

## PREFACE

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### What is “Contemporary” About Engineering Economics?

Decisions made during the engineering design phase of product development determine the majority of the costs associated with the manufacturing of that product (some say that this value may be as high as 85%). As design and manufacturing processes become more complex, engineers are making decisions that involve money more than ever before. Thus, the competent and successful engineer in the twenty-first century must have an improved understanding of the principles of science, engineering, and economics, coupled with relevant design experience. Increasingly, in the new world economy, successful businesses will rely on engineers with such expertise.

Economic and design issues are inextricably linked in the product/service life cycle. Therefore, one of my strongest motivations for writing this text was to bring the realities of economics and engineering design into the classroom and to help students integrate these issues when contemplating many engineering decisions. Of course my underlying motivation for writing this book was not simply to address contemporary needs, but to address as well the ageless goal of all educators: to help students to learn. Thus, thoroughness, clarity, and accuracy of presentation of essential engineering economics were my aim at every stage in the development of the text.

### New to the Fifth Edition

Much of the content has been streamlined to provide materials in depth and to reflect the challenges in contemporary engineering economics. Some of the highlighted changes are as follows:

- All the chapter opening vignettes—a trademark of *Contemporary Engineering Economics*—have been updated or completely replaced with more current and thought-provoking issues. Selection of vignettes reflects the important segment of global economy in terms of variety and scope of business as well. With more than 80% of the total GDP (Gross Domestic Product) in the United States provided by the service sector, engineers work on various economic decision problems in the service sector as well. For this reason, many engineering economic decision problems from the service sector are presented in this 5<sup>th</sup> edition.
- Excel spreadsheet modeling techniques are incorporated into various economic decision problems to provide many “what-if” solutions to key decision problems.
- All the end-of-chapter problems are revised to reflect the materials changes in the main text. There are a total of 642 problems and 62 short case-study questions. Compared with the previous edition (509 problems and 59 short-case study problems), we have increased the number of questions by 24% by adding 136 new problems. About 40% of end-of-chapter practice problems are either new or updated.
- Added a new appendix on how to prepare for the *Fundamental Engineering Exam* with practice problems and problem-solving strategies.
- A risk simulation tool, Crystal Ball is introduced in Chapter 12 to provide a comprehensive risk analysis modeling scheme to handle project uncertainty.

Chapters	Chapter Opening Vignettes	Company	Sector	Industry
1	• Search engines	Google	Technology	Computer Services Information Technology
2	• Blackberry	Research in Motion	Technology	Communication Equipment
3	• Powerball – Lottery winning	Mr. Harris	Services	Gaming
4	• Refinancing home mortgage	Personal Finance	Financial	Banking
5	• Health-Unit plan – Medical equipment	General Electric	Conglomerates	Healthcare
6	• Carlsbad Desalination Project	Poseidon Resources	Public works	Construction
7	• Car washing franchise	Proctor & Gamble	Consumer/ Non-Cyclical	Personal and Household Products
8	• Biodegradable plastic - Bioplastics	NatureWorks	Manufacturing	Chemical
9	• Robotic pill dispenser	New Plymouth Pharmacy	Services	Hospital/Pharmacy
10	• Factory upgrade for chip production	Intel	Technology	Semiconductors
11	• College cost	Personal	Consumer	Education
12	• Strategic investment in Ethanol maker Coskata	General Motors	Manufacturing	Automobile/Energy
13	• Container shipping	Maersk	Transportation	Shipping
14	• Replacing aging aircraft	United Airline	Transportation	Airline
15	• Joint venture in developing theme Park in China	Disney	Services/ Entertainment	Broadcasting and Cable TV
16	• Indian River lagoon project in South Florida	State of Florida	Public	Environmental

- Significant content changes have been made in Chapter 13 (Real Options Analysis) to provide a new perspective on how engineers should manage risk in their strategic economic decision problems. In particular, a method of estimating project volatility has been added to make real-option analysis a more practical financial tool in managing the risk involved in long-term projects.
- Some other specific changes in each chapter are summarized as follows:

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<b>Chapters</b>	<b>New Contents or Improvements</b>
<b>1</b>	<ul style="list-style-type: none"> <li>• Revised Section 1.2 by providing the most contemporary issues – Smart Grid Project.</li> <li>• Updated Section 1.4 to reflect technological as well as market perception changes in hybrid vehicles.</li> </ul>
<b>2</b>	<ul style="list-style-type: none"> <li>• Replaced all financial analyses (including financial ratios) based on the financial statements by Research in Motion Ltd.</li> <li>• Provided various graphical illustrations to improve the understanding of financial analysis.</li> </ul>
<b>3</b>	<ul style="list-style-type: none"> <li>• Provided Excel financial functions to solve various economic equivalence problems.</li> <li>• Revised Section 3.4 with new examples to explore many different unconventional but useful equivalence problems.</li> </ul>
<b>4</b>	<ul style="list-style-type: none"> <li>• Revised Section 4.5.3 to reflect various home mortgage financing options.</li> </ul>
<b>5</b>	<ul style="list-style-type: none"> <li>• Introduced a project balance concept in Section 5.3.3.</li> </ul>
<b>6</b>	<ul style="list-style-type: none"> <li>• Introduced Excel presentation of life-cycle-cost analysis.</li> </ul>
<b>7</b>	<ul style="list-style-type: none"> <li>• Revised Section 7.3.4 (Decision Rule for Mixed Investment) to give a clear understanding on the issue of multiple-rates of return problems.</li> <li>• Introduced Excel modeling to calculate the return on invested capital.</li> </ul>
<b>8</b>	<ul style="list-style-type: none"> <li>• Created a new section on Cost-Volume-Profit Analysis (Section 8.3.3)</li> <li>• Updated all data related to cost of owning and operating a vehicle.</li> </ul>
<b>9</b>	<ul style="list-style-type: none"> <li>• Updated tax information.</li> </ul>
<b>10</b>	<ul style="list-style-type: none"> <li>• Generated all cash flow statement tables by using Excel.</li> <li>• Revised Section 10.4.3 (Lease-or-Buy Decision) to provide better understanding of various economic issues related to these outsourcing decisions in the real world.</li> </ul>
<b>11</b>	<ul style="list-style-type: none"> <li>• Updated all data related to consumer price index as well as other cost data to reflect the current trend in inflation as well as deflation in various economic sectors.</li> <li>• Generated all cash flow statements by using Excel.</li> </ul>
<b>12</b>	<ul style="list-style-type: none"> <li>• Provided a procedure conducting “what if” analysis using Excel.</li> <li>• Replaced @RISK with Crystal Ball in modeling a complex risk analysis decision problem.</li> </ul>
<b>13</b>	<ul style="list-style-type: none"> <li>• Most significant content changes in terms of pedagogical aspect of presentation, by providing many graphical illustrations to explain complicate conceptual financial as well as real option problems.</li> <li>• Created a new section on how to estimate project volatility (Section 13.6).</li> </ul>
<b>14</b>	<ul style="list-style-type: none"> <li>• Adopted Excel modeling techniques to solve various replacement decision problems.</li> </ul>
<b>15</b>	<ul style="list-style-type: none"> <li>• Streamlined the presentation.</li> </ul>
<b>16</b>	<ul style="list-style-type: none"> <li>• Revised Section 16.2 on Economic Analysis on Healthcare Service to improve the pedagogical aspect of presentation.</li> <li>• Provide a new detailed case example on cost-benefit-analysis.</li> </ul>
<b>Appendix</b>	<ul style="list-style-type: none"> <li>• Appendix A – How to prepare Fundamental Engineering Exam by providing 40 review questions and problem-solving strategies.</li> <li>• Appendix C: A new table on normal distribution function.</li> </ul>

## Overview of the Text

Although it contains little advanced math and few truly difficult concepts, the introductory engineering economics course is often a curiously challenging one for the sophomores, juniors, and seniors who take it. There are several likely explanations for this difficulty.

1. The course is the student's first analytical consideration of money (a resource with which he or she may have had little direct contact beyond paying for tuition, housing, food, and textbooks).
2. The emphasis on theory may obscure for the student the fact that the course aims, among other things, to develop a very practical set of analytical tools for measuring project worth. This is unfortunate since, at one time or another, virtually every engineer—not to mention every individual—is responsible for the wise allocation of limited financial resources.
3. The mixture of industrial, civil, mechanical, electrical, and manufacturing engineering, and other undergraduates who take the course often fail to “see themselves” in the skills the course and text are intended to foster. This is perhaps less true for industrial engineering students, whom many texts take as their primary audience, but other disciplines are often motivationally shortchanged by a text's lack of applications that appeal directly to them.

## Goal of the Text

This text aims not only to provide sound and comprehensive coverage of the concepts of engineering economics but also to address the difficulties of students outlined above, all of which have their basis in inattentiveness to the practical concerns of engineering economics. More specifically, this text has the following chief goals:

1. To build a thorough understanding of the theoretical and conceptual basis upon which the practice of financial project analysis is built.
2. To satisfy the very practical needs of the engineer toward making informed financial decisions when acting as a team member or project manager for an engineering project.
3. To incorporate all critical decision-making tools—including the most contemporary, computer-oriented ones that engineers bring to the task of making informed financial decisions.
4. To appeal to the full range of engineering disciplines for which this course is often required: industrial, civil, mechanical, electrical, computer, aerospace, chemical, and manufacturing engineering, as well as engineering technology.

## Prerequisites

The text is intended for undergraduate engineering students at the sophomore level or above. The only mathematical background required is elementary calculus. For Chapters 12 and 13, a first course in probability or statistics is helpful but not necessary, since the treatment of basic topics there is essentially self-contained.

## Taking Advantage of the Internet

The integration of computer use is another important feature of *Contemporary Engineering Economics*. Students have greater access to and familiarity with the various spreadsheet tools, and instructors have greater inclination either to treat these topics explicitly in the course or to encourage students to experiment independently.

A remaining concern is that the use of computers will undermine true understanding of course concepts. This text does not promote the use of trivial spreadsheet applications as a replacement for genuine understanding of and skill in applying traditional solution methods. Rather, it focuses on the computer's productivity-enhancing benefits for complex project cash flow development and analysis. For spreadsheet coverage, the emphasis is on demonstrating a chapter concept that embodies some complexity that can be much more efficiently resolved on a computer than by traditional longhand solutions.

## Resources for Instructors

Instructors have access online to all available resources. The following resources are available to instructors who adopt this textbook:

- TestGen, a test generator program that enables instructors to easily create paper or online quizzes and tests.
- Excel files of selected example problems from the text as well as end-of-chapter problems
- Instructor's Solutions Manual in both WORD and PDF version.
- PowerPoint lecture notes with live Excel file links

## Resources for Students

The following resources are available for students:

- Pearson e-Text a complete on-line version of the book that includes highlighting, note-taking and search capabilities and access to the Excel media files which accompany this text (all Excel examples in the book) as well as additional student study resources. All end-of-chapter problems with asterisks indicate the availability of some form of Excel template.
- FE Review problems by chapter
- **Analysis Tools from the book website:** A collection of various financial calculators is available through the book website at <http://www.pearsonhighered.com/park>. Cash Flow Analyzer is an integrated online Java program that is menu driven for convenience and flexibility; it provides (1) a flexible and easy-to-use cash flow editor for data input and modifications, and (2) an extensive array of computational modules and user-selected graphic outputs.

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