IC121: Mechanics of Particles and Waves
School of Basic Sciences, IIT Mandi
Semester I, 2017

Instructor: Dr. Pradeep Kumar (SBS)

Problem Set - 5 **Due Date: 07 Nov. 2017- Roll # 16076-16151**

09 Nov. 2017- Roll # 16001-16075

Marks-40

Q.1. Find the equation of motion of the charge using Lagrange's method in an electrical circuit (having no resistance) with components of an inductor of inductuance L is connected to the capacitor of capacitance C. Initially the capacitor has charge Q. Compare the equation of motion with usual methods in electrodynamics. **(4)**

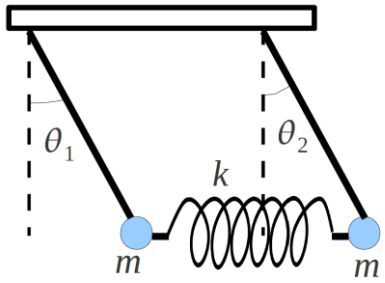
Q.2. Find the Lagrangian and Lagrange's equation of motion for a spring mass system (simple harmonic oscillator). **(4)**

Q.3. Find the Lagrangian and Lagrange's equation of motion for a simple pendulum of length L. **(4)**

Q.4. A solid cylinder with radius *a is* rolling on the rough inside surface of fixed cylinder with center *O* and radius b, $b > a$. Find the Lagrange's equation of motion and deduce the period of the small oscillations. **(7)**

Q.5. Two masses each of mass m are connected by a spring to each other and by springs to fixed position spring 1, 2, and 3 have spring constants $k, k_{12},$ and k respectively. Find the eigenfrequencies of the system using the Lagrangian method, assuming that oscillations are small. **(7)**

Q.6. Determine the eigenfrequencies and describe the normal mode motion for two pendulum of equal length b and equal masses m connected by a spring of force constant k (as shown in the figure below). Choose the generalized coordinates and solve using Lagrangian method for small oscillations. **(7)**



Q.7. Determine the eigen-frequencies and describe the normal mode motions of a symmetrical linear triatomic molecule similar to CO_2 (as shown in the figure below). The central atom has mass$M$and the symmetrical atoms have masses m. **(7)**