Assignment : Central forces   2nd Nov. 2020

1. Use Hamilton's equations to find the differential eq^n for planetary motion and prove that the areal velocity is constant.

2. A particle of mass m moves under the action of central force whose potential is $v(r) = Kmr^3$ $(k>0)$, then
(I) for what kinetic energy and angular momentum will the orbit be a circle of radius R about the origin ?
(ii) Calculate the period of circular motion.

3. The eccentricity of the earth's orbit is 0.0167. Calculate the ratio of momentum maximum and minimum speeds of the earth in its orbit.

4. The maximum and minimum velocities of a satellite are V_{max} and V_{min} respectively. Prove that the eccentricity of the orbit of the satellite is,

$$e = \frac{V_{max} - V_{min}}{V_{max} + V_{min}}$$

5. A particle of mass 'm' is observed to move in a spiral orbit given by the eq^n $r = C\theta$ where C is a constant. Is it moving in a central force field ? If it is so, find the force law. [Hint : Eq^n of orbit : $\frac{d^2u}{d\theta^2} + u = - \frac{mf(\frac{1}{u})}{L^2 u^2}$]

6. A particle describes a circular motion under the influence of an attractive central force directed towards a point on the circle. Show that the force varies as the inverse fifth power of the distance.