Declaration

I, **Biswajit Bhagowati**, hereby declare that the present thesis entitled, **A Study on Lake Eutrophication Dynamics and Management through Data-Driven Modelling**, is the record of work done by me under the supervision of **Dr. Kamal Uddin Ahamad, Professor, Department of Civil Engineering, Tezpur University, Tezpur**. The contents of the thesis represent my original work that has not been previously submitted for any Degree/Diploma/Certificate in any other University or Institution of Higher Education.

This thesis is being submitted to Tezpur University for the Degree of Doctor of Philosophy in Civil Engineering

Place: Tezpur University, Tezpur

Date:

_____

(Biswajit Bhagowati)

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Biswajit Bhagowati

(Biswajit Bhagowati)

Place: Tezpur University, Tezpur

Date: 07-06-2024

Certificate

TEZPUR UNIVERSITY

This is to certify that the thesis entitled, **A Study on Lake Eutrophication Dynamics and Management through Data-Driven Modelling**, submitted to the School of Engineering, Tezpur University in partial fulfilment of the award of the degree of Doctor of Philosophy, in Civil Engineering is a record of research work carried out by Mr. Biswajit Bhagowati under my supervision and guidance.

All help received by him from various sources have been duly acknowledged.

No part of this thesis has been submitted elsewhere for any other degree.

(Supervisor)

Dr. Kamal Uddin Ahamad
Professor, Department of Civil Engineering
School of Engineering, Tezpur University
June, 2023

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Acknowledgements

First and foremost, I take it as an honour to express my profound gratitude and sincere thanks to my respected supervisor Dr. Kamal Uddin Ahamad, Professor, Department of Civil Engineering, Tezpur University, for his invaluable supervision, guidance, support and constructive suggestions and particularly for his meticulous approach and gracious engagement at each and every stage of the course to make this project a reality and success.

I would like to acknowledge my sincere gratitude to the members of the doctoral committee of my research and departmental research committee for their valuable comments and feedback during the review meetings. I also express my gratitude towards the institute authority, especially the personnel of Civil Engineering Department, for providing me the access to the laboratory and research facilities.

My sincere thanks to the members of my thesis review committee and the anonymous reviewers for their precious comments and feedback.

I express my sincere gratitude to Bishal, who helped me immensely during my experimental works. I am also grateful to my seniors Binanda da and Jayanta da for their continuous support and guidance throughout the journey.

I am also deeply grateful to my parents, my wife Dr. Zahnupriya Kalita and my elder brother Dr. Nabaratna Bhagawati for their unconditional support, encouragement and trust that helped me to complete my Ph.D. course.

Last but not the least, heartiest thanks to the Almighty, who bestowed all his blessings on me.

Biswajit Bhagowati

Dedicated to my

Parents, Teachers and friends

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List of Abbreviations/Notations

ANFIS	:	Adaptive Neuro-Fuzzy Inference System
ANN	:	Artificial Neural Networks
Avg	:	Average
BOD	:	Biochemical Oxygen Demand
Chl-a	:	Chlorophyll-a
COD	:	Chemical Oxygen Demand
DO	:	Dissolved Oxygen
E	:	Nash-Sutcliffe efficiency
EC	:	Electrical Conductivity
FFNN		Feed-forward neural network
FIS	:	Fuzzy inference system
GPR	:	Gaussian Process regression
GRNN	:	General Regression Neural Network
MAE	:	Mean Absolute Error
Max	:	Maximum
Min	:	Minimum
MLP	:	Multilayer Perceptron
MLR	:	Multiple Linear Regression
MSE	:	Mean Squared Error
N	:	Nitrogen
P	:	Phosphorus
R	:	Correlation Coefficient
R^2	:	Coefficient of determination

RMSE	:	Root Mean Square Error
RBFN	:	Radial basis function neural network
SD	:	Secchi disk depth
St. Dev.	:	Standard deviation
SVM	:	Support vector machines
SVM	:	Support vector machines
SVR	:	Support vector regression
TANSIG	:	Sigmoid Tangent Activation Function
TDNN	:	Time Delay Neural Network
TDS	:	Total Dissolved Solids
Temp	:	Temperature
TN	:	Total nitrogen
TP	:	Total Phosphorus
TP	:	Total Phosphorus
TSI	:	Trophic status index
Turb	:	Turbidity
WQI	:	Water Quality Index