

C O N T E N T S

	<u>Page</u>
Preface	i - iii
Acknowledgement	iv - v
Abstract	vi - viii
Contents	ix - xiii
List of Tables	xiv - xvii
List of Figures	xviii - xx

CHAPTER I

INTRODUCTION	1 - 25
1.1 Part I - Prediction of hourly flows by computer aided self-organisation of mathematical models	2
1.2 Part II - Forecasting of river flow during storm periods by a learning identification algorithm	4
1.3 Part III - Rainfall-run off model of flows of a river for a short span storm period by learning algorithms	5
1.4 Part IV - Forecasting of hourly river flow using heuristic learning algorithm	6
1.5 Part V - Real time estimation of river flow during a short span storm period	7
1.6 Part VI - Real time forecasting of daily river flow of a non-tidal river	8

	<u>Page</u>
1.7 Scope of the Work	10
1.8 The Teesta, its catchment and the observation sites	12
1.8.1 The main observation stations	14

CHAPTER II

SURVEY OF THE EXISTING LITERATURE	26 - 90
2.1 Introduction	26
2.2 Mathematical Models of Hydrological Systems	33
2.2.1 Box-Jenkins family of stochastic models.. ..	33
2.3 Mathematical Models of Dependence of Up-stream Flows on Down-stream Flows	37
2.3.1 Linear Least Square Regression Analysis.. ..	38
2.3.2 Least Squares Estimation of Parameters	41
2.3.3 Recursive Least Square Estimation of Parameters and Algorithms	43
2.3.4 Recursive Instrumental Variable Algorithms	49
2.3.5 Exponential Weighting of Past Data	56
2.3.6 Recursive Time Varying Parameters Estimation Algorithms	58
2.4 Models of Catchment Hydrology Depicting Rainfall Run Off Correlation and Hourly Flow Model Using Group Method of Data Handling Algorithms	63
2.4.1 Brief Description of multilayer GMDH	63
2.5 Combinatorial Group Method of Data Handling	76
2.5.1 Process equation	77
2.6 Real Time River Flow Model	78
2.6.1 Processing of the Statistical Data	80

CHAPTER III

HYDROLOGICAL MODELS OF THE RIVER TEESTA BY LEARNING IDENTIFICATION ALGORITHMS		.. .. 91-	161
3.1	Introduction ...	.. ..	91
3.2	Brief Description of the Multilayer Group Method of Data Handling Algorithms ...	.. ..	93
3.3	Part I : Use of GMDH in Formulating Flow Prediction Process at Coronation Bridge Point of the River Teesta	.. ..	97
3.4	Part II: Use of GMDH in Formulating the Six-hourly Flow Forecasting Model of the River Teesta at Domohani Road Bridge Point near Jalpaiguri Town	.. ..	103
3.5	Part III: Use of GMDH in Formulating Flow Prediction Process at Coronation Bridge Point of the River Teesta	.. ..	109

CHAPTER IV

FORECASTING OF HOURLY RIVER FLOW USING COMBINATORIAL GROUP METHOD OF DATA HANDLING ALGORITHMS ...		.. .. 162 -	184
4.1	Introduction ...	.. ..	162
4.2	Process Equation ...	.. ..	163
4.3	Illustration ...	.. ..	165

CHAPTER V

REAL-TIME ESTIMATION OF RIVER FLOW DURING A SHORT SPAN STORM PERIOD ...		.. .. 185 -	217
5.1	Introduction ...	.. ..	185
5.2	Development of the Recursive Algorithms..	.. ..	186

	<u>Page</u>
5.2.1 Description of system's dynamic equation	187
5.3 Least Square Estimation of Parameters	189
5.4 Algorithms for Recursive Least Square Estimation of Parameters	190
5.5 Recursive Instrument Variable Algorithms for Parameter Estimation	191
5.6 Results of Investigation	193

CHAPTER VI

REAL TIME FORECASTING OF DAILY RIVER FLOW	218 - 279
6.1 Introduction	218
6.2 Processing of the Statistical Data	219
6.3 Development of the Non-stationary Process Model	221
6.4 Development of Real-time Recursive Least Square Prediction Algorithm	223
6.5 Illustration	226
6.5.1 Section 1	226
6.5.2 Section 2	227
6.5.3 Section 3	227

CHAPTER VII

CONCLUSION AND SCOPE OF FURTHER WORK	230 - 234
--------------------------------------------	-----------

APPENDICES

COMPUTER PROGRAMS IN HIGH BASIC LANGUAGE	235 - 326
A.1.1 DETERMINATION OF COEFFICIENT OF CORRELATION	235