

## CONTENT

|  | Page      |
|--|-----------|
| Preface  | xiii      |
| <b>CHAPTER 1 INTRODUCTION TO ENGINEERING ECONOMICS</b>       | <b>1</b>  |
| Overview   | 1         |
| Engineering Decision Makers                                  | 2         |
| Engineering and Economics                                    | 2         |
| Economics : A Capsule View                                   | 3         |
| Engineering Economy : A Short History                        | 4         |
| Problem Solving and Decision Making                          | 6         |
| The Engineering Economic Decision Maze                       | 12        |
| Review Exercise and Discussions                              | 14        |
| Problem  | 15        |
| Extensions   | 17        |
| <b>SECTION ONE DISCOUNTED CASH FLOW MECHANICS</b>            | <b>21</b> |
| <b>CHAPTER 2 TIME VALUE OF MONEY</b>                         | <b>25</b> |
| Overview   | 25        |
| Reasons for Interest   | 26        |
| Simple Interest  | 27        |
| Compound Interest  | 28        |
| Time-Value Equivalence                                       | 32        |
| Compound-Interest Factors                                    | 34        |
| Review Exercises and Discussions                             | 42        |
| Problems   | 45        |
| Extension  | 47        |
| <b>CHAPTER 3 DISCOUNTED CASH FLOW CALCULATIONS</b>           | <b>50</b> |
| Overview   | 50        |
| Cash Flow Diagrams   | 50        |
| Calculation of time-Value Equivalents                        | 52        |
| Calculations with Continuous Interest                        | 58        |
| Review Exercises and Discussions                             | 63        |
| Problems   | 65        |
| Extension  | 70        |
| <b>CHAPTER 4 PRESENT-WORTH COMPARISONS</b>                   | <b>72</b> |
| Overview   | 72        |
| Conditions for Present-Worth Comparisons                     | 73        |
| Basic Present-Worth Comparison Patterns                      | 74        |
| Comparison of Assets That Have Unequal Lives                 | 76        |
| Comparison of Assets Assumed to Have Infinite life           | 79        |
| Comparison of Deferred Investments                           | 80        |
| Valuation  | 82        |
| Review Exercises and Discussions                             | 86        |
| Problems   | 89        |
| Extensions   | 94        |
| <b>CHAPTER 5 EQUIVALENT ANNUAL-WORTH COMPARISONS</b>         | <b>98</b> |
| Overview   | 98        |
| Utilization of the Equivalent Annual-Worth Comparison Method | 99        |
| Situations for Equivalent Annual-Worth Comparisons           | 102       |

|   |     |
|---|-----|
| Consideration of Asset Life                             | 105 |
| Use of a Sinking Fund                                   | 110 |
| Review Exercises and Discussion                         | 112 |
| Problems  | 115 |
| Extensions  | 115 |
| <br>  |     |
| CHAPTER 6 RATE-OF-RETURN COMPARISONS                    | 118 |
| Overview  | 118 |
| PW, EAW, and Internal Rate of Return                    | 119 |
| Utilization of the Rate-of-Return method                | 119 |
| Consistency of Comparison Methods                       | 124 |
| IRR Irregularities                                      | 127 |
| Minimum Acceptable Rate of Return                       | 132 |
| Review Exercises and Discussions                        | 133 |
| Problems  | 138 |
| Extensions  | 141 |
| <br>  |     |
| SECTION TWO ECONOMIC ANALYSES                           | 147 |
| <br>  |     |
| CHAPTER 7 STRUCTURAL ANALYSIS OF ALTERNATIVES           | 149 |
| Overview  | 149 |
| Development of Alternatives                             | 150 |
| Classification of Alternatives                          | 151 |
| IRR Analysis of Several Mutually Exclusive Alternatives | 152 |
| Analysis of Independent Alternatives                    | 157 |
| Review Exercises and Discussions                        | 158 |
| Problems  | 161 |
| Extensions  | 167 |
| <br>  |     |
| CHAPTER 8 REPLACEMENT ANALYSIS                          | 170 |
| Overview  | 170 |
| Replacement Studies                                     | 170 |
| Replacement Assumptions and Analysis                    | 171 |
| Replacement Due to Deterioration                        | 175 |
| Replacement Due to Obsolescence                         | 177 |
| Replacement Due to Inadequacy                           | 179 |
| Precautions for Replacement Studies                     | 181 |
| Review Exercises and Discussions                        | 182 |
| Problems  | 184 |
| Extensions  | 187 |
| <br>  |     |
| CHAPTER 9 FINANCIAL ANALYSIS                            | 193 |
| Overview  | 193 |
| Financial Focus   | 194 |
| Cost-of-Capital Concepts                                | 194 |
| Calculation of the Weighted Cost of Capital             | 194 |
| Payback Comparison method                               | 196 |
| Capital Budgeting                                       | 199 |
| Review Exercises and Discussions                        | 205 |
| Problems  | 207 |
| Extensions  | 210 |
| <br>  |     |
| CHAPTER 10 ANALYSIS OF PUBLIC PROJECTS                  | 215 |
| Overview  | 215 |
| The Public Sector                                       | 216 |
| Benefit-cost Analysis                                   | 216 |
| The Discount-Rate Question                              | 224 |
| Benefit-Cost Applications                               | 227 |
| Review Exercises and Discussions                        | 232 |
| Problems  | 234 |

|  |     |
|--|-----|
| Extension  | 240 |
| SECTION THREE MANAGEMENT OF MONEY                                      | 249 |
| CHAPTER 11 ACCOUNTING AND DEPRECIATION                                 | 251 |
| Overview   | 251 |
| Accounting   | 252 |
| Depreciation   | 257 |
| Depreciation Methods   | 259 |
| Equivalence of Depreciation Methods When Interest Charges Are Included | 266 |
| Depreciation and Taxes   | 267 |
| Choice of a Depreciation method  | 269 |
| Review Exercises and Discussions                                       | 270 |
| Problems   | 273 |
| Extensions   | 276 |
| CHAPTER 12 INCOME TAX CONSIDERATIONS                                   | 281 |
| Overview   | 281 |
| Tax Concepts   | 282 |
| Corporate Income Taxes   | 284 |
| After-Tax Economic Comparisons   | 289 |
| Review Exercises and Discussions                                       | 296 |
| Problem  | 300 |
| Extension  | 304 |
| CHAPTER 13 EFFECTS OF INFLATION  | 307 |
| Overview   | 307 |
| Concepts of Inflation  | 308 |
| Measuring Inflation  | 308 |
| Impact of Inflation on Economic Evaluations                            | 309 |
| Before-Tax, Constant-Value Comparisons                                 | 311 |
| After-Tax Actual Cash Flow Comparisons                                 | 314 |
| After-Tax Modified Cash Flow comparison                                | 317 |
| Deciding When and How to Consider Inflation                            | 318 |
| Review Exercises and Discussions                                       | 319 |
| Problems   | 323 |
| Extension  | 326 |
| CHAPTER 14 SENSITIVITY ANALYSIS  | 328 |
| Overview   | 328 |
| What If?   | 328 |
| Sensitivity of a Single Proposal                                       | 332 |
| Sensitivity of Alternatives  | 338 |
| Review Exercises and Discussions                                       | 339 |
| Problems   | 342 |
| Extension  | 345 |
| CHAPTER 15 INDUSTRIAL PRACTICES  | 349 |
| Overview   | 349 |
| Sources of Funds   | 350 |
| Strategic Considerations Concerning Funding Sources                    | 351 |
| Financial Leverage   | 353 |
| Tactical Considerations Concerning funding Sources                     | 356 |
| Leasing  | 358 |
| Decision-Making Practices for Industrial Investments                   | 360 |
| Review Exercises and Discussions                                       | 371 |
| Problems   | 373 |
| Extension  | 378 |

|  |     |
|--|-----|
| SECTION FOUR ECONOMIC DECISIONS  | 381 |
| CHAPTER 16 BREAKEVEN ANALYSIS  | 383 |
| Overview   | 383 |
| Cost and Competitiveness   | 384 |
| Breakeven Comparisons  | 387 |
| Breakeven Charts   | 388 |
| Linear Breakeven Analysis  | 391 |
| Nonlinear Breakeven Analysis   | 396 |
| Applying Breakeven Analysis  | 401 |
| Review Exercises and Discussions   | 402 |
| Problems   | 408 |
| Extension  | 414 |
| CHAPTER 17 EXPECTED VALUE  | 417 |
| Overview   | 417 |
| Recognizing Risk   | 418 |
| Including Risk in Economic Analyses  |     |
| Probability Estimates  | 420 |
| Probability Concepts   | 421 |
| Expected Value   | 423 |
| Investment-Risk Decision Criteria  | 429 |
| Review Exercises and Discussions   | 432 |
| Problems   | 436 |
| Extension  | 438 |
| CHAPTER 18 DECISION TREES  | 443 |
| Overview   | 443 |
| Probability Concepts   | 443 |
| Decision Trees   | 450 |
| Discounted Decision Trees  | 453 |
| Value of Additional Information  | 458 |
| Application of Decision Trees  | 461 |
| Review Exercises and Discussions   | 466 |
| Problems   | 472 |
| Extension  | 472 |
| CHAPTER 19 DECISION MATRICES   | 478 |
| Overview   | 478 |
| Decision Difficulties  | 479 |
| Comparison of Decisions under conditions of Certainty, Risk, and Uncertainty | 479 |
| Criteria for Decisions under Uncertainty                                     | 481 |
| Evaluation of Decision Criteria  | 485 |
| Dimensions for Decisions   | 489 |
| Mixed-Rating Comparison Model  | 495 |
| Review Exercises and Discussions   | 498 |
| Problems   | 500 |
| Extension  | 506 |
| Appendixes   |     |
| A Selected References  | 511 |
| B Discrete-Compounding Interest Factors                                      | 514 |
| C Continuous-Compounding Interest Factors                                    | 541 |
| Index  | 551 |