

The Open University of Sri Lanka
 B.Sc./B.Ed. Degree, Continuing Education Programme
 No Book Test (NBT) - 2023/2024
 Level 4 - Applied Mathematics
 ADU4301 – Newtonian Mechanics I



Date: 10-02-2024

Time: 1:00 p.m. To 2:00 a.m.

Answer All Questions.

1. (a) A particle moves on an orbit with central force $\frac{\mu}{r^2}$. Prove that the orbit is an ellipse or parabola or hyperbola according as $v^2 - \frac{2\mu}{r} < 0$, $v^2 - \frac{2\mu}{r} = 0$, $v^2 - \frac{2\mu}{r} > 0$.
- (b) A particle describes an ellipse of eccentricity e about a centre of force at a focus. When the particle is at one end of a minor axis, its velocity is doubled. Prove that the new path is a hyperbola of eccentricity $\sqrt{9 - 8e^2}$.
2. A particle, of mass M , is projected vertically upwards in a cloud. During the motion, the particle absorbs moisture from the stationary cloud so that the particle is at distance x above the point of projection, moving with speed v , it has mass $M(1 + \alpha x)$ where α is a constant. The initial speed of the particle is $\sqrt{2gk}$.
 - (a) Show that $\frac{dv^2}{dx} + \frac{2\alpha}{1+\alpha x} v^2 = -2g$.
 - (b) Show that the greatest height, h is given by $(1 + \alpha h)^3 = 1 + 3k\alpha$.

