Indian Institute of Science Education and Research, Mohali

Classical Mechanics (PHY301)

(September – December 2021)

Mid-Semester Exam (Part 1)

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1. Consider a simple pendulum of mass m, length L with acceleration due to gravity g pointing vertically downwards.

   (a) Write down the Lagrangian for this system. [1]

   (b) Derive an expression for Energy of the system. [1]

   (c) What is the energy if the amplitude of the pendulum is ϕ_0? [1]

   (d) Express time period for this system in terms of an integral. [1]

   (e) Evaluate the integral in the limit of $\phi_0 < 1$ retaining up to fourth power of ϕ_0. [3]

   (f) What is the percentage variation of time period from the simple harmonic oscillator limit for $\phi_0 = \pi/4$? [1]