

Dynamic Modeling of Biochemical Systems (ODE/SDE) — Hands-on

Master dynamic modeling of biochemical reactions using deterministic (ODE) and stochastic (SDE) formalisms. This module covers reaction system formulation, mass-action and Hill kinetics, numerical solvers, stability and bifurcation analysis, noise-driven systems, and simulation workflows using Python (SciPy), R (deSolve), COPASI, and Tellurium/RoadRunner. By the end, you will generate reproducible simulation notebooks, visualize trajectory behavior, and interpret dynamical signatures (steady states, oscillations, switching).

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Session 1

Fee: Rs 8800 [Apply Now](#)

Reaction Systems, Kinetics & ODE Setup

Reaction networks & kinetic laws

[mass-action](#) [Michaelis-Menten](#) [Hill kinetics](#)

Converting reactions to ODEs

[stoichiometry matrices](#) [state variables](#) [rate laws](#)

Toolchain overview

Python SciPy R deSolve COPASI / Tellurium

Session 2

Fee: Rs 11800 Apply Now

Numerical Solvers, Stiffness & Stability

Solvers & integration methods

Euler / RK4 LSODA / CVODE adaptive solvers

Stiffness & model behavior

timescale separation numerical instability solver troubleshooting

Stability & phase-plane analysis

Jacobian & eigenvalues steady states oscillations

Session 3

Fee: Rs 14800 Apply Now

Stochastic Modeling (SDE) & Noise

Sources & types of stochasticity

intrinsic noise extrinsic noise biological variability

SDE models & simulation

Langevin equations Euler-Maruyama noise terms & variance

Tools for stochastic simulation

Tellurium StochPy Python SDE libraries COPASI stochastic mode

Session 4

Fee: Rs 18800 Apply Now

Mini Capstone: Full Dynamical Model Build

Build a complete ODE/SDE model for a biological pathway

Theory + Practical

Simulation, visualization & interpretation

trajectories & phase-plots **steady states &**
oscillations **noise comparison**

Deliverables

PDF/HTML report **Python/R notebook**
environment.yml / requirements.txt