CONTENTS

Title page	İ
Certificate of Approval	ii
Certificate	ii
Acknowledgements	iv
Declaration	v
Nomenclature	vi
List of Figures	viii
List of Tables	X
Abstract	xi
Contents	xii
Chapter 1 Introduction	1 - 3
1.1 General	1
1.2 Objectives	3
Chapter 2 Review of Literature	4 - 41
2.1 Principles of Oxygen transfer	5
2.2 Types of aerators	9
2.2.1 Mechanical aerators	9
2.2.2 Gravity aerators	13
2.2.3 Diffused air systems	15
2.3 Comparative performance of existing aerators	16
2.4. Modeling of aerators	20
2.4.1. Dimensional and model analysis	22
2.4.2. Power per unit volume concept	34
2.5 Stepped cascade aeration system	35
2.5.1 Characterisation of flow regime	35
2.5.2 Oxygen transfer mechanism	36
2.6 Summary of the available literatures	39

2.7 Scope of the study	40
Chapter 3 Theoretical Analysis 42	2 - 59
3.1 Aeration theory	42
3.2 Estimation of oxygen transfer coefficient of an aeration system	45
3.2.1 Clean water testing	45
3.2.2 Pond water testing	47
3.3 Determination of oxygen transfer rate and efficiency	50
3.4 Dimensional Analysis	51
3.4.1 Description of variables	53
3.4.2 Formation of non-dimensional relationships	56
3.5 Similarity criteria	58
3.5.1 Geometric similarity	58
3.5.2 Dynamic similarity	58
Chapter 4 Materials and Methods	0 - 80
4.1 Materials	60
4.1.1 Experimental tanks	60
4.1.2 Experimental setup of circular stepped cascade pump (CSCP) aerator	60
4.1.2.1 Open well submersible pump	61
4.1.2.2 Experimental circular stepped cascade unit	63
4.1.2.3 Cascade stand	65
4.1.3 Instruments	65
4.2 Methodology	70
4.2.1 Aeration experiments	70
4.2.2 Experimental studies	72
4.2.2.1 Preliminary tests and quality control	73
4.2.2.2 Determination of the optimum values of geometric parameters	73
4.2.2.3 Determination of the effect of dynamic conditions on CSCP	
aeration system	76
4.2.2.4 Evaluation of the performances of prototype CSCP aerator	76

Chapter 5 Results and Discussion	81 -112
5.1 Optimum values of geometric parameters: Series G	81
5.1.1 Regression model of response	
83	
5.1.2 Localization of the optimized condition	
86	
5.1.3 Model adequacy checking	
91	
5.2 Effect of dynamic variables on CSCP aeration system: Series D	93
5.2.1 Effect of discharge on SOTR, P, and SAE of different cascade setup	os 97
5.2.2 Effect of bottom radius (R _b) of cascade unit on SOTR, P, and	
SAE at different discharges	99
5.2.3 Variation of NDSAE with Re and Fr	102
5.2.4 Variation of Ne with Re and Fr	105
5.2.5 Experimental Errors	107
5.2.6 Summary of the study concerning geometric and dynamic similarity	y 108
5.3 Performance evaluation of prototype CSCP aerators	109
5.4 Comparative performances of aerators used in aquaculture	111
Chapter 6 Summary and Conclusions 11	3 - 116
References 11	17 -125
Appendix A Preliminary tests and quality control	6 - 127
Appendix B Sample calculation of experimental results for Series G	28 -131
Appendix C Sample calculation of experimental results for Series D	132
Appendix D Sample calculation of experimental results for series P	133