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Engineering  
Process Design  
Economics A***

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# ***Practical Guide***

least, the author wishes to thank his constantly helpful wife Maggie and his secretary Pat Weimer; the former for her patience, encouragement, and

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for acting as a sounding-board,  
and the latter who toiled  
endlessly, cheerfully, and most  
competently on the book's  
preparation. CONTENTS

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This reference outlines the

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fundamental concepts and strategies for economic assessments for informed management decisions in industry. The book illustrates how to prepare capital cost and operating expense estimates,

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profitability analyses, and feasibility studies, and how to execute sensitivity and uncertainty assessments. From financial reports to opportunity costs and engineering trade-offs, Process Engineering Economics

# Online Library Chemical Engineering Process Design Economics A Practical Guide

considers a wide range of alternatives for profitable investing and for projecting outcomes in various chemical and engineering fields. It also explains how to monitor costs, finances, and economic

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limitations at every stage of  
chemical project design,  
preparation, and evaluation.  
Product-driven process design –  
from molecule to enterprise  
provides process engineers and  
process engineering students

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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-

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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

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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



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professional practitioners.

Sustainable process engineering is a methodology to design new and redesign existing processes that follow the principles of green chemistry and green engineering, and ultimately

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contribute to a sustainable development. The newest achievements of chemical engineering, opened new opportunities to design more efficient, safe, compact and environmentally benign chemical

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processes. The book provides a guide to sustainable process design applicable in various industrial fields. • Discusses the topic from a wide angle: chemistry, materials, processes, and equipment. • Includes state-

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of-the-art research achievements that are yet to be industrially implemented. • Transfers knowledge between chemists and chemical engineers. • QR codes direct the readers to animations, short videos,

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magazines, and blogs on specific topics • Worked examples deepen the understanding of the sustainable assessment of chemical manufacturing processes

## Industrial Chemical Process

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Analysis and Design  
Chemical Engineering Design  
Project  
Design And Economics  
Chemical Process Engineering  
Fortran Programs for Chemical  
Process Design, Analysis, and

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Economics A Practical Guide  
Simulation

Perry's Chemical Engineers'  
Handbook, 9th Edition

**Process Plant Design provides an introduction to the basic principles of plant design and shows how the fundamentals of design can be**

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**blended with commercial aspects to produce a final specification; how textbook parameters can be applied to the solution of real problems; and how training in chemical engineering can best be utilized in the industrial sphere. It has been assumed that the reader**



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**knows how to calculate a heat transfer coefficient and the height of an absorber, for example, and the bulk of the book is concerned with the translation of such parameters into plant items which are ultimately linked into the production unit. The book follows a**

**fairly logical sequence in which flowsheets, heat and mass balances, for example, are considered before attention is paid to the design of plant items, exchangers, columns, and so on. Because of the vital role of economics in any design function,**

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**costing is dealt with early in the book and the principles further developed as appropriate. Rarely is the plant designer concerned with the design of smaller and standard items of equipment, and hence considerable emphasis is placed on the selection of such items. This**

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**section may prove of particular value to the engineer in industry, especially if he has not the backing of comprehensive technical manuals produced by the larger companies. Finally, an attempt is made to draw together the many facets of equipment design into**

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**one specification for the complete plant, and the many aspects relating to the completed unit are introduced in a final section.**

**"The book provides the whole horizon of process engineering and plant design from concept phase through the execution to**

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**commissioning of the plant in the real practice. Providing a complete industrial perspective. The book covers the pertinent guidelines and standards and how engineering documents are generated using these standards with topics as Hazardous Area Classification,**

**Relief System Design, Revamp  
Engineering, Interaction with Other  
Disciplines, and Pre-  
commissioning and  
Commissioning. The concepts are  
supported by illustrated practical  
examples. It also deals with  
decision making processes on**

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**strategic level, management tasks  
and leading functions beside the  
technical know-how"--**

**There are many comprehensive  
design books, but none of them  
provide a significant number of  
detailed economic design  
examples of typically complex**



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**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**

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**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**

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**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 be developed and tested for their ability to maintain product**

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**quality during disturbances.**

**Complete Aspen Dynamics files are  
be provided of the dynamic  
simulations.**

**This book gives engineers the  
fundamental theories, equations,  
and computer programs (including  
source codes) that provide a ready**

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**way to analyze and solve a wide  
range of process engineering  
problems.**

**Chemical Engineering Design  
Process Synthesis  
Chemical Projects Scale Up  
Basic Concepts for Novices**

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**From Molecule to Enterprise**

*Notes and methods useful for  
chemical engineering students in  
process design.*

*Development of a new chemical plant  
or process from concept evaluation to  
profitable reality is often an*

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*enormously complex problem.*

*Generally, a plant-design project moves to completion through a series of stages which may include inception, preliminary evaluation of economics and market, data development for a final design, final*



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*economic evaluation, detailed engineering design, procurement, erection, startup, and production. The general term plant design includes all of the engineering aspects involved in the development of either a new, modified, or expanded industrial*

*plant. In this context, individuals involved in such work will be making economic evaluations of new processes, designing individual pieces of equipment for the proposed new ventures, or developing a plant layout for coordination of the overall*

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*operation. Because of the many design duties encountered, the engineer involved is many times referred to as a design engineer. If the latter specializes in the economic aspects of the design, the individual may be referred to as a cost engineer.*

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*On the other hand, if he or she emphasizes the actual design of the equipment and facilities necessary for carrying out the process, the individual may be referred to as a process design engineer. The material presented in this book is intended to*

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*aid the latter in developing rapid  
chemical designs without becoming  
unduly involved in the often  
complicated theoretical underpinnings  
of these useful notes, charts, tables,  
and equations.*

*The Leading Integrated Chemical*

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*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*

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*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*

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*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.*



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*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*

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*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*

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*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,*

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*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*

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*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-*

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*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*

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Economics A Practical Guide  
*brand new to this edition.*

*Engineers often find themselves  
tasked with the difficult challenge of  
developing a design that is both  
technically and economically feasible.  
A sharply focused, how-to book,  
Engineering Economics and*

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Engineering Process Design  
Economics A Practical Guide

*Economic Design for Process Engineers provides the tools and methods to resolve design and economic issues. It helps you integrate technical and economic decision making, creating more profit and growth for your organization. The*



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*book puts methods that are simple, fast, and inexpensive within easy reach. Author Thane Brown sets the stage by explaining the engineer's role in the creation of economically feasible projects. He discusses the basic economics of projects — how*

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*they are funded, what kinds of investments they require, how revenues, expenses, profits, and risks are interrelated, and how cash flows into and out of a company. In the engineering economics section of the book, Brown covers topics such as*

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*present and future values, annuities,  
interest rates, inflation, and inflation  
indices. He details how to create order-  
of-magnitude and study grade  
estimates for the investments in a  
project and how to make study grade  
production cost estimates. Against this*

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*backdrop, Brown explores a unique scheme for producing an Economic Design. He demonstrates how using the Economic Design Model brings increased economic thinking and rigor into the early parts of design, the time in a project's life when its cost*

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*structure is being set and when the engineer's impact on profit is greatest. The model emphasizes three powerful new tools that help you create a comprehensive design option list. When the model is used early in a project, it can drastically lower both*

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*capital and production costs. The book's uniquely industrial focus presents topics as they would happen in a real work situation. It shows you how to combine technical and economic decision making to create economically optimum designs and*

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*increase your impact on profit and growth, and, therefore, your importance to your organization. Using these time-tested techniques, you can design processes that cost less to build and operate, and improve your company's profit.*

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***Chemical Engineering Design and  
Analysis  
A Practical Guide  
A Guide to Chemical Engineering  
Process Design and Economics  
Design, Integration and Sustainability  
Analysis***



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*Plant Design and Economics for  
Chemical Engineers*

*Biorefineries and Chemical Processes*

*This work has been  
selected by scholars as  
being culturally  
important and is part of*

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*Upper-level*

*undergraduate text for  
process design courses  
in chemical engineering.  
Introduces students to  
the technology and  
terminology they will*

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*encounter in industrial practice. Presents short-cut techniques for specifying equipment or isolating important elements of a design project. Emphasizes*



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*project definition, flow sheet development and equipment specification. Covers the economics of process design. End-of-chapter exercises guide students through step-by-*

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*step solutions of design problems. Includes four case studies from past AICHE competitions.*

*This highly recommended book on transport phenomena shows readers*

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*how to develop  
mathematical  
representations (models)  
of physical phenomena.  
The key elements in  
model development  
involve assumptions*

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*about the physics, the  
application of basic  
physical principles, the  
exploration of the  
implications of the  
resulting model, and the  
evaluation of the degree*

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*to which the model  
mimics reality. This  
book also expose readers  
to the wide range of  
technologies where their  
skills may be applied.*

*Chemical Engineering*

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*Process Design and  
Economics A Practical  
Guide* Process Publishing  
Company Chemical  
Engineering  
Design Principles,  
Practice and Economics

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Economics A Practical Guide  
*of Plant and Process Design*  
Butterworth-Heinemann  
Chemical Engineering  
Process Design and  
Economics  
An Introduction to Mass  
and Heat Transfer

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*Chemical Process*

*Economics*

*Systematic Methods of  
Chemical Process Design*

*Chemical Engineering*

*Economics*

*Chemical Process Design*



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*and Integration*

CHEMICAL PROCESS

ENGINEERING Written by one  
of the most prolific and respected  
chemical engineers in the world  
and his co-author, also a well-  
known and respected engineer,

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this two-volume set is the “new standard” in the industry, offering engineers and students alike the most up-to-date, comprehensive, and state-of-the-art coverage of processes and best practices in the field today.

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This new two-volume set explores and describes integrating new tools for engineering education and practice for better utilization of the existing knowledge on process design. Useful not only

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for students, university professors, and practitioners, especially process, chemical, mechanical and metallurgical engineers, it is also a valuable reference for other engineers, consultants, technicians and

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scientists concerned about various aspects of industrial design. The text can be considered as complementary to process design for senior and graduate students as well as a hands-on reference work or

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refresher for engineers at entry  
level. The contents of the book  
can also be taught in intensive  
workshops in the oil, gas,  
petrochemical, biochemical and  
process industries. The book  
provides a detailed description

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and hands-on experience on process design in chemical engineering, and it is an integrated text that focuses on practical design with new tools, such as Microsoft Excel spreadsheets and UniSim

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simulation software. Written by two of the industry's most trustworthy and well-known authors, this book is the new standard in chemical, biochemical, pharmaceutical, petrochemical and petroleum



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refining. Covering design,  
analysis, simulation, integration,  
and, perhaps most importantly,  
the practical application of  
Microsoft Excel-UniSim software,  
this is the most comprehensive  
and up-to-date coverage of all of

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the latest developments in the industry. It is a must-have for any engineer or student's library.

The fifth edition of Plant Design and Economics for Chemical Engineers is a major revision of the popular fourth edition. There

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are new chapters on process synthesis, computer-aided design, and design of chemical reactors. A traditionally strong feature of the text, economic analysis, has been revamped and updated. Another strength,

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equipment sizing and cost estimation, is updated and expanded as well. These improvements also reflect changes in equipment availability. The numerous real examples throughout the book

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include computer or hand solutions, and often both. There is a new increased emphasis on computer use in design, economic evaluation, and optimization. Concepts, strategies, and approaches to

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computer use are featured.

These concepts are not tied to particular software programs and therefore apply to wide a range of applications software, of both current and future release. This widely used text is now more

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useful than ever, providing a one-stop basic guide to chemical process design and evaluation. As the range of feedstocks, process technologies and products expand, biorefineries will become increasingly

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complex manufacturing systems.  
Biorefineries and Chemical  
Processes: Design, Integration  
and Sustainability Analysis  
presents process modelling and  
integration, and whole system  
life cycle analysis tools for the



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synthesis, design, operation and  
sustainable development of  
biorefinery and chemical  
processes. Topics covered  
include: Introduction: An  
introduction to the concept and  
development of biorefineries.

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Tools: Included here are the methods for detailed economic and environmental impact analyses; combined economic value and environmental impact analysis; life cycle assessment (LCA); multi-criteria analysis;

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heat integration and utility system design; mathematical programming based optimization and genetic algorithms. Process synthesis and design: Focuses on modern unit operations and innovative process flowsheets.

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Discusses thermochemical and biochemical processing of biomass, production of chemicals and polymers from biomass, and processes for carbon dioxide capture.

Biorefinery systems: Presents

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biorefinery process synthesis  
using whole system analysis.  
Discusses bio-oil and algae  
biorefineries, integrated fuel cells  
and renewables, and  
heterogeneous catalytic reactors.  
Companion website: Four case

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studies, additional exercises and  
examples are available online,  
together with three  
supplementary chapters which  
address waste and emission  
minimization, energy storage and  
control systems, and the

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optimization and reuse of water.

This textbook is designed to bridge a gap between engineering design and sustainability assessment, for advanced students and practicing process designers and

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engineers.

Written for those less comfortable with science and mathematics, this text introduces the major chemical engineering topics for non-chemical engineers. With a focus on the



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practical rather than the theoretical, the reader will obtain a foundation in chemical engineering that can be applied directly to the workplace. By the end of this book, the user will be aware of the major

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considerations required to safely and efficiently design and operate a chemical processing facility. Simplified accounts of traditional chemical engineering topics are covered in the first two-thirds of the book, and include:

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materials and energy balances, heat and mass transport, fluid mechanics, reaction engineering, separation processes, process control and process equipment design. The latter part details modern topics, such as

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biochemical engineering and sustainable development, plus practical topics of safety and process economics, providing the reader with a complete guide. Case studies are included throughout, building a real-world

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connection. These case studies form a common thread throughout the book, motivating the reader and offering enhanced understanding. Further reading directs those wishing for a deeper appreciation

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of certain topics. This book is ideal for professionals working with chemical engineers, and decision makers in chemical engineering industries. It will also be suitable for chemical engineering courses where a

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simplified introductory text is  
desired.

Process Plant Design

Occupational Outlook Handbook

A Case Study Approach, Second  
Edition

An Introduction

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Heinemann Chemical  
Engineering Series  
Principles of Analysis and  
Design

This 1998 book  
introduces the basics of  
engineering design and



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analysis for beginning  
chemical engineering  
undergraduate students.  
Chemical Engineering  
Design: Principles,  
Practice and Economics  
of Plant and Process

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Design is one of the best-known and most widely adopted texts available for students of chemical engineering. The text deals with the application of chemical

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engineering principles  
to the design of  
chemical processes and  
equipment. The third  
edition retains its  
hallmark features of  
scope, clarity and

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practical emphasis,  
while providing the  
latest US codes and  
standards, including  
API, ASME and ISA design  
codes and ANSI  
standards, as well as

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coverage of the latest aspects of process design, operations, safety, loss prevention, equipment selection, and more. The text is designed for chemical

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and biochemical

engineering students  
(senior undergraduate  
year, plus appropriate  
for capstone design  
courses where taken),  
and professionals in

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industry (chemical  
process, biochemical,  
pharmaceutical,  
petrochemical sectors).  
Provides students with a  
text of unmatched  
relevance for chemical

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viability. In addition to the process design aspects of commercializing the laboratory development, consideration is given to the utilization of a development in an existing plant. Explains how heat removal for exothermic reactions can be scaled up Outlines how a reactor

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can be sized from batch kinetic data

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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

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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

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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

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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

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helps readers identify typical problems and how to solve them. Focus is on the use of systematic algorithms that employ numerical methods to solve different chemical engineering problems by describing and transforming the information. Problems are assigned for each



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chapter, ranging from simple to difficult, allowing readers to gradually build their skills and tackle a broad range of problems. MATLAB and Excel® are used to solve many examples and the more than 70 real examples throughout the book include computer or hand solutions,

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or in many cases both. The book also includes a variety of case studies to illustrate the concepts and a downloadable file containing fully worked solutions to the book 's problems on the publisher 's website. Introduces the reader to chemical engineering computation

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without the distractions caused by the contents found in many texts. Provides the principles underlying all of the major processes a chemical engineer may encounter as well as offers insight into their analysis, which is essential for design calculations. Shows how to solve

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chemical engineering problems using computers that require numerical methods using standard algorithms, such as MATLAB® and Excel®.

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scale-ups and process evaluations a solid understanding of basic concepts of chemical engineering analysis, design, and calculations.

Upper-level undergraduate text for process design courses in chemical engineering. Introduces students to the technology & terminology they

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will encounter in industrial practice. Presents short-cut techniques for specifying equipment or isolating important elements of a design project. Emphasizes project definition, flow sheet development & equipment specification. Covers the economics of process design. End-of-

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chapter exercises guide students through step-by-step solutions of design problems. Includes four case studies from past AIChE competitions.

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synthesis, computer-aided design and design of chemical reactors. The economic analysis has been updated. Numerous real examples include computer or hand solutions, with an

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increased emphasis on  
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computer modeling have revolutionized process design for chemical engineering. Team work and creative problem solving are still the building blocks of successful

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biochemical,  
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reactor engineering to  
understand process  
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software tools to compare

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different solutions for  
the same problem Includes  
historical perspectives  
and traces the improving  
efficiencies of  
commercially important  
chemical production

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processes Features worked  
examples and end-of-  
chapter problems with  
solutions to show the  
application of concepts  
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engineering students to the exciting of field of chemical engineering. The material in the text is meant to precede the traditional second-year topics. It provides students with, 1) materials to assist them in deciding whether to major in chemical engineering; and 2)

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help for future chemical engineering majors to recognize in later courses the connections between advanced topics and relationships to the whole discipline. This text, or portions of it, may be useful for the chemical engineering portion of a broader

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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



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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.

Chemical Process Engineering presents

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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

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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.

Volume 23 of Advances in Chemical

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Engineering covers the active field of process synthesis. There are currently three prevalent approaches to complex process synthesis strategies: heuristics-based selection, geometric representation, and optimization methods. This volume addresses a

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variety of these synthesis strategies for process subsystems, representing only a sample of the state-of-the-art of process synthesis research. The five papers in this volume address quite different process subsystems and application areas but still combine basic concepts

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related to a systematic approach. All five of the papers develop successful synthesis methods for their respective cutting-edge applications. As a group, the papers serve to highlight many unresolved issues in process synthesis and also provide guidelines for future

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research. Considers current approaches  
to process synthesis problems Examines  
areas of possible future research

Articles written by leading experts in  
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Chemical Process Engineering Volume  
2

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Industrial Process Engineering and  
Plant Design

Engineering Economics and Economic  
Design for Process Engineers

**Offering a modern, process-  
oriented approach emphasizing  
process control scheme**



**development instead of extended coverage of LaPlace space descriptions of process dynamics, this text focuses on aspects that are most important for process engineering in the 21st century. Instead of starting with the**

**controller, the book starts with the process and moves on to how basic regulatory control schemes can be designed to achieve the process' objectives while maintaining stable operations. In addition to continuous control concepts,**

**process and control system  
dynamics are embedded into the  
text with each new concept  
presented. The book also includes  
sections on batch and semi-batch  
processes and safety automation  
within each concept area. It**

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**discusses the four most common  
process control loops—feedback,  
feedforward, ratio, and  
cascade—and discusses application  
of these techniques for process  
control schemes for the most  
common types of unit operations.**

**It also discusses more advanced and less commonly used regulatory control options such as override, allocation, and split range controllers, includes an introduction to higher level automation functions, and**

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**provides guidance for ways to  
increase the overall safety,  
stability, and efficiency for many  
process applications. It introduces  
the theory behind the most  
common types of controllers used  
in the process industries and also**

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**provides various additional plant  
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Emphasizing basic mass and  
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Chemical and Energy Process  
Engineering prepares the next  
generation of process engineers**

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**through an exemplary survey of  
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thermodynamics, and the analysis  
of energy efficiency. By  
emphasizing the laws of  
thermodynamics and the law of  
mass/matter conservation, the**



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**author builds a strong foundation  
for performing industrial process  
engineering calculations. The  
book's systematic treatment  
applies these core principles on a  
macro-level scale, allowing for  
more manageable calculations.**

**The development of new processes is demanding and exciting. The instruction within these pages enables engineers to understand and analyze existing processes and primes them for participation in the development of new ones.**

**The fifth edition of Plant Design and Economics for Chemical Engineers is a major revision of the popular fourth edition. There are new chapters on process synthesis, computer-aided design, and design of chemical reactors. A**

**traditionally strong feature of the text, economic analysis, has been revamped and updated. Another strength, equipment sizing and cost estimation, is updated and expanded as well. These improvements also reflect changes**

**in equipment availability. The numerous real examples throughout the book include computer or hand solutions, and often both. There is a new increased emphasis on computer use in design, economic**

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future release. This widely used  
text is now more useful than ever,  
providing a "one-stop" guide to  
chemical process design and  
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