

Contents

<i>Preface</i>	(v)
----------------------	-----

CHAPTER 1

Set Theory

Definition of Set	1
Roster, Tabular or Enumeration Form	1
Set builder Form	2
Union of Set	5
Intersection of Sets	9
Distributive Laws of Unions and Intersections	12
Complement of a Set	14
Difference of Sets	16
De Morgan's Law	19
Some Important results on Difference, Union and Intersection	22
Symmetric Difference of Two Sets	30
Cardinal Number of a Set	33
Ordered Pairs	37
Cartesian Products	37
<i>Summary</i>	41
<i>Self Practice Exercises</i>	42
<i>Answers</i>	44

CHAPTER 2

Functions and its Applications

Brief History and Introduction	46
Definition of a Function or Mapping	47
Types of Mapping	48
One-One Mapping (or Injection)	48

One–Many Mapping	48
Many–One Mapping	48
Into–Mapping.....	49
Onto–Mapping	49
Some Functions	50
Graph of Functions.....	67
General Condition for Market Equilibrium in an Economic System.....	81
Market Equilibrium.....	82
Break Even Analysis	82
<i>Summary</i>	86
<i>Self Practice Exercises</i>	87
<i>Answers</i>	89

CHAPTER 3

Limits and Continuity

Brief Overview and Introduction.....	90
Limit of a Function	90
Some Other Types of Limits.....	91
Some Important Theorem.....	92
Some Important Results.....	93
Methods of Evaluation of Limits	93
Rationalization Method	94
Substitution Method	94
The Concept of Right and Left hand Limit.....	106
Difference between Limit and Value of a Function	107
Continuity	111

Application of Limits and Continuity in Business and Economics	120
<i>Brief Summary</i>	123
<i>Self Practice Exercises</i>	124
<i>Answers</i>	126
<i>Appendix</i>	126

CHAPTER 4

Derivatives and its Applications

Concept and Definition	131
Meaning of Increment	132
Some Important Rules	132
Some Important Standard Derivative.....	136
Some Solved Illustrations using 1 st principle	140
Some Important Standard Derivatives of Trigonometric Functions	151
Some Standard Derivative of Inverse Trigonometric Functions	163
Application of Concepts of Differentiation to Business and Economics	169
Elasticity of Demand.....	169
Some Important cases of e_d	170
Elasticity of Supply	171
Concept of Total Cost, Average Cost and Marginal Cost	177
Concept of Total Revenue, Average Revenue and Marginal Revenue	186
<i>Summary</i>	192
<i>Self Practice Exercises</i>	194
<i>Answers</i>	197
<i>Appendix</i>	199

CHAPTER 5

Maxima and Minima and its Application

Introduction.....	202
Increasing Function	202
Decreasing Function	203
Maxima and Minima of a Function.....	205
First Order Derivative test for Maxima and Minima	206
Second Order Derivative test for Maxima and Minima.....	206
Convexity and Concavity.....	217
Point of Inflexion.....	219
Application of Theory of Maxima and Minima in Business and Economics	225
Effect of Taxation and Subsidy on Profitability.....	236
Effect of Taxation	236
Effect of Subsidy.....	237
<i>Summary</i>	242
<i>Self Practice Exercises</i>	243
<i>Answers</i>	245

CHAPTER 6

Partial Derivatives and its Application

Concept and Definition	246
The Concept of Successive Partial Derivatives.....	246
The Concept of Cross Partial Derivatives	247
Total Differentials	251
Second Order Total Differential	254
Euler's Theorem.....	258
Euler's Theorem on Homogenous Functions of Two Variables.....	259
Derivative of Implicit Functions.....	264

Application of the Concepts of Partial Derivatives to Business and Economics	266
Demand Analysis	266
Nature of Commodities whether substitutes (competitive) or Complementary	267
Partial Elasticity of Demand	268
Utility Analysis	272
Marginal Rate of Substitution	272
Constrained Utility Maximization	274
Production Analysis	275
The Concept of Maxima and Minima of a function of two variables.....	281
<i>Summary</i>	284
<i>Self Review Questions</i>	284
<i>Answers</i>	286
<i>Appendix</i>	287

CHAPTER 7

Integration and its Application

Definition.....	290
Some Standard Fundamental Integrals	291
Methods of Integration	299
Integration by Parts	314
Some Important Rule	319
Some Standard Integrals.....	320
Integration by Partial Fraction.....	330
Definite Integrals	341
Fundamental Theorem of Integral Calculus – Valuation of Definite Integral.....	344
Application of Integration in Business and Economics	354
Consumer and Producer Surplus	365

Learning Curve	371
Summary.....	372
<i>Self Practice Exercises</i>	373
<i>Answers</i>	377

CHAPTER 8

Differential Equations and its Application

Definitions	381
Order of a Differential Equation	381
Degree of the Differential Equation.....	382
Solution of a Differential Equation	383
Solution of First Order and First degree Differential Equation.....	384
Equation with Variables are Separable	387
Homogenous Differential Equation	391
An Equation Reducible to Homogenous Form	395
Linear Differential Equation	399
Equations Reducible to Linear Form (Bernoulli's Equation).....	404
Exact Differential Equation	406
Equations Reducible to Exact Differential Equation Form.....	408
Solving Second Order Differential Equations	412
Application of Differential Equation to Business and Economics	415
<i>Summary</i>	418
<i>Self Practice Questions</i>	418
<i>Answers</i>	419

CHAPTER 9

Theory of Matrices-I

Brief History	421
Forms of Matrix	422

Rules of Matrix's Operation	425
Some of the Properties of Matrix Addition	426
Scalar Multiplication of Matrix	429
Some of the Properties of Scalar Multiplication	430
Multiplication Rule	433
Some of the Properties of Matrix Multiplication.....	434
Transpose of a Matrix	447
Application of Theory of Matrix to Business and Economics.....	450
<i>Summary</i>	453
<i>Self Practice Exercises</i>	453
<i>Answers</i>	456

CHAPTER 10

Determinants of Matrices

Definition	458
Minor and Cofactor of the Elements of a Determinant	459
Cofactors of the Elements	460
Some Important Properties of Determinants	462
<i>Summary</i>	492
<i>Self Practice Exercises</i>	493
<i>Answers</i>	496

CHAPTER 11

Theory of Matrices - II

Definition.....	497
Singular Matrix.....	497
Non-singular Matrix	497
Adjoint of a Square Matrix	497
Properties of Inverse of a Matrix	503
Orthogonal Matrix.....	509

Matrix Inversion Method	519
Gauss–Jordan Elimination Method	527
Rank of Matrix.....	529
Application of Theory of Matrix to Business and Economics.....	530
<i>Summary</i>	551
<i>Self Practice Exercises</i>	552
<i>Answers</i>	554

CHAPTER 12

Input Output Analysis

Brief History	555
The Alternate Explanation.....	557
Simon–Hawkins Conditions.....	562
Solution for a 2 – Sector Model with Primary Inputs	566
In Case of 2 Primary Inputs Utilized	566
Determination of Equilibrium Prices (2 – Sector Model).....	569
Importance of Input–Output Analysis	572
Practical Issues.....	573
Theoretical Issues	573
<i>Review Questions</i>	574
<i>Self Practice Exercises</i>	574
<i>Answers</i>	576

CHAPTER 13

Theory of Equation and Inequation

Introduction.....	577
The Nature of the Roots of the Quadratic Equation.....	590
Relation between Roots and Coefficients of a Quadratic Equation	592
Formulation of an Equation using given Roots	593

Solving Simultaneously Linear Equation Having Two Variables ..	599
Cubic and Biquadratic Equations.....	605
Inequalities.....	608
Graphs of Linear Inequations or Inequalities in Two variables.....	615
Graphs of System of Linear Equations.....	619
<i>Summary</i>	622
<i>Self Practice Exercises</i>	623
<i>Answers</i>	625

CHAPTER 14

Progression

Arithmetic Progression.....	626
Properties of an Arithmetic Progression	628
Arithmetic Mean (A. M)	632
Representation of Terms in A.P	634
Geometric Progression	639
Geometric Means	647
Relationship between A.M and G.M	655
Harmonic Progression	656
<i>Summary</i>	657
<i>Self Practice Exercises</i>	658
<i>Answers</i>	660

CHAPTER 15

Permutation and Combination

A Brief Historical Background	661
The Fundamental Principles of Counting.....	661
Multiplication Rule	662
Corollary.....	663
Permutations when some of the objects are Similar	666

Combination.....	677
<i>Brief Summary</i>	692
<i>Self Practice Questions</i>	693
<i>Answers</i>	695

CHAPTER 16

Theory of Probability-I

Introduction.....	697
A Brief Historical Background	697
Different Approaches to Probability	700
Empirical or Statistical Approach (Von Mises)	702
Axiomatic Approach	703
Addition Theorems.....	709
Corollary.....	711
Solved Exercises	712
Compound Probability	718
Conditional Probability.....	718
Multiplication Theorem	719
Bayes' Theorem.....	730
<i>Brief Summary</i>	742
<i>Review Questions</i>	744
<i>Self Practice Exercises</i>	744
<i>Answers</i>	748

CHAPTER 17

Theory of Probability - II

Random Variable	750
Probability Function (or Density Function) of a Random Variable	750
Expectation of Random Variable	756

Binomial Distribution	760
Mean (or expectation) and Variance of the Binomial Distribution	762
Fitting of a Binomial Distribution	770
Poissons Distribution.....	772
Fitting of a Poisson Distribution	781
Solved Exercises	789
Normal Approximation to Binomial Distribution	802
<i>Brief Summary</i>	805
<i>Review Questions</i>	806
<i>Self Practice Questions</i>	807
<i>Answers</i>	813
<i>Appendix</i>	815

CHAPTER 18

**Linear Programming Formulation and
Graphical Method**

Brief History	817
Introduction	817
Basic Requirement of Linear Programming.....	818
Assumptions of Linear Programming Problems	820
Business Application of Linear Programming Problem	821
Guidelines for Formulation of Linear Programming Problem	824
Graphical Method of Solving Linear Programming Problem	836
The Corner or Extreme Point Method	838
Iso-Profit or Iso-Cost Method.....	852
Special Cases of Linear Programming.....	853
<i>Summary</i>	858
<i>Self Practice Exercises</i>	858
<i>Answers</i>	863

CHAPTER 19

The Simplex Method and Duality

Brief Introduction	866
The Simplex Method (Maximization Case).....	866
Simplex Method for Minimization Case (all \geq constraint type) Using Charne's Big – M Method	889
Some Typical Problems Encounter in Simplex method.....	897
Duality	897
Some of the Advantages of Duality	909
<i>Summary</i>	909
<i>Self Practice Exercises</i>	910
<i>Answers</i>	912

CHAPTER 20

Decision Theory and Decision Tree

Introduction.....	914
General Characteristics of Decision Making.....	914
Some of the Steps in Decision Making Process	915
Different Categories of Decision Making Models.....	917
Maximin or Minimax Criterion (Pessimism Criterion).....	920
Maximax or Minimin Criterion (Optimism Criterion)	921
Hurwicz–Alpha Criterion	922
Regret Criterion	924
Decision Making Under Risk (Stochastic Models).....	927
Expected Opportunity Loss (EOL).....	930
Expected Value of Perfect Information (EVPI).....	932
Bayesian Analysis and Posterior Probabilities	936

Decision Tree Analysis	941
<i>Summary</i>	946
<i>Review Questions</i>	947
<i>Self Practice Exercises</i>	947
<i>Answers</i>	951

CHAPTER 21

Game Theory

Brief History	952
Introduction.....	952
Key Terminology	952
Saddle Point	954
Types of Games.....	954
Dominance Rule	960
Arithmetic Method	964
Algebraic Method	967
Matrix Method	971
Graphical Method	975
Solution of Two Person Zero Sum Game by Linear Programming Method	979
<i>Summary</i>	984
<i>Self Practice Exercises</i>	985
<i>Answers</i>	987
<i>Appendix</i>	989

CHAPTER 22

Mathematics of Finance

Introduction.....	991
What is Time Value?	991
Some Key Terminology	991

Concept of Simple and Compound Interest	992
Compound Interest	993
Nominal vs Effective Rate	995
Future Value of a Single Sum	997
Present Value of a Single Sum.....	999
Annuities	1001
Calculation of Future Value of an Ordinary Annuity (Using Time line Analysis)	1001
Calculation of Present Value of an Ordinary Annuity (Using Time line Analysis)	1004
Sinking Fund, Amortization and Capital Recovery	1007
Future Value of an Annuity Due.....	1010
Present Value of an Annuity Due.....	1013
Bond Basics.....	1015
Bond Valuation.....	1016
<i>Summary</i>	1017
<i>Review Questions</i>	1018
<i>Self Practice Exercises</i>	1019
<i>Answers</i>	1020
<i>Logarithms Tables</i>	1021
<i>Index</i>.....	1033