

*Sam J*

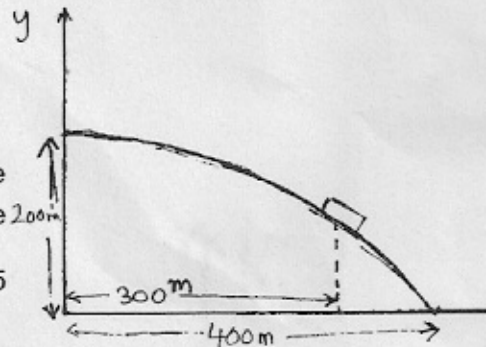
AML 110  
MECHANICS  
Minor 2

Max. Marks 60  
Max. Time 1 hour

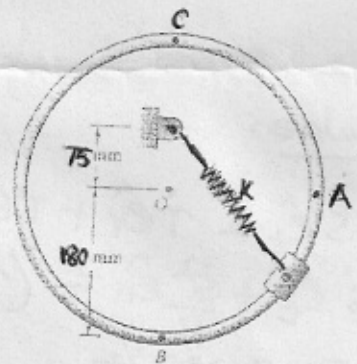
10-10-2009

Please answer all the 4 questions. The value of 'g', acceleration due to gravity on the earth's surface can be taken as  $9.81 \text{ m/s}^2$ . All questions are worth 15 marks each. Some formulae are given at the end.

- Q1. A small block of mass 1 kg slides down a hill whose elevation is approximated by  $y = 200 \cos(\pi x/800)$ , where  $x$  and  $y$  are in m. Its speed at the position shown ( $x = 300\text{m}$ ) is  $40 \text{ m/s}$ , and is increasing at the rate of  $4.5 \text{ m/s}^2$ .
- Find the  $v$  and  $a$ , the velocity and acceleration of the block at this instant.
  - Find the normal reaction and the coefficient of friction.



- Q2. A 1.2 kg collar, attached to a spring ( $k = 300 \text{ N/m}$ ), slides on a frictionless circular ring in a vertical plane. The spring has an unstretched length of 105 mm. The collar is initially at rest at C and is given a small push to get moving. Determine the velocity of the collar and the force exerted by the ring on the collar as it passes through the point A.



- Q3. Chandrayaan II is to be launched by ISRO. It will first approach the moon with a trajectory of eccentricity 2 and will come to within 750 km of the surface of the moon. Assume the moon to be a sphere of radius 1750 km and the acceleration due to gravity on its surface is  $1.62 \text{ m/s}^2$ .
- Find the velocity of Chandrayaan at this closest position.
  - Find the minimum change in its velocity needed at this closest position so that it goes into an elliptic orbit around moon with a minimum distance of 50 km from its surface.