

The Open University of Sri Lanka
 B.Sc /B.Ed Degree Programme
 Applied Mathematics - Level 04
 ADU4301/ADE4301 – Newtonian Mechanics I
 No Book Test (NBT) - 2017/2018



Duration :- One Hour

Date:- 08. 02. 2019

Time:- 4.15 p.m. - 5.15 p.m.

Answer All Questions.

1. A particle P , whose initial mass is m_0 , is projected vertically upwards from the ground at time $t = 0$ with speed g/k , where k is a constant. As the particle moves upwards it gains mass by picking up small droplets of moisture from the cloud. The droplets are at rest before they are picked up. At time t the speed of P is v and its mass has increased to $m_0 e^{kt}$. Assuming that, during the motion, the acceleration due to gravity is constant,

(a) Show that, while P is moving upwards, $kv + \frac{dv}{dt} = -g$

(b) Find, in terms of m_0 , the mass of P when it reaches its greatest height above the ground.

2. A uniform rod AB , of mass m and length $2a$, is free to rotate in a vertical plane about a fixed smooth horizontal axis L . The axis L is perpendicular to the rod and passes through the point C of the rod, where $AC = 2a/3$.

(a) Find the moment of inertia of the rod about L .

The rod is held at rest with B vertically above C and is slightly displaced.

(b) Find the angular speed of the rod when CB makes an angle θ with the upward vertical.

(c) Find the magnitude of the angular acceleration of the rod when CB makes an angle θ with the upward vertical.

(d) Find, in terms of g and a only, the angular speed of the rod when the force acting on the rod at C is perpendicular to the rod.

