risk analysis and critical comparison of biodiesel production systems as well as techno-economical aspects of biodiesel plants. The book also thoroughly investigates the important aspects of biodiesel production and combustion by taking advantage of advanced sustainability analysis tools including life cycle assessment (LCA) and exergy techniques. In closing, the application of Omics technologies in biodiesel production is presented and discussed. This book is relevant to anyone with an interest in renewable, more sustainable fuel and energy solutions.

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## NANOTECHNOLOGY FOR CHEMICAL ENGINEERS

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*Springer* The book describes the basic principles of transforming nano-technology into nano-engineering with a particular focus on chemical engineering fundamentals. This book provides vital information about differences between descriptive technology and quantitative engineering for students as well as working professionals in various fields of nanotechnology. Besides chemical engineering principles, the fundamentals of nanotechnology are also covered along with detailed explanation of several specific nanoscale processes from chemical engineering point of view. This information is presented in form of practical examples and case studies that help the engineers and researchers to integrate the processes which can meet the commercial production. It is worth mentioning here that, the main challenge in nanostructure and nanodevices production is nowadays related to the economic point of view. The uniqueness of this book is a balance between important insights into the synthetic methods of nano-structures and nanomaterials and their applications with chemical engineering rules that educates the readers about nanoscale process design, simulation, modelling and optimization. Briefly, the book takes the readers through a journey from fundamentals to frontiers of engineering of nanoscale processes and informs them about industrial perspective research challenges, opportunities and synergism in chemical Engineering and nanotechnology. Utilising this information the readers can make informed decisions on their career and business.

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## CHEMICAL ENGINEERING: SOLUTIONS TO THE PROBLEMS IN VOLUME 1

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*Elsevier* This volume in the Coulson and Richardson series in chemical engineering contains full worked solutions to the problems posed in volume 1. Whilst the main volume contains illustrative worked examples throughout the text, this book contains answers to the more challenging questions posed at the end of each chapter of the main text. These questions are of both a standard and non-standard nature, and so will prove to be of interest to both academic staff teaching courses in this area and to the keen student. Chemical engineers in industry who are looking for a standard solution to a real-life problem will also find the book of considerable interest. \* An invaluable source of information for the student studying the material contained in Chemical Engineering Volume 1 \* A helpful method of learning - answers are explained in full

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## CHEMICAL PROCESS MODELLING AND COMPUTER SIMULATION

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*PHI Learning Pvt. Ltd.* This comprehensive and thoroughly revised text, now in its second edition, continues to present the fundamental concepts of how mathematical models of chemical processes are constructed and demonstrate their applications to the simulation of two of the very important chemical engineering systems: the chemical reactors and distillation systems. The book provides an integrated treatment of process description, mathematical modelling and dynamic simulation of realistic problems, using the robust process model approach and its simulation with efficient numerical techniques. Theoretical background materials on activity coefficient models, equation of state models, reaction kinetics, and numerical solution techniques—needed for the development of mathematical models—are also addressed in the book. The topics of discussion related to tanks, heat exchangers, chemical reactors (both continuous and batch), biochemical reactors (continuous and fed-batch), distillation columns (continuous and batch), equilibrium flash vaporizer, and refinery debutanizer column contain several worked-out examples and case studies to teach students how chemical processes can be measured and monitored using computer programming. The new edition includes two more chapters—Reactive Distillation Column and Vaporizing Exchangers—which will further strengthen the text. This book is designed for senior level undergraduate and first-year postgraduate level courses in “Chemical Process Modelling and Simulation”. The book will also be useful for students of petrochemical engineering, biotechnology, and biochemical engineering. It can serve as a guide for research scientists and practising engineers as well.

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## BIOSEPARATIONS SCIENCE AND ENGINEERING

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*Oxford University Press* Designed for undergraduates, graduate students, and industry practitioners, Bioseparations Science and Engineering fills a critical need in the field of bioseparations. Current, comprehensive, and concise, it covers bioseparations unit operations in unprecedented depth. In each of the chapters, the authors use a consistent method of explaining unit operations, starting with a qualitative description noting the significance and general application of the unit operation. They then illustrate the scientific application of the operation, develop the required mathematical theory, and finally, describe the applications of the theory in engineering practice, with an emphasis on design and scaleup. Unique to this text is a chapter dedicated to bioseparations process design and economics, in which a process simulator, SuperPro Designer® is used to analyze and evaluate the production of three important biological products. New to this second edition are updated discussions of moment analysis, computer simulation, membrane chromatography, and evaporation, among others, as well as revised problem sets. Unique features include basic information about bioproducts and engineering analysis and a chapter with bioseparations laboratory exercises. Bioseparations Science and Engineering is ideal for students and professionals working in or studying bioseparations, and is the premier text in the field.

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## SUSTAINABLE UTILITY SYSTEMS

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### MODELLING AND OPTIMISATION

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*Walter de Gruyter GmbH & Co KG* This book provides a thorough guidance on maximizing the performance of utility systems in terms of sustainability. It covers general structure, typical components and

efficiency trends, and applications such as top-level analysis for steam pricing and selection of processes for improved heat integration. Examples are provided to illustrate the discussed models and methods to give sufficient learning experience for the reader.

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### INTEGRATED DESIGN AND SIMULATION OF CHEMICAL PROCESSES

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*Elsevier* This comprehensive work shows how to design and develop innovative, optimal and sustainable chemical processes by applying the principles of process systems engineering, leading to integrated sustainable processes with 'green' attributes. Generic systematic methods are employed, supported by intensive use of computer simulation as a powerful tool for mastering the complexity of physical models. New to the second edition are chapters on product design and batch processes with applications in specialty chemicals, process intensification methods for designing compact equipment with high energetic efficiency, plantwide control for managing the key factors affecting the plant dynamics and operation, health, safety and environment issues, as well as sustainability analysis for achieving high environmental performance. All chapters are completely rewritten or have been revised. This new edition is suitable as teaching material for Chemical Process and Product Design courses for graduate MSc students, being compatible with academic requirements world-wide. The inclusion of the newest design methods will be of great value to professional chemical engineers. Systematic approach to developing innovative and sustainable chemical processes Presents generic principles of process simulation for analysis, creation and assessment Emphasis on sustainable development for the future of process industries

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### CHEMICAL PROCESS EQUIPMENT

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#### DESIGN AND DRAWING (VOLUME I), SECOND EDITION

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*PHI Learning Pvt. Ltd.* This text introduces the students and practicing engineers to the practices and standards of drafting the equipment used in chemical, food processing, polymer engineering, and pharmaceuticals processing industries. The textbook follows the Bureau of Indian Standards BIS 696-1972 specifications and methodology of equipment drawing. It introduces to the symbolic representations of the equipment as used in the chemical, food processing and pharma industries. It provides the detailed drawings of some commonly used equipment that are repeatedly used in different sizes and shapes. Orthographic and assembled views are illustrated. Several assignments have been suggested for practicing the drawing. In this second edition, a new chapter on computerized drawing method has been introduced. For this solid edge software has been used. Though the software itself guides the readers through the making of drawing of the parts and their assemblies, guidelines to use software is also given. The text is intended for the undergraduate students of chemical and its related branches such as polymer engineering, petroleum engineering and pipeline engineering.

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### CHEMICAL ENGINEERING PROCESS SIMULATION

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*Elsevier* Chemical Engineering Process Simulation, Second Edition guides users through chemical processes and unit operations using the main simulation software used in the industrial sector. The book helps predict the characteristics of a process using mathematical models and computer-aided process simulation tools, as well as how to model and simulate process performance before detailed process design takes place. Content coverage includes steady-state and dynamic simulation, process design, control and optimization. In addition, readers will learn about the simulation of natural gas, biochemical, wastewater treatment and batch processes. Provides an updated and expanded new edition that contains 60-70% new content Guides readers through chemical processes and unit operations using the primary simulation software used in the industrial sector Covers the fundamentals of process simulation, theory and advanced applications Includes case studies of various difficulty levels for practice and for applying developed skills Features step-by-step guides to using UniSim Design, SuperPro Designer, Symmetry, Aspen HYSYS and Aspen Plus for process simulation novices

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### VISIONS AND CONCEPTS FOR EDUCATION 4.0

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#### PROCEEDINGS OF THE 9TH INTERNATIONAL CONFERENCE ON INTERACTIVE COLLABORATIVE AND BLENDED LEARNING (ICBL2020)

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*Springer Nature* This book contains papers in the fields of Interactive, Collaborative, and Blended Learning; Technology-Supported Learning; Education 4.0; Pedagogical and Psychological Issues. With growing calls for affordable and quality education worldwide, we are currently witnessing a significant transformation in the development of post-secondary education and pedagogical practices. Higher education is undergoing innovative transformations to respond to our urgent needs. The change is hastened by the global pandemic that is currently underway. The 9th International Conference on Interactive, Collaborative, and Blended Learning: Visions and Concepts for Education 4.0 was conducted in an online format at McMaster University, Canada, from 14th to 15th October 2020, to deliberate and share the innovations and strategies. This conference's main objectives were to discuss guidelines and new concepts for engineering education in higher education institutions, including emerging technologies in learning; to debate new conference format in worldwide pandemic and post-pandemic conditions; and to discuss new technology-based tools and resources that drive the education in non-traditional ways such as Education 4.0. Since its beginning in 2007, this conference is devoted to new learning approaches with a focus on applications and experiences in the fields of interactive, collaborative, and blended learning and related new technologies. Currently, the ICBL conferences are forums to exchange recent trends, research findings, and disseminate practical experiences in collaborative and blended learning, and engineering pedagogy. The conference bridges the gap between 'pure' scientific research and the everyday work of educators. Interested readership includes policymakers, academics, educators, researchers in pedagogy and learning theory, school teachers, industry-centric educators, continuing education practitioners, etc.

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### PROCESS PLANT EQUIPMENT

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#### OPERATION, CONTROL, AND RELIABILITY

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*John Wiley & Sons* "Process Plant Equipment Book is another great publication from Wiley as a reference book for final year students as well as those who will work or are working in chemical production plants and refinery..." -Associate Prof. Dr. Ramli Mat, Deputy Dean (Academic), Faculty of Chemical Engineering, Universiti Teknologi Malaysia "...give[s] readers access to both fundamental information on process plant equipment and to practical ideas, best practices and experiences of highly successful engineers from around the world... The book is illustrated throughout with numerous black & white photos and diagrams and also contains case studies demonstrating how actual process plants have implemented the tools and techniques discussed in the book. An extensive list of references enables readers to explore each individual topic in greater depth..." -Stainless Steel World and Valve World, November 2012 Discover how to optimize process plant equipment, from selection to operation to troubleshooting From energy to pharmaceuticals to food, the world depends on processing plants to manufacture the products that enable people to survive and flourish. With this book as their guide, readers have the information and practical guidelines needed to select, operate, maintain, control, and troubleshoot process plant equipment so that it is efficient, cost-effective, and reliable throughout its lifetime. Following the authors' careful explanations and instructions, readers will find that they are better able to reduce downtime and unscheduled shutdowns, streamline operations, and maximize the service life of processing equipment. Process Plant Equipment: Operation, Control, and Reliability is divided into three sections: Section One: Process Equipment Operations covers such key equipment as valves, pumps, cooling towers, conveyors, and storage tanks Section Two: Process Plant Reliability sets forth a variety of tested and proven tools and methods to assess and ensure the reliability and mechanical integrity of process equipment, including failure analysis, Fitness-for-Service assessment, engineering economics for chemical processes, and process component function and performance criteria Section Three: Process Measurement, Control, and Modeling examines flow meters, process control, and process modeling and simulation Throughout the book, numerous photos and diagrams illustrate the operation and control of key process equipment. There are also case studies demonstrating how actual process plants have implemented the tools and techniques discussed in the book. At the end of each chapter, an extensive list of references enables readers to explore each individual topic in greater depth. In summary, this text offers students, process engineers, and plant managers the expertise and technical support needed to streamline and optimize the operation of process plant equipment, from its initial selection to operations to troubleshooting.

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### INTEGRATED AND HYBRID PROCESS TECHNOLOGY FOR WATER AND WASTEWATER TREATMENT

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*Elsevier* Tackling the issue of water and wastewater treatment nowadays requires novel approaches to ensure that sustainable development can be achieved. Water and wastewater treatment should not be seen only as an end-of-pipe solution but instead the approach should be more holistic and lead to a more sustainable process. This requires the integration of various methods/processes to obtain the most optimized design. Integrated and Hybrid Process Technology for Water and Wastewater Treatment discusses the state-of-the-art development in integrated and hybrid treatment processes and their applications to the treatment of a vast variety of water and wastewater sources. The approaches taken in this book are categorized as (i) resources recovery and consumption, (ii) optimal performance, (iii) physical and environmental footprints, (iv) zero liquid discharge concept and (v) regulation-driven. Through these categories, readers will see how such an approach could benefit the water and wastewater industry. Each chapter discusses challenges and prospects of an integrated treatment process in achieving sustainable development. This book serves as a platform to provide ideas and to bridge the gap between laboratory-scale research and practical industry application. Includes comprehensive coverage on integrated and hybrid technology for water and wastewater treatment Takes a new approach in looking at how water and wastewater treatment contributes to sustainable development Provides future direction of research in sustainable water and wastewater treatment

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### COULSON AND RICHARDSON'S CHEMICAL ENGINEERING

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#### VOLUME 2A: PARTICULATE SYSTEMS AND PARTICLE TECHNOLOGY

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*Butterworth-Heinemann* Coulson and Richardson's Chemical Engineering: Volume 2A: Particulate Systems and Particle Technology, Sixth Edition, has been fully revised and updated to provide practitioners with an overview of chemical engineering, including clear explanations of theory and thorough coverage of practical applications, all supported by case studies. A worldwide team of contributors has pooled their experience to revise old content and add new content. The content has been updated to be more useful to practicing engineers. This complete reference to chemical engineering will support you throughout your career, as it covers every key chemical engineering topic. Fluid Flow, Heat Transfer and Mass Transfer has been developed from the series' volume 1, 6th edition. This volume covers the three main transport processes of interest to chemical engineers: momentum transfer (fluid flow), heat transfer and mass transfer and the relationships between them. Particulate Systems and Particle Technology has been developed from the series' volume 2, 5th edition. This volume covers the properties of particulate systems, including the character of individual particles and their behavior in fluids. Sedimentation of particles, both singly and at high concentrations, flow in packed and fluidized beds and filtration are then examined. Separation Processes has been developed from the series' volume 2, 5th edition. This volume covers distillation and gas absorption, which illustrate applications of the fundamental principles of mass transfer. Several techniques-adsorption, ion exchange, chromatographic and membrane separations, and process intensification-are described. Chemical and Biochemical Reactors and Reaction Engineering has been developed from the series' volume 3, 3rd edition. Features fully revised reference material converted from textbooks Covers foundational to technical topics Features emerging applications, numerical methods and computational tools

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### GREEN CHEMISTRY IN THE PHARMACEUTICAL INDUSTRY

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*John Wiley & Sons* Edited by three of the world's leading pharmaceutical scientists, this is the first book on this important and hot topic, containing much previously unpublished information. As such, it covers all aspects of green chemistry in the pharmaceutical industry, from simple molecules to complex proteins, and from drug discovery to the fate of pharmaceuticals in the environment. Furthermore,

this ready reference contains several convincing case studies from industry, such as Taxol, Pregabalin and Crestor, illustrating how this multidisciplinary approach has yielded efficient and environmentally-friendly processes. Finally, a section on technology and tools highlights the advantages of green chemistry.

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**CHEMICAL PROCESS RETROFITTING AND REVAMPING**

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**TECHNIQUES AND APPLICATIONS**

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*John Wiley & Sons* The proposed book will be divided into three parts. The chapters in Part I provide an overview of certain aspect of process retrofitting. The focus of Part II is on computational techniques for solving process retrofit problems. Finally, Part III addresses retrofit applications from diverse process industries. Some chapters in the book are contributed by practitioners whereas others are from academia. Hence, the book includes both new developments from research and also practical considerations. Many chapters include examples with realistic data. All these feature make the book useful to industrial engineers, researchers and students.

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**ACTIVATED CARBON**

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**CLASSIFICATIONS, PROPERTIES AND APPLICATIONS**

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*Nova Science Pub Incorporated* This book presents topical research in the study of activated carbon, which includes topics such as the surface chemistry of activated carbons and as catalyst supports; thermal processing of activated carbons from agro-industrial wastes; activated carbon as a metal oxide support; Virtual Porous Carbon (VPC) models and combining ozone and activated carbon for water and wastewater treatment.

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**CATALYSIS IN THE REFINING OF FISCHER-TROPSCH SYNCRUDE**

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*Royal Society of Chemistry* The first book to provide a review of the literature on the catalysis needed to refine syncrude to transportation fuels.