TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Medical Engineering
UNIVERSITY EXAMINATION FOR:
BSc. Medical Engineering
Type unit code **: Engineering Mechanic (Dynamics)**
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS
DATE: Pick Date **Sep 2018**

Instruction to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.

Maximum marks for each part of a question are as shown.

Do not write on the question paper.

Question ONE

a) A baseball is thrown downward from a tower of height h with an initial speed v_o. Determine the speed at which it hits the ground and the time of travel.

Given:

$h = 50ft \qquad g = 32.2ft/s^2 \qquad v_o = 18ft/s$

(3 marks)

b) The acceleration of a particle along a straight line is define by $a_p = bt + c$. At $t = 0$ $s_p = s_{po}$ *and* $v_p = v_{po}$. When $t = t_1$ Determine

(1) the particle's position
(2) the total distance travelled and
(3) the velocity

Given ;

$b = 2m/s^3$, $c = -9m/s^2$, $S_{po} = 1\ m$, $v_{po} = 10m/s$, $t_1 = 9s$ (10 marks)

A car travels along the curve having a radius of R if its speed is uniformly increased from v_1 to v_2 in time t determine the magnitude of its acceleration at the instant ots speed is v_3.

Given:

$v1 = 15m/s$, $t = 3s$, $v2 = 27m/s$, $v3 = 20m/s$, and $R = 300m$ (7 marks)

Question TWO

a) A small projectile is fire vertically downwards through a fluid medium with an initial velocity of ***60m/s.*** Due to the resistance of the fluid the projectile experience a deceleration equal to $a = (-0.4v^3)\ m/s^2$, where v is in ***m/s***. Determine the projectile's velocity and position ***4s*** after it is fire

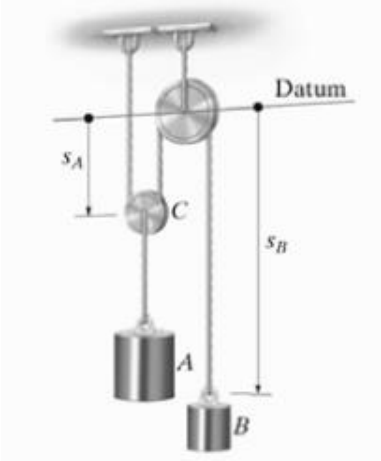
(10 marks)

b) During a test a rocket is travelling upwards at a speed of 75m/s, and when it is 40m from the ground its engine fails. Determine the maximum high s_B reached by the rocket and the speed before it hits the ground. While in motion the rocket is subjected to a constant downwards acceleration of $9.81m/s^2$ due to gravity. Neglect the effect of air resistance.

(10 marks)

Question THREE

a) A 100kg block ***A*** shown in the figure below is release from rest. If the masses of the pulleys and the cord are neglected, determine the speed of the 20 kg block ***B*** in ***2s***



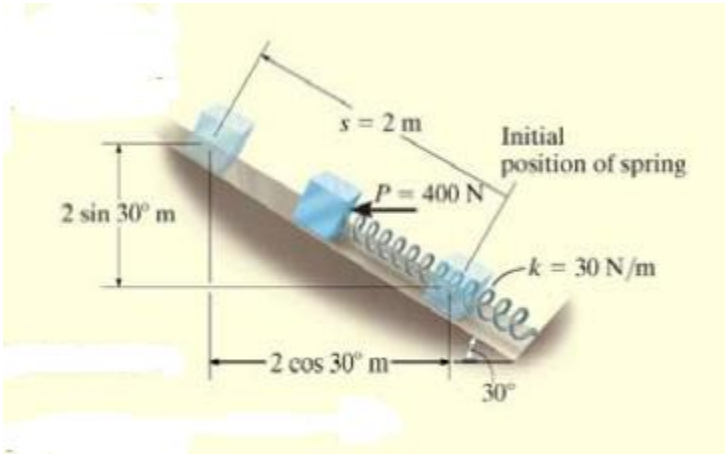
(10 marks)

b) A projectile is fire vertically upwards from the ground, with an initial velocity of 50m/s. Determine the maximum height to which it will travel if
   (1) atmospheric resistance is neglected
   (2) atmospheric resistance is measured as $F_D = (0.001v^2)$ N, where v is the speed at any instant, measured in m/s

(10 marks)

Question FOUR

a) The block on the figure bellow rest on a smooth incline. If the spring is originally stretched ***0.5m***, determine the total work done by all the forces acting on the block, when a Horizontal force ***P = 400N*** pushes the block up the plane ***s = 2.0m***



(10 marks)

b) A 3500-lb car on the figure bellow is travelling down the 10^O incline at a speed 20ft/s. if the driver jam on the brakes, causing his wheel to lock, determine how

far s the tires skid on the road. The coefficient of kinetic friction between the wheel and the road is $\mu_k = 0.5$

(10 marks)

Question FIVE

a) For a short time a crane lifts a ***2.50Mg*** beam with a force ***F = (28 +3s2) kN***. Determine the speed of the beam when it has risen ***s = 3m***. Also how much time does it take to attain this height starting from rest?

(10 marks)

b) The power screw start from rest and is given a rotational speed $\dot{\theta}$ which increases uniformly with time t according to $\dot{\theta} = kt$, where ***k*** is a constant. Determine the expressions for velocity ***v*** and acceleration ***a*** of the center of the ball ***A*** when the screw has turned through one complete revolution from the rest. The lead of the screw (advancement per revolution) is ***L***.

(10 marks)