

**Dedicated to my Deuta & Maa**

*Shri Dhaneswar Nath*

&

*Smt. Bonti Devi*

## DECLARATION BY THE CANDIDATE

I, **Darshana Devi**, hereby declare that the subject matter in this thesis entitled “**A Qualitative Study on Different Classes of Fractional Order Hybrid Differential Equations**”, is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other university/institute.

This thesis is being submitted to the Tezpur University for the degree of Doctor of Philosophy in Mathematical Sciences.

Date: 12/06/2025

Place: Tezpur

*Darshana Devi*

Signature of the Candidate

# TEZPUR UNIVERSITY



Dr. Jayanta Borah,  
Dept. of Mathematical Sciences  
Nagarm-784028, Assam, India


Phone(Ext.): 03712-27-5522  
+91-8638326218(M)  
E-mail: jba@tezu.ernet.in

## CERTIFICATE OF THE SUPERVISOR

This is to certify that the thesis entitled "**A Qualitative Study on Different Classes of Fractional Order Hybrid Differential Equations**" submitted to the School of Sciences of Tezpur University in partial fulfillment for the award of the degree of Doctor of Philosophy in Mathematical Sciences is a record of research work carried out by **Ms. Darshana Devi** under my supervision and guidance. All help received by her from various sources have been duly acknowledged.

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

Date: 12/06/2025  
Place: Tezpur



**Dr. Jayanta Borah**

Department of Mathematical Sciences  
School of Sciences  
Tezpur University, Assam

# ACKNOWLEDGEMENT

*My Ph.D. journey and this thesis would not have been possible without the support and kindness of many wonderful people, to whom I am truly grateful.*

*First and foremost, I extend my deepest gratitude to my supervisor, Dr. Jayanta Borah. His constant encouragement, guidance, and wisdom have been invaluable in keeping me focused and motivated. Despite his busy schedule, he has always been patient and supportive, clarifying my doubts and providing thoughtful advice whenever needed. It has been an absolute privilege to learn under his mentorship. Thank you Sir, for your kindness, support, and invaluable contributions to my academic journey. I am also sincerely thankful to his wife, Dr. Jayashree Dutta, for her encouragement and support.*

*I am incredibly grateful to my Doctoral Committee members, Prof. Shuvam Sen and Dr. Deepjyoti Goswami, for their insightful feedback and guidance throughout these years. I also extend my heartfelt thanks to Prof. Nayandeep Deka Baruah for his valuable suggestions. My sincere appreciation goes to the Department of Mathematical Sciences, Tezpur University, for giving me the opportunity to pursue my Ph.D. and for providing access to essential research facilities. I am equally thankful to all the faculty members for their constant encouragement and support.*

*I feel truly blessed to have seniors like Duranta Daa, Subha Daa, Monalisha Baa, and Ankur Daa, who have always been there to guide and help me. I would also like to thank Dr. Khirod Boruah for his valuable input and guidance. My heartfelt thanks also go to my fellow researchers Firdous, Abhishek, Pranjali, Pritam, Shrabani, Hirak, Pankita, Rohan, Juganta, Sweta, Pooja, and many others who have stood by me during difficult times, always ready to help with kindness and generosity.*

*A special thanks to Bhabana, Chayanika, and Tanushree for their unwavering support and for making my time on campus truly special. I am also grateful to Krishangi, Seema, Kangkan, and Mayur for their encouragement, especially during tough times.*

*At this moment of achievement, I would like to express my deepest gratitude to my family, the greatest pillar of my life. My father (Dhaneswar Nath), mother (Bonti Devi), and brother (Parthajit Nath), have always believed in me and given me the freedom to*

*follow my dreams. Their love and support mean everything to me. I am also forever grateful to Dr. Simanta Doley for standing by my side, offering endless encouragement and motivation.*

*I also extend my heartfelt thanks to Ani Jethai, Renu Jethai, Babu Daa, Baba Daa, Tulu Daa, Moina Daa, Akamani Daa, Pinky Bou, Pubali Bou, Munu Bou and all my relatives and well-wishers, whose love and encouragement have been a constant source of inspiration.*

*Last but not least, I sincerely thank the entire fraternity of Tezpur University for providing the resources that made my research possible. I am also deeply grateful to Tezpur University for the Institutional Fellowship, which greatly supported my academic journey.*

*Thank you all for your insights, guidance and infinite support!*

Darshana Devi