Indian Institute of Information Technology, Vadodara

Course - Physics
Course Code - ph101
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EndSem

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1. If the total force on a system of particles is zero show that the torque on the system is the same about all origins.

2. Let $\lambda(v)$ denote the Lorentz transformation matrix between the coordinators(x', t') of frame F' and (x, t) of frame F. Write down the matrix $\lambda(v)$ that expresses (x', t') in terms of (x, t). Also write down $\lambda(-v)$ that expresses (x, t) in terms of (x', t'). Find the product of the matrices $\lambda(v)\lambda(-v)$.

3. A thin plank of mass M and length l is pivoted at one end. The plank is released at $60°$ from the vertical. What is the magnitude and direction of the force on the pivot when the plank is horizontal?

4. A cylinder of mass M, radius R and moment of inertia αMR^2 spins with angular velocity ω_0. When the cylinder is gently laid on the plane, it skids for a short time and eventually rolls without slipping. What is the final angular velocity ω_f?

5. Frame F' moves uniformly with velocity $v$along positive x direction with respcet to frame F. Consider the following pairs of events

   (i) $E_1 : t_1 = 0, x_1 = 0, \qquad E_2 : t_2 = 2s, x_2 = 2 * 10^8 m.$

   (ii) $E_1 : t_1 = 0, x_1 = 0, \qquad E_2 : t_2 = 0.1s, x_2 = 10^8 m.$

   The y and z coordinates of all the events are 0. Find the possible values of v for which the pairs of event in (i) and (ii) occur

   (a) Simultaneously.

   (b) At the same location.

6. A source S emits monochromatic light with frequency v and wavelength λ. The source moves towards an observer O with speed v. Find the wavelength λ' and the frequency v' of the light as reveived by the observer O and verfy that $v'\lambda' = c$.

"Physics is, hopefully, simple. Physicists are not."

Edward Teller

Answers