

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2014/2015**

**EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL, MECHANICAL ENGINEERING, GEGIS, MMPE**

**SMA 2273: APPLIED MATHS I**

**DATE: APRIL 2015 TIME: 2 HOURS**

**INSTRUCTIONS: Answer Question One and Any Other Two Questions**

**QUESTION ONE (30 marks)**

1. Define the following terms;
2. A newton (1marks)
3. Power (1marks)
4. State the first and the second Newton’s law of motion (4marks)
5. Mr. Ronie throws a ball straight up with an initial velocity of 11.2 m/s
6. What maximum height does it reach (3marks)
7. How long does the ball take to reach this height? (2marks)
8. Find position of the ball at $t-2 sec$ (2marks)
9. A mass of 500 kg moves on a straight line from a speed of 540 km/h to 720 km/h in 2 minutes. What is the impulse developed in this time? (3marks)
10. A car travelling at 72 km/h along a straight level road is brought uniformly to a stop in a distance of 40 m. The car weighs 8.80 x 103 N. Find the breaking force (4marks)
11. A 10 kg weight is suspended vertically from the centre of a rope as shown below;

 

Determine the tension T in the rope. (4marks)

1. A particle is acted on by forces 

Find the force needed to keep the particle in equilibrium (3marks)

1. A van of mass 1600 kg starts from rest and after travelling 240 m, its speed is 23 m/s. Given that the car is subject to a constant resistance force of 450N, find the constant driving force. (3marks)

**QUESTION TWO (20 marks)**

1. A ball of mass 3 kg is projected up a rough plane inclined at 300 to the horizontal with a velocity of 14m/s. Given that μ=0.4, find the distance the particle moves up the plane before coming to rest (11marks)
2. Two masses m1 and m2 are suspended from a fixed frictionless pulley, where m2>m1
3. a. Find the acceleration of the system

b. Calculate the tension in the string

1. If m1=0.55 kg and m2=0.8 kg. Find
2. Acceleration
3. Tension in the string (9marks)

**QUESTION THREE (20 marks)**

1. A golf ball is struck from a point 0 with velocity 24m/s at an angle of 400 to the horizontal. The ball first hits the ground at a point$ p$, which is at a height $h$ metres above the level of 0. The horizontal distance between $0$ and p is 57 metres.

i. Show that the ball takes 3.1 sec to move from $0$ to $p$ (3marks)

ii. Find the value of $h$ (2marks)

iii. Find the speed with which the ball hits the ground at $p$ (4marks)

iv. Find the angle between the direction of motion and the horizontal as the ball hits the ground at $p$ (3marks)

1. A particle moves on the x-axis in a force field having potential

∅=$x^{2}(6-x)$

i. Find the points of equilibrium

ii. Investigate their stability (8marks)

**QUESTION FOUR (20 marks)**

1. A light rod XY, 5 m long is suspended by strings AX and BY from two points A and B as shown below. A mass is placed at a point G of the rod so as to keep the rod in a horizontal position. Find the position of G, if angle AXY=1200 and angle BYX=1500 (10marks)
2. A spanner used to tighten a nut is 300 mm long. The force exerted at the end of the spanner is 100N.

i. Find the torque exerted on the nut (2marks)

ii. Calculate the work done when the nut turns through an angle of 300 (2marks)

1. A 10 kg mass ($m\_{1}$) moves east with a velocity of 0.5 m/s along a frictionless surface towards another 10 kg mass attached to a spring with a spring constant of 2.0 m/m2

i. Determine the total mechanical energy of the system after the impact (3marks)

ii. Find the distance $m\_{2}$ moved compressing the spring before stopping (3marks)