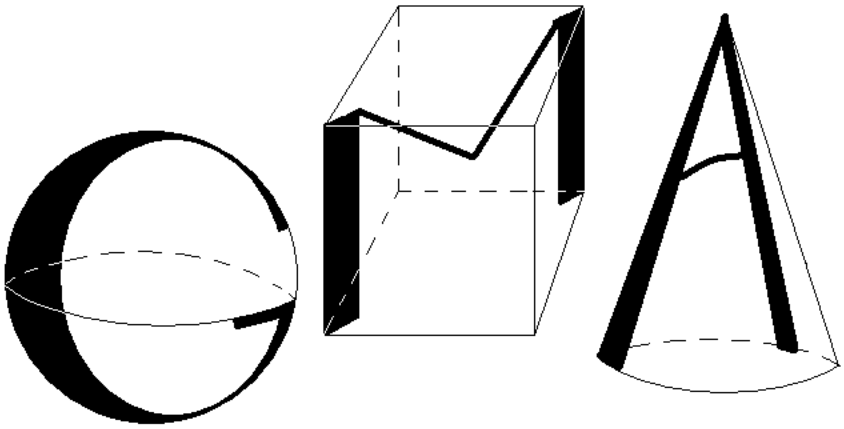

Colloquium

April 16, 3:00 p.m. (8^{th} Period)

(in the Atrium)

Speaker: Abhiram Hegade

Title: Beyond Integer Order: Unraveling Fractional Differential Equations

Abstract

Step beyond the integer order! This talk explores fractional differential equations, a generalization of classical calculus that models complex phenomena with memory and hereditary properties. We'll journey through the history of fractional derivatives, from their conceptual origins to modern developments. After laying the groundwork with essential definitions and preliminary results, we'll dive into the stability analysis of fractional-order systems.

A key focus will be the Linear Homogeneous system governed by the Hilfer fractional derivative, also known as the Generalized Riemann-Liouville Fractional Derivative (GRLFD). With derivatives of order $\alpha \in (0, 1)$ and type $\beta \in [0, 1]$, these systems offer a rich framework for studying nonlocal dynamics. We will derive solutions, determine equilibrium points, and analyze stability properties. Finally, we will visualize system behavior through phase portraits corresponding to specific eigenvalues, bringing these abstract ideas to life.