



**GOLDEN JUBILEE
DISTINGUISHED ALUMNI
LECTURE SERIES
2025**

**SCHOOL OF MATHEMATICS AND
STATISTICS**

Chair: Prof. Saroj Panigrahi

Dean, School of Mathematics and Statistics
University of Hyderabad

Date & Time:

14 Feb, 2025 | 03:00 PM

Venue:

Central Seminar Hall (East Campus)

Coordinator : Dr. M.S.Datt

School of Mathematics and Statistics
University of Hyderabad

SPEAKER



Dr. A Benerji Babu

Professor, Department of Mathematics, NIT Warangal.
He completed his M.Sc(Applied Mathematics) and M.Phil
From University of Hyderabad and earned his Ph.D degree
from Osmania University, Hyderabad.

Title of the talk

**Mathematical Modelling of Convective Instabilities in
Binary Fluids: Effects of Thermal and Compositional
Buoyancy.**

Abstract

Convective instabilities in binary fluid mixtures play a crucial role in natural and industrial processes, including geophysics, astrophysics, and materials science. This study develops a mathematical model to examine the impact of thermal and compositional buoyancy on these instabilities. The governing equations are formulated based on mass, momentum, energy, and species concentration conservation laws. To analyze the onset of convection, both linear and weakly nonlinear stability analyses are conducted under varying parameter regimes, including Rayleigh and solutal Rayleigh numbers, Lewis number, and Prandtl number. The study investigates how thermal and solutal buoyancy forces influence flow structures and instability thresholds through analytical and numerical methods. The results reveal the interplay between thermal and compositional gradients, highlighting their role in either triggering or suppressing convection. In particular, the interaction between double-diffusive effects and buoyancy-driven flows is explored to identify critical instability conditions. These insights enhance our understanding of convective transport in binary mixtures, with applications in crystal growth, oceanic circulation, and chemical engineering.