

# Contents

## PREFACE

## PART I LANGUAGE AND METHODS 1

## CHAPTER 1 SETS AND MAPPINGS 3

---

<b>1.1</b>	<b>Elements of Logic</b>	<b>3</b>
1.1.1	Necessity and Sufficiency	3
1.1.2	Theorems and Proofs	4
<b>1.2</b>	<b>Elements of Set Theory</b>	<b>5</b>
1.2.1	Notation and Basic Concepts	5
1.2.2	Convex Sets	7
1.2.3	Relations and Functions	11
<b>1.3</b>	<b>A Little Topology</b>	<b>13</b>
1.3.1	Continuity	22
1.3.2	Some Existence Theorems	27
<b>1.4</b>	<b>Real Valued Functions</b>	<b>32</b>
1.4.1	Related Sets	33
1.4.2	Concave Functions	36
1.4.3	Quasiconcave Functions	41
1.4.4	Convex and Quasiconvex Functions	45
<b>1.5</b>	<b>Exercises</b>	<b>48</b>

---

**CHAPTER 2    CALCULUS AND OPTIMIZATION                      53**

---

<b>2.1</b>	<b>Calculus</b>	<b>53</b>
2.1.1	Functions of a Single Variable	53
2.1.2	Functions of Several Variables	55
2.1.3	Homogeneous Functions	63
<b>2.2</b>	<b>Optimization</b>	<b>66</b>
2.2.1	Real Valued Functions of Several Variables	68
2.2.2	Second-Order Conditions	71
<b>2.3</b>	<b>Constrained Optimization</b>	<b>77</b>
2.3.1	Equality Constraints	78
2.3.2	Lagrange's Method	79
2.3.3	Geometrical Interpretation	84
2.3.4	Second-Order Conditions	87
2.3.5	Inequality Constraints	91
2.3.6	Kuhn-Tucker Conditions	94
<b>2.4</b>	<b>Value Functions</b>	<b>97</b>
<b>2.5</b>	<b>Exercises</b>	<b>101</b>

**PART II**  
**ECONOMIC AGENTS    107**

---

**CHAPTER 3    CONSUMER THEORY                                      109**

---

<b>3.1</b>	<b>Primitive Notions</b>	<b>109</b>
<b>3.2</b>	<b>Preferences and Utility</b>	<b>111</b>
3.2.1	Preference Relations	111
3.2.2	The Utility Function	119
<b>3.3</b>	<b>The Consumer's Problem</b>	<b>125</b>
<b>3.4</b>	<b>Indirect Utility and Expenditure</b>	<b>133</b>
3.4.1	The Indirect Utility Function	133
3.4.2	The Expenditure Function	138
3.4.3	Relations Between the Two	145
<b>3.5</b>	<b>Properties of Consumer Demand</b>	<b>151</b>
3.5.1	Relative Prices and Real Income	152

3.5.2	Income and Substitution Effects	153
3.5.3	Some Elasticity Relations	162
<b>3.6</b>	<b>Exercises</b>	<b>165</b>
<b>CHAPTER 4 TOPICS IN CONSUMER THEORY</b>		<b>173</b>
<hr/>		
<b>4.1</b>	<b>Duality</b>	<b>173</b>
4.1.1	Expenditure and Consumer Preferences	174
4.1.2	Convexity and Monotonicity	178
4.1.3	Indirect Utility and Consumer Preferences	180
<b>4.2</b>	<b>Integrability</b>	<b>184</b>
<b>4.3</b>	<b>Revealed Preference</b>	<b>189</b>
<b>4.4</b>	<b>Uncertainty</b>	<b>195</b>
4.4.1	Preferences	195
4.4.2	Von Neumann-Morgenstern Utility	199
4.4.3	Risk Aversion	207
<b>4.5</b>	<b>Exercises</b>	<b>214</b>
<b>CHAPTER 5 THEORY OF THE FIRM</b>		<b>218</b>
<hr/>		
<b>5.1</b>	<b>Primitive Notions</b>	<b>218</b>
<b>5.2</b>	<b>Production</b>	<b>219</b>
5.2.1	Returns to Scale and Varying Proportions	224
<b>5.3</b>	<b>Cost</b>	<b>227</b>
<b>5.4</b>	<b>Duality in Production</b>	<b>235</b>
<b>5.5</b>	<b>The Competitive Firm</b>	<b>236</b>
5.5.1	Profit Maximization	236
5.5.2	The Profit Function	238
<b>5.6</b>	<b>Exercises</b>	<b>244</b>

**PART III  
MARKETS AND WELFARE 251**

**CHAPTER 6 PARTIAL EQUILIBRIUM 253**

---

**6.1 Perfect Competition 253**

**6.2 Imperfect Competition 257**

6.2.1 Cournot Oligopoly 260

6.2.2 Bertrand Oligopoly 262

6.2.3 Monopolistic Competition 263

**6.3 Equilibrium and Welfare 265**

6.3.1 Price and Individual Welfare 266

6.3.2 Efficiency of the Competitive Outcome 270

6.3.3 Efficiency and Total Surplus Maximization 272

**6.4 Exercises 274**

**CHAPTER 7 GENERAL EQUILIBRIUM 280**

---

**7.1 Equilibrium in Exchange 280**

**7.2 Equilibrium in Competitive Market Systems 286**

7.2.1 Existence of Equilibrium 286

**7.3 Equilibrium in Production 302**

7.3.1 Producers 302

7.3.2 Consumers 305

7.3.3 Equilibrium 306

7.3.4 Welfare 313

**7.4 Core and Equilibria 317**

7.4.1 Replica Economies 318

**7.5 Exercises 328**

**CHAPTER 8 SOCIAL CHOICE AND WELFARE 334**

---

**8.1 The Nature of the Problem 334**

<b>8.2</b>	<b>Social Choice and Arrow's Theorem</b>	<b>335</b>
8.2.1	A Diagrammatic Proof	341
<b>8.3</b>	<b>Measurability, Comparability, and Some Possibilities</b>	<b>346</b>
8.3.1	The Rawlsian Form	348
8.3.2	The Utilitarian Form	351
8.3.3	Flexible Forms	352
<b>8.4</b>	<b>Justice</b>	<b>354</b>
<b>8.5</b>	<b>Exercises</b>	<b>356</b>
<b>PART IV</b>		
<b>STRATEGIC BEHAVIOR</b>		<b>361</b>
<b>CHAPTER 9</b>		
<b>Game Theory</b>		<b>363</b>
<hr/>		
<b>9.1</b>	<b>Strategic Decision Making</b>	<b>363</b>
<b>9.2</b>	<b>Strategic Form Games</b>	<b>365</b>
9.2.1	Dominant Strategies	366
9.2.2	Nash Equilibrium	369
9.2.3	Incomplete Information	376
<b>9.3</b>	<b>Extensive Form Games</b>	<b>381</b>
9.3.1	Game Trees: A Diagrammatic Representation	384
9.3.2	An Informal Analysis of Take-Away	385
9.3.3	Extensive Form Game Strategies	387
9.3.4	Strategies and Payoffs	388
9.3.5	Games of Perfect Information and Backward Induction Strategies	389
9.3.6	Games of Imperfect Information and Subgame Perfect Equilibrium	393
9.3.7	Sequential Equilibrium	402
<b>9.4</b>	<b>Exercises</b>	<b>418</b>

**CHAPTER 10 INFORMATION ECONOMICS 424**

---

<b>10.1</b>	<b>Adverse Selection</b>	<b>425</b>
10.1.1	Information and the Efficiency of Market Outcomes	425
10.1.2	Signaling	430
10.1.3	Screening	448
<b>10.2</b>	<b>Moral Hazard and the Principal Agent Problem</b>	<b>456</b>
10.2.1	Symmetric Information	457
10.2.2	Asymmetric Information	459
<b>10.3</b>	<b>Information and Market Performance</b>	<b>463</b>
<b>10.4</b>	<b>Exercises</b>	<b>463</b>

<b>LIST OF THEOREMS</b>	<b>467</b>
-------------------------	------------

<b>LIST OF DEFINITIONS</b>	<b>473</b>
----------------------------	------------

<b>HINTS AND ANSWERS</b>	<b>477</b>
--------------------------	------------

<b>REFERENCES</b>	<b>485</b>
-------------------	------------

<b>INDEX</b>	<b>489</b>
--------------	------------