Overview of Engineering Economics

“...engineering...is the art of doing that well with one dollar, which any bungler can do with two after a fashion.”
Arthur Mellon Wellington, 1889

“It is apparent that the so-called principles of design are subordinate to the principles that underlie economic judgment.”
J.C.L. Fish

1.1 WHY STUDY ENGINEERING ECONOMICS?

• Companies are money factories that convert raw materials and/or brain power into dollars.
• The success of any company that you work for depends on it being able to provide a product or service that can be sold at a profit that yields an acceptable rate of return. This is its mission.
• Regardless of your job description, completion of your tasks in a timely and cost-effective manner contributes to the achievement of your company’s mission.
• Choosing between engineering alternatives, such as three heat exchangers or two office building designs, is based on technical and economic evaluations of the alternatives.
• The decision to fund a technical project, such as the construction of a chemical plant, is based on a technical evaluation of the project and its anticipated rate of return.
• You can also use the principles of engineering economics to
  Decide whether it’s cheaper to rent or buy a house.
  Determine the monthly cost of leasing a car.
  Choose between a lump sum lottery payment or a series of annual payments.
  Evaluate a personal investment.
• And as an aside, the mathematics of engineering economics is trivial. There are no derivatives, integrals, or differential equations. A few simple algebraic equations and sums are used, but the range of engineering and personal finance problems that they can solve is limitless.

1.2 TEXT OBJECTIVES

The purpose of this text is to show you how to incorporate engineering economics into the following engineering tasks:
2 CHAPTER 1 Overview of Engineering Economics

1. **Comparing two or more cost alternatives**, such as different structural shapes (civil engineering), reactors (chemical engineering), air conditioning systems (mechanical engineering), and electric generators (electrical engineering). This is covered in Chapters 4 and 5.

2. **Calculating the rate of return of a simple investment**, such as an office building (civil engineering), a chemical plant (chemical engineering), a bottling plant (mechanical engineering), and a power plant (electrical engineering). This is covered in Chapter 6.

3. **Calculating the rate of return of multi-simple & non-simple investments** is explained and illustrated in Chapter 7.

4. **Selecting the best simple investment from two or more mutually exclusive investments** (only one can be chosen), such as two or more competing office building designs (civil engineering), chemical plant designs (chemical engineering), bottling plant designs (mechanical engineering), and power plant designs (electrical engineering). This is covered in Chapter 8.

5. **Incorporating state and federal income taxes into a rate of return calculation**. This is covered in Chapter 9.

6. **Determining the sensitivity of the rate of return to a change in the value of an economic variable**, such as the selling price of a product or the fixed capital required to build a manufacturing plant. This is covered in Chapter 10.

7. **Using profitability measures that are different from the rate of return**. This is covered in Chapter 11.

To carry out these engineering tasks, you need to understand the foundation of engineering economics. This is covered in Chapters 2 and 3.

In addition to the technical applications of engineering economics, the book presents numerous examples and applications of it that can be used in your personal life. For example, when you graduate you may purchase a house and finance it with a mortgage. There is an Excel spreadsheet in Chapter 3 that calculates the yearly interest of a mortgage for arbitrary values of the size of the loan and its term and interest rate. You will see that the total interest paid can be more than the size of the loan itself!

There are several examples that illustrate the investment cash flows required to fund different retirement cash flow scenarios. And if you win the lottery, you will be able to compare the economic worths of a lump sum payment and a uniform series of 10 or 20 annual payments.