

## **Congratulations for seeking Govt. Sponsored Project**

**Name:** Dr. Pawan Kumar Shaw

**Department:** Mathematics

**Project Title:** **Nonlinear Dynamics of Fractional Order Systems with Synchronization.**

**Funding Agency:** ANRF-IRG

**Sanction Amount:** Rs. 34,31460

**Tenure:** 3 Years

### **Abstract:**

The project titled “**Nonlinear Dynamics of Fractional Order Systems with Synchronization**” aims to advance the understanding of complex dynamical systems using the framework of fractional calculus. Unlike classical integer-order models, fractional-order systems incorporate memory and hereditary properties, making them highly effective for modeling real-world phenomena with nonlocal and long-term dependencies.

The research focuses on analyzing the dynamical behavior, stability, and synchronization of coupled fractional-order nonlinear systems. It investigates various forms of synchronization, including complete, phase, lag, and generalized synchronization, and examines their dependence on system parameters, coupling strength, and external perturbations. The study combines mathematical modeling, stability analysis, and numerical simulations to explore complex behaviors such as chaos, bifurcations, and self-organization.

The expected outcomes include bridging key gaps in the theory of fractional-order nonlinear systems and providing deeper insights into coherence in complex networks. The findings will have interdisciplinary applications in areas such as secure communication, neural networks, power systems, signal processing, and biological modeling. Additionally, the project will contribute to the development of efficient computational techniques and innovative synchronization strategies, thereby strengthening research in applied mathematics and nonlinear dynamics.