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**University Examinations 2016/2017**

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE PHYSICAL, BACHELOR OF EDUCATION SCIENCE PHYSICS/MATHS, PHYSICS/ CHEMISTRY AND PHYSICS / COMPUTER

**SPH 3100: MECHANICS I**

**DATE: December, 2016 TIME: HOURS**

**INSTRUCTIONS:** *Answer questions* ***one*** *and any other* ***two*** *questions.*

**QUESTION ONE - (30 MARKS)**

1. (i) Define impulse and give its SI units. (2 Marks)

(ii) State the dimensions of momentum. (3 Marks)

1. (i) The total mass of cargo lorry was determined by weighing the empty lorry first, then

weighing the load carried by the lorry and summing up. If the mass of the lorry was 9980 10 kg and that of the load was 6019 10 kg find the percentage error in the total mass. (4 Marks)

1. A car starts from rest and acquires a velocity of 20m/s within a distance of 240m. Determine the acceleration of the car. (3 Marks)
2. Distinguish between inelastic collisions and elastic collisions. (4 Marks)
3. The linear speed of centrifuge is 40m/s. If the radius of the centrifuge is 10cm, Determine its angular acceleration. (3 Marks)
4. A railway truck of mass kg moving at a velocity of 3m/s collides with a stationary truck of mass kg. The trucks join and move together. What percentage of the first truck’s initial kinetic energy remains as kinetic energy for the two trucks after collision?

(5 Marks)

1. In a car crash test, a car of mass kg collides with a wall and rebounds. The final and initial velocities of the care are = 2.6m/s and respectively.
2. What is the impulse delivered to the lf the collision lasts 0.15S. (4 Marks)
3. Average force exerted on the car. (2 Marks)

**QUESTION TWO (20 MARKS)**

1. Three objects and are connected by strings over frictionless pulleys as shown.

Given that = 10 kg, = 15kg and that the horizontal surface exerts a force of 30N on . Find the speed of after it moves 4m assuming the system is released from rest. (8 Marks)

1. The diagram below represents a velocity time graph for motion of a body, study it well and answer the questions that follow.



1. Describe the variation of velocity for the motion from A,B,C to D. (3 Marks)
2. Calculate acceleration between A and B. (3 Marks)
3. Average velocity between B and C. (2 Marks)
4. Total displacement for the whole journey. (4 Marks)

**QUESTION THREE (20 MARKS)**

1. A buss of mass 9000kg ascends an anticline of angle to the horizontal from rest and attains a velocity of 20m/s in a distance of 400m. Calculate;
2. The change in kinetic energy of the bus. (4 Marks)
3. Work done by the engine in driving the bus through the distance of 400m.(8 Marks)
4. The power of the engine assuming no frictional forces. (4 Marks)
5. Show that the work done in absence of frictional forces is equal to the change in kinetic energy. (4 Marks)

**QUESTION FOUR (20 MARKS)**

1. Two vectors are represented in unit vectors as;

 = 2i – 4j + 3k

= 4i – 3j + 2k

1. Find (3 Marks)
2. A model aeroplane has mass of 1kg and a control string of length 10m attached to it so that it flies in a horizontal circle. The wire is inclined at an angle of to the horizontal and fixed to a point O. It takes 2 seconds for the plane to complete the circular path.
3. Calculate the tension in the control wire. (5 Marks)
4. Upward force acting on it due to air. (3 Marks)
5. A car of mass 1200kg moves round a banked road of banking angle . If the radius of the round about is 20m and the coefficient of friction between the tyres of the car and the road is 0.4. Find the maximum speed at which the car can negotiate the round about safely. (4 Marks)