



# THEORETICAL MECHANICS

## PROF.CHARUDATT KADOLKAR

Department of Physics  
IIT Guwahati

**PRE-REQUISITES** : Introduction to Newtonian Mechanics is desired.

**INTENDED AUDIENCE** : First year of MSc or 2 nd and 3 rd year of BE/BTech in Engg Physics

### COURSE OUTLINE :

This course focuses on analytical aspects of classical mechanics and is targeted towards the audience who are interested in pursuing research in Physics. Various formulations of mechanics, like the Lagrangian formulation, the Hamiltonian formulation, the Poisson bracket formulation will be taught in the course. The course also introduces the mechanics of continuous systems and fields.

### ABOUT INSTRUCTOR :

Prof. Charudatt Kadolkar graduated from IIT Bombay and completed his PhD in Physics, also at IIT Bombay. After completing a post-doctoral fellowship, he joined IIT Guwahati in 1995. He has been teaching Physics at various levels for past 22 years. His primary research interest is condensed matter physics.

### COURSE PLAN :

**Week 1:** Motion and Constraints, Generalized Coordinates, Alembert Principle of Virtual Work

**Week 2:** Variational Calculus, Hamiltons Principle, Lagrangian Formulation.

**Week 3:** Applications of Lagrangian Mechanics, Phase Space.

**Week 4:** Central Forces, Orbits, Kepler Motion.

**Week 5:** Central Forces, Scattering.

**Week 6:** Rigid Body Kinematics, Euler Angles, Rotating Frames.

**Week 7:** Rigid Body Dynamics, Euler Equations.

**Week 8:** Small Oscillations.

**Week 9:** Phase Space, Hamilton's Equations of Motion.

**Week 10:** Cannonical Transformations, Cannonical invariants, Symplectic Approach to CT.

**Week 11:** Poisson Bracket Formulation, Symmetry groups of Mechanical Systems, Liouville's Theorem.

**Week 12:** Hamilton Jacobi Theory, Hamilton's Principal Fucntion, Action-Angle variables.