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Notice for the PhD Viva Voce Examination

Mr Arkaprovo Chakraborty, Registration Number: 2270148, PhD Scholar at the Department of Mathematics, School of Sciences, CHRIST (Deemed to be University), Bangalore will defend his PhD thesis at the public viva-voce examination on Monday, 22 September 2025 at 10.00 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	**Dynamics of Climate and Ecological Models with Effects of Global Warming, Time Delay and Fear Effect within the Frame of Fractional Calculus**
Discipline	:	**Mathematics**
External Examiner - I	:	**Dr Mehmet Yavuz** Associate Professor Necmettin Erbakan University Meram Yeniyol, 42090 Meram, Konya Türkiye
External Examiner - II	:	**Dr V Parthiban** Associate Professor Department of Mathematics School of Advanced Sciences Vellore Institute of Technology, Chennai Campus Vandalur - Kelambakkam Main Road Chennai - 600127 Tamil Nadu
Supervisor	:	**Dr Pundikala Veeresha** Associate Professor Department of Mathematics School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar (Academics)

Place: Bengaluru
Date: 12 September 2025

ABSTRACT

This thesis investigates the complex dynamics of climate and ecological systems through advanced mathematical modeling, fractional calculus, numerical analysis, and real-world data integration. A modified Cryosphere model based on surface energy and mass balance is analyzed to understand climate change impacts on polar regions. The Lorenz-84 atmospheric model is extended to include global warming effects, time delays, and control strategies to manage chaotic behavior and improve predictability. A fractional-order Samardzija-Greller predator-prey model is developed to explore synchronization, multiscale dynamics, and the influence of time-scale separation in ecological interactions. Behavioral effects like fear response and predator-taxis sensitivity are incorporated to study their roles in ecological stability and biodiversity conservation. The thesis also develops stochastic and fractional models to simulate and forecast environmental indicators such as air pollution, forest carbon uptake and river water quality. By bridging theory and application, the work contributes to the understanding of sustainable environmental and ecological management.

Keywords: *Nonlinear dynamics; mathematical modeling; control and synchronization; stochasticity; chaos; time delay; global warming; fear effect; Caputo fractional derivative.*

Publications:

1. **Chakraborty**, N. Mukherjee, and P. Veeresha, "Diffusive instability, patterns and limit cycles in a slow-fast generalized Samardzija-Greller model: a multiscale approach," ***Nonlinear Dynamics***, vol. 113, no. 14, pp. 18037–18058, **2025**.
2. **Chakraborty** and P. Veeresha, "Investigating the dynamics, synchronization and control of chaos within a transformed fractional Samardzija–Greller framework," ***Chaos, Solitons & Fractals***, vol. 182, p. 114810, **2**
3. **Chakraborty** and P. Veeresha, "Unveiling stabilization mechanisms in a chaotic fractional Cryosphere model.," ***Mathematics in Engineering, Science & Aerospace (MESA)***, vol. 15, no. 1, **2024**
4. **Chakraborty** and P. Veeresha, "Effects of global warming, time delay and chaos control on the dynamics of a chaotic atmospheric propagation model within the frame of Caputo fractional operator," ***Communications in Nonlinear Science and Numerical Simulation***, vol. 128, p. 107657, **2024**.
5. **Chakraborty**, P. Veeresha, A. Ciancio, H. M. Baskonus, and M. Alsulami, "The effect of climate change on the dynamics of a modified surface energy balance-mass balance model of Cryosphere under the frame of a non-local operator," ***Results in Physics***, vol. 54, p. 107031, **2023**.