

**PHYS 306: HOMEWORK ASSIGNMENT No. 5:  
MOTION IN NON-INERTIAL FRAMES**

(March 2nd, 2017)

**HOMEWORK DUE: Friday, MARCH 10th, 2017**

**To be handed in during class- Late Homework will not be accepted**

**QUESTION (1) FORCES IN A ROTATING CIRCULAR FRAME:** We consider an infinitesimally thick circular wire oriented vertically (ie., in a flat plane which is vertical). The circle has radius  $R_o$ , and is spinning about a vertical axis through its centre at a constant angular velocity  $\omega_o$ .

**1(a)** Suppose a small mass  $m_o$  is constrained to move without friction on the wire (ie., at radius  $R_o$  from the centre). Find the Lagrangian for the point mass (i) in the non-rotating frame, and (ii) in the frame rotating with the circle.

**1(b)** Now find the equation of motion for the mass  $m_o$ , and use it to find (i) the equilibrium position of the mass on the circle, and (ii) the frequency of small oscillations of the mass around this equilibrium point.

**QUESTION (2) MOTION ON A ROTATING ROD:** A small mass  $m_o$  is allowed to slide without friction on a very long rigid rod. The rod is rotating with constant angular velocity  $\omega_o$  in a horizontal plane, with one end fixed at the origin  $\mathcal{O}$ .

**2(a)** Find the equation of motion for the distance  $r(t)$  of the mass on the rod, from the centre of rotation at  $\mathcal{O}$ .

**2(b)** Suppose that at time  $t = 0$ , the radial velocity  $dr/dt$  of the mass is zero. What is the subsequent motion of the mass?

**END of 5th HOMEWORK ASSIGNMENT**