Indian Institute of Technology Guwahati

Tutorial-1 PH4030: Classical Mechanics Dated 30 July 2026

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1. A body of mass m at rest splits into masses m_1 and m_2 by an explosion. After the split, the bodies move with a total kinetic energy T. Show that their relative speed is $\sqrt{2Tm/(m_1m_2)}$.

2. Two particles, P and Q, each of mass m are connected by a light, inextensible string of length 2l which passes through a small, smooth hole O in a smooth horizontal table. Particle P is free to slide on the table and Q hangs freely below it. Initially, OQ of length l and P is projected from rest at right angles to OP with velocity $(8gl/3)^{1/2}$. Show that in the ensuing motion the particle Q will just reach the table. Use conservation of energy and conservation of angular momentum.

3. Two masses, m1 and m2 are connected by a linear spring of constant k and the system is initially at rest on a frictionless surface. The spring is compressed by an amount δ and released. Find the velocity of each mass when the spring returns to its natural, non deformed length L.

4. A mass m tied to a spring having a force constant k oscillates in one dimension. If the motion is subjected to the force F=-kx, find expressions for displacement, velocity and period of oscillation.

5. Is $\vec{F} = \vec{A} \times \vec{r}$, a conservative force?

6. Consider the gravitational potential energy resulting from the earth's attraction on a particle of mass m given as $\frac{-GMm}{r}$, where r is the distance of the particle from the centre of Earth, and M is the mass of earth. Using the property of conservative force, obtain the expression of critical speed needed for a particle to escape to infinity.

7. Describe the motion of a pendulum bob with the Lagrange method.

8. A bead slides on a smooth wire that is rotating uniformly about a point O in a horizontal plane (i.e. the XY plane). Describe the motion of the bead.
