GARISSA UNIVERSITY COLLEGE

(A Constituent College of Moi University)

UNIVERSITY EXAMINATION 2016/2017 ACADEMIC YEAR ONE SECOND SEMESTER EXAMINATION

SUPPLEMENTARY/SPECIAL EXAMINATION

SCHOOL OF EDUCATION, ARTS AND SOCIAL SCIENCES

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS)

COURSE CODE: PHY 110

COURSE TITLE: BASIC PHYSICS 1

EXAMINATION DURATION: 3 HOURS

DATE: 26/09/17 **TIME: 09.00-12.00 PM**

INSTRUCTION TO CANDIDATES

- **The examination has SIX (6) questions**
- **Question ONE (1) is COMPULSORY**
- **Choose any other THREE (3) questions from the remaining FIVE (5) questions**
- **Use sketch diagrams to illustrate your answer whenever necessary**
- **Do not carry mobile phones or any other written materials in examination room**
- **Do not write on this paper**

This paper consists of TWO (2) printed pages ***please turn over***

QUESTION ONE (COMPULSORY)

a. Define the terms angular velocity and centripetal acceleration **[2 marks]**

b. If $\mathbf{A} + \mathbf{B} + \mathbf{C} = \mathbf{0}$ and $\mathbf{A} = 2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ and $B = 5\mathbf{i}+6\mathbf{j}+7\mathbf{k}$ Find

   i. $|\mathbf{C}|$ **[2 marks]**

   ii. ii) Angle between **C** and the X – axis **[3 marks]**

c. Differentiate contact and non-contact forces **[2 marks]**

d. i) What is meant by simple harmonic motion? **[1 mark]**

   ii) Prove that the bob of a simple pendulum may move with simple harmonic motion and find an expression for its period. **[3 marks]**

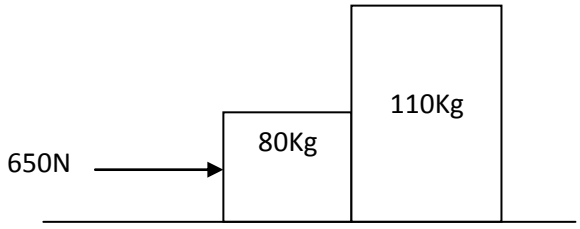
e. Considering a body of mass M having an initial velocity u be acted upon by a force F for a time t , so that its final velocity is v. show that **F**=Ma **[3 marks]**

f. A motorcycle stunt rider rides off the edge of a cliff with a horizontal velocity of magnitude 5m/s. Find the rider's position and velocity after ¼ seconds **[2 marks]**

g. Derive the three equations of motion in a straight line for a body starting motion from rest. **[3 marks]**

h. A ball is thrown vertically into the air at 50m/s. How high will it rise and how long will it take to reach that height? $G = 10m/s^2$ **[4 marks]**

i. Two boxes of mass 80Kg and 110Kg are in contact and at rest on a horizontal surface as shown. A 650N push is exerted on the 80Kg box in the direction shown. If the coefficient of friction is 0.2 calculate



   i. The acceleration of the system **[2 marks]**

   ii. The force each box exerts on the other **[2 marks]**

QUESTION TWO

(a) A 600N object is to be given on acceleration of $0.7m/s^2$ Find the unbalanced force acting on it.

[1 mark]

(b) Two masses of 0.5 and 0.25Kg are connected by a light inextensible string, which passes over a smooth pulley. If the system is released from rest with the string taut, find the acceleration of each mass and the distance travelled in 1 sec. from rest. **[6 marks]**

(c) If a projectile at a point O on the ground is projected with a velocity u at an angle α to the horizontal motion separately show that maximum horizontal range is given by $R = \frac{u^2}{g}$ **[4 marks]**

(d) i) State the newton's law of universal gravitation **[1 mark]**

ii) State the three Kepler's laws of planetary motion **[3 marks]**

QUESTION THREE

a) Clearly distinguish instantaneous velocity and instantaneous acceleration

b) State and explain two factors affecting centripetal force **[2 marks]**

c) A conical pendulum consists of a small massive bob of mass M hung from a string of length L and rotating steadily in a horizontal circle of radius R, the bob is displaced at angle ϑ. With the help of diagram Show that its period of oscillation is given by

$T = 2\pi\sqrt{\frac{LCos\ \theta}{g}}$ **[7 marks]**

d) A stone of mass 0.4kg is tied to a string of length 0.5m and whirled in a circle. If the stone revolves uniformly and makes one complete revolution per second, Find its acceleration and the force exerted on the stone by the string

[4 marks]

QUESTION FOUR

(a) i) state the law of conservation of linear momentum **[2 marks]**

ii) Differentiate between elastic and inelastic collisions **[2 marks]**

iii) A 5kg lump of clay that is moving at 10m/s to the left strikes a 6kg lump of clay moving at 12m/s to the right. The two lumps stick together after they collide. Find the final speed of the composite object and the kinetic energy dissipated in the collision. **[4 marks]**

(b) Clearly distinguish between conservative and non- conservative forces and give one example of each of the forces. **[3 marks]**

(c) Show that in case of a conservative force the work done round a closed path is zero **[3 marks]**

QUESTION FIVE

a i) state the work-energy theorem **[1 mark]**

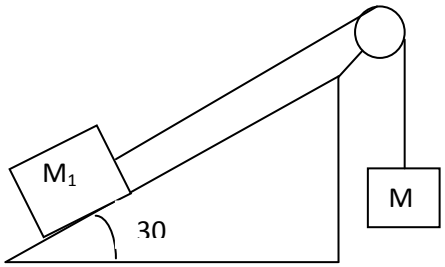
ii) State the three Newton's laws of motion **[3 marks]**

b) A block of mass M_1 lying on inclined plane at an angle of 30^o to the horizontal is pulled up the plane by a mass M_2. The two mass are connected by a light inextensible cord passing over a smooth pulley as shown. Given that μ between M_1 and the plane is 0.15 and that $M_1 = M_2 = 2kg$.

i) Draw the free body diagrams for the two masses **[3 marks]**

ii) Determine the acceleration of the masses **[5 marks]**

iii) Determine the tension in the cord **[3 marks]**



QUESTION SIX

(a) i) Show that work done in compressing an ideal gas at constant temperature is given by

$$W=nRT \ln \frac{v_2}{v_1}$$ **[5 marks]**

(ii) How much work is required to compress isothermally 2g of oxygen initially at STP to half its original volume? (Assume that oxygen behaves as an ideal gas)

[5 marks]

(b) Starting with the first law of thermodynamics and using the $dQ = dU + PdV$ equation of state, $PV = RT$; show that the equation of reversible adiabatic change for ideal gas is given by

$$PV^{\gamma} = Cons\tan t$$ **[5 marks]**