

**MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY**

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**University Examinations 2014/2015**

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING, CIVIL ENGINEERING AND ELECTRICAL ENGINEERING.

**SPS 3110: PHYSICS 1**

**DATE: DECEMBER 2014 TIME: 2 HOURS**

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

**Important Constants**

g=10N/kg or 10m/s2

Specific heat capacity of copper = 400J/kg/k

Specific heat capacity of water = 4200J/kg/k

**QUESTION ONE (30 MARKS)**

1. (i) Define the cross product of 2 vectors and (1 mark)

(ii)Differentiate between velocity and speed (2 marks)

1. (i) A stone falling freely after being projected vertically upwards hit the ground at a velocity of 50m/s. Calculate the maximum height reached by the stone (3 marks)

(ii) Show that the change in momentum of a body is equal to the force causing the acceleration of the body (4 marks)

1. (i) State Newton’s second law of motion (1 mark)

(ii) A passage of mass 80 kg is standing on the floor of an elevator. What apparent weight does the scale of the elevator read for the passenger when the elevator is accelerating at 2/ms2 upwards (3 marks)

1. (i) State 2 reasons why a body exhibiting uniform circular motion is said to be accelerating (2 marks)

(ii) Differentiate between neutral equilibrium and stable equilibrium ( 2 marks

1. (i) State 2 properties of simple harmonic motion (2 marks)

(ii) Differentiate between transverse and longitudinal waves (2 marks)

(iii) Describe the conditions required for the superposition of 2 waves to produce a standing wave (3 marks)

1. (i) A copper ball of mass 0.5 kg is dropped into water at temperature of 100c. The rise in the temperature of the water is 250c, neglecting heat losses to the surroundings, calculate the initial temperature of the block if the mass of the water was 2.0 kg (4 marks)

(ii) State the first law of Thermodynamics (1 mark)

**QUESTION TWO (20 MARKS)**

1. Two vectors are given in unit vectors as follows:





Find: (i) The scalar product (3 marks)

(ii)  (4 marks)

1. A flywheel of mass 28 kg and radius 14cm makes 1000 revolutions per minute. Calculate
2. Linear velocity of a particle on the circumstance of the flywheel (3 marks)
3. The angular momentum of the flywheel (3 marks)
4. A car starts from rest and attains a velocity of 20m/s in 5 seconds with uniform acceleration. It maintains this velocity for the next 10 seconds before being in 8 seconds.
5. Calculate the total displacement of the car (4 marks)
6. Sketch a velocity line graph for the motion of the car (3 marks)

**QUESTION THREE**

1. Two trolleys of one of man 0.8 kg moving in the positive x-direction with a velocity of 1.65m/s and the other of mass 0.5kg moving in the positive y-directions of the Cartesian plane at a speed of 2.24m/s undergo inelastic collision and fuse together. What is their common velocity immediately after collision (6 marks)
2. Show that the work done in moving an object in absence of frictional force is equal to the change in kinetic energy (6 marks)
3. Cold water circulates through a house from the main water pipe at the basement. The water enters the house through a pipe of diameter 8.0cm at a flow speed of 0.6m/s under a pressure of 4.0x105N/m2. Calculate:
4. The speed of flow of the water in a 5.0cm diameter pipe 9.0m above the main water pipe in the basement (3 marks)
5. Pressure of the water in the 5cm diameter pipe (5 marks)

**QUESTION FOUR**

1. Show the coefficient of linear expression is half the coefficient of area expansion

(8 marks)

1. Show that for a non-viscous liquid exhibiting streamline flow;

+ = constant (8 marks)

1. A progressive wave has velocity of 180m/s. If the periodic time of the wave is 25, determine the wavelength of the wave. (4 marks)