Contents

Declaration i

Certificate ii

Certificate iii

Preface vi

Acknowledgements ix

Contents xiii

1 Introduction 1
- 1.1 Definitions, Notations and Formulae . . . 3
- 1.2 Scalar Form: . . . 3
  - 1.2.1 Other Generalized Functions . . . 5
  - 1.2.2 Inverse Series Relation . . . 8
  - 1.2.3 Polynomials and Their Inverse Series Relations . . . 10
  - 1.2.4 Riodan's Inversion Pairs . . . 14
- 1.3 Matrix Form: . . . 17
  - 1.3.1 Preliminaries . . . 17
  - 1.3.2 Examples . . . 24
- 1.4 Matrix Polynomials . . . 27
- 1.5 Operators E and Δ . . . 29
  - 1.5.1 Auxiliary result . . . 29
- 1.6 Fractional Order Integral and Derivatives . . . 31

2 A General Inverse Matrix Series Relation and Associated Polynomials-I 33
- 2.1 Introduction . . . 34
- 2.2 Lemma . . . 35
- 2.3 Main Result . . . 38
- 2.4 General Class of Matrix Polynomials . . . 42

2.5 Particular Cases . . . 44
2.6 Wilson Matrix Polynomial and Racah Matrix Polynomial . . . 50
2.7 Application . . . 52
2.7.1 Generating Function Relations . . . 52
2.7.2 Summation Formulas . . . 55
2.8 Matrix Analogues of Riordan's Inverse Pairs . . . 57

3 A General Matrix Inverse Series Relation and Associated Polynomials-II 59
3.1 Introduction . . . 60
3.2 Lemma . . . 62
3.3 Main result . . . 64
3.4 Particular cases . . . 69
3.5 Alternative Forms of Theorem -I . . . 72
3.6 Wilson Matrix Polynomials and Racah Matrix Polynomials . . . 74
3.7 Application . . . 79
3.7.1 Generating Function Relations . . . 80
3.7.2 Summation Formulas . . . 82
3.8 Matrix analogues of Riordan's Inverse Pairs . . . 85

4 Generalized Konhauser Matrix Polynomial and its Properties 90
4.1 Introduction . . . 91
4.2 Generalized Konhauser Matrix Polynomial . . . 91
4.3 Inverse Series Relation . . . 93
4.4 Mittag-Leffler Matrix Function . . . 96
4.5 Generating Function Relations . . . 97
4.6 Summation Formulas . . . 101
4.7 Differential Recurrence Relation . . . 103
4.8 General Order Derivative . . . 105
4.9 Mixed Relation . . . 106
4.10 Contour Integral . . . 107
4.11 Matrix Integral Transform . . . 108

5 Generalized Mittag-Leffler Matrix Function 110
5.1 Introduction . . . 111
5.2 Generalized Mittag-Leffler Matrix Function . . . 111
5.3 Differential Equation . . . 113
5.4 Eigen Function Property . . . 116
5.5 Mixed Relation . . . 118
5.6 Particular Cases . . . 121
5.6.1 Differential Equation . . . 121
5.6.2 Eigen Function Property . . . 123
5.7 Extended Konhauser Matrix Polynomial . . . 124
5.8 Inverse Series Relations . . . 126

5.9 Generating Function Relations 130
5.10 Summation Formulas. 133

6 A Generalized Matrix Function ${}_pR_q(A, B : (C), (D); z)$ 136
6.1 Introduction 137
6.2 The Matrix Function ${}_pR_q(A, B : (C), (D); z)$ 138
6.3 Particular Cases 138
6.4 Contiguous Matrix Function Relations 142
6.5 Differential Equation 147
6.6 Matrix Differential Formulas 150
6.7 Integral Representation 154
6.8 Fractional Calculus of ${}_pR_q(A, B : (C), (D); z)$ 157

7 Bibliography 159

Reprints of Publised/Accepted Research Papers 170

Papers Presented at the National/International Confferences 171

Lists of Communicated Paper 172