Acknowledgments

First of all, I would like to express my deepest gratitude to my Ph.D. supervisor Prof. Balram Dubey who has guided me at every moment of this work and he was phenomenal in moral support, motivation, and dedication throughout the whole work. Whenever I felt lonely, nonetheless his monitoring was more phenomenal. His encouragement for my innovative research and new ideas are inevitable to forge for my continuous achievement.

I am thankful to the Vice-Chancellor, Director, Dean Academic (AGSRD), and Registrar of BITS Pilani for giving me an opportunity to achieve a challenging position in respective field pertinent to my qualification which allowed me to use my skills to prove myself worthy. I am further thankful to them for providing me the facilities regarding research work and a healthy environment.

I owe my sincere gratitude to Prof. Devendra Kumar, HoD, Department of Mathematics and Ex-Hods, Prof. Balram Dubey, Prof. B. K. Sharma who provided me a golden opportunity to work in the Department of Mathematics and in finalizing this work within time and throughout the entire procedure. I would like to acknowledge all the faculty members and staff of the Mathematics Department for demonstrating genuine interest and enthusiasm in their teaching and relentless support.

I am also thankful to the doctoral advisory committee (DAC) members Prof. Rajiv Kumar and Prof. B. K. Sharma for their valuable comments and constructive suggestions during Ph.D. research work.

I wish to express my sincere thanks to Prof. J. B. Shukla, IIT Kanpur, India for his great contribution to enrich my understanding about mathematical modelling in ecology. I extend my thanks to Dr. Sourav Kumar Sasmal, BITS Pilani, Dr. Sanjay Lamba, University of California, Berkeley, USA, Dr. Debaldev Jana, SRM, Chennai, Mr. Ashish Poonia, IIT Guwahati for their invaluable discussions, research ideas and most importantly for moral support when it was needed.

I heartily thank to my respected seniors Dr. Atasi Patra Maiti and Dr. Preeti Dubey, who helped and inspired me throughout my research work. I would also like to thank my beloved juniors Sajan, Ashvini and Ansu for giving me opportunity to explain various concepts to them.

I am very thankful to my friend and batch mate Yogendra and his wife Nikita to support me physically and mentally whenever it was needed. I will forever be indebted to both of them for their mental support and help during the toughest conditions of COVID. I am also thankful to all my lab mates to support me directly or indirectly.

I acknowledge my sincere thank to my respected grandfather Shri Bhagirath Singh, adoptive parents (Late Shri Sultan Singh, Smt. Sona Devi), genetic parents (Mr. Rajendra Singh, Smt. Prabhati Devi), brother (Ashish) and family members for their enormous love, unquestioning support. I don't envisage a life without their love and blessings.

I owe my heartfelt thank to my wife Rinku, whom I may have neglected way too much during my research work, for her continual support and love.

I am thankful to University Grant Commission (UGC), New Delhi for financial assistance as a part of this work.

Place: BITS Pilani Ankit Kumar

Date: 26 July 2021 (Department of Mathematics)