Contents

Title Page i

Certificate of Approval v

Certificate vii

Acknowledgements ix

Declaration xi

Contents xiii

Abstract xvii

Abbreviations xix

List of Symbols xxi

Chapter 1 Introduction 1

1.1 Motivation 2

1.2 Literature Survey 5

1.3 Multi-Objective Mathematical Programming 9

1.4 Solution Methodology 14

1.4.1 Fuzzy Programming Method 15

1.4.2 Goal Programming Method 18

1.4.3 Weighting Method 21

1.5 Preliminaries on Fuzzy Set Theory 22

1.5.1 Nearest Trapezoidal Defuzzication 23

1.6 Mathematical Tools and Techniques 25

1.7 Objectives and Scope of the Thesis 27

1.8 The Structure of the Thesis 28

Chapter 2 Single Objective and Multi-Objective Multi-Choice Linear Programming Problems 33

Copyright IIT Kharagpur

2.1 Transformation of a Multi-Choice Linear Programming Problem 34
2.1.1 Mathematical Model 35
2.1.2 Transformation of Equivalent Models 35
2.1.3 Numerical Example 44
2.1.4 Results and Discussion 47
2.2 Generalized Transformation Techniques for Multi-Choice Linear Programming Problems 47
2.3 Multi-Choice Multi-Objective Linear Programming Problem 56
2.3.1 Mathematical Model 56
2.3.2 Equivalent Models 56
2.3.3 Numerical Example 57
2.4 Conclusions 63

Chapter 3 Interpolating Polynomial Approach for Solving Multi-Choice Linear Programming Problem 65
3.1 Interpolating Polynomial Approach 66
3.1.1 Mathematical Model 66
3.1.2 Formulation of Interpolating Polynomials 66
3.2 Multi-Objective Multi-Choice Transportation Problem 73
3.2.1 Problem Formulation 73
3.2.2 Equivalent Mathematical Model 74
3.2.3 Numerical Example 76
3.3 Conclusions 82

Chapter 4 Single Objective and Multi-Objective Probabilistic Programming Problems Involving Multi-Choice Parameters 83
4.1 Single Objective Probabilistic Programming Problems Involving Multi-Choice Parameters 84
4.1.1 Mathematical Model 84
4.1.2 Formulation of Deterministic Model 85
4.1.3 Transformation of Multi-Choice Programming 87
4.1.4 Numerical Example 88
4.2 Multi-Objective Probabilistic Programming Problems Involving Multi-Choice Parameters 91
4.2.1 Mathematical Model 91
4.2.2 Equivalent Deterministic Model 92
4.2.3 Transformation of Multi-Choice Programming 93

Copyright IIT Kharagpur

4.2.4 Numerical Example 94
4.2.5 Results and Discussion 97
4.3 Conclusions 97

Chapter 5 Multi-Choice Linear Programming Problem Involving Fuzzy Parameters and Fuzzy Decision Variables 99
5.1 Mathematical Model 100
5.2 Solution Procedures 100
5.2.1 Formulation of Interpolating Polynomial 103
5.3 Details of the Solution Procedure 105
5.4 Numerical Example 108
5.5 Conclusions 115

Chapter 6 Multi-Objective Multi-Choice Mathematical Programming Model for Integrated Production Planning: A Case Study 117
6.1 Preliminaries 119
6.2 Production Planning: Linear Programming Model 121
6.3 Steel Production in Rourkela Steel Plant 123
6.3.1 Factors in Steel Production Process 124
6.4 Mathematical Model Formulation 125
6.4.1 Model Description 126
6.4.2 Description of the Terms 126
6.4.3 Formulation of Constraints 128
6.4.4 Formulation of Objective Function 131
6.5 Presentation of Data 135
6.6 Solution Procedure 139
6.6.1 Fuzzy Programming Method 140
6.6.2 Weighting Method 141
6.7 Results and Discussion 142
6.8 Conclusions 143

Chapter 7 Conclusions and Scope of Future Research 145
7.1 Contributions of the Thesis 145
7.2 Conclusions 146
7.3 Scope for Future Research 146

Bibliography 149

List of Research Papers (Published/ Communicated) 165

Copyright ITNarayanpur

Copyright
IIT Kharagpur

Copyright
IIT Kharagpur